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Research articles

Spin waves and stability of zigzag order in the Hubbard model with spin-dependent hopping terms: Application to the honeycomb lattice compounds Na_2IrO_3 and $\alpha - \text{RuCl}_3$

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A B S T R A C T

Spin waves in the zigzag ordered state on a honeycomb lattice are investigated within a Hubbard model with spin-dependent hopping terms. Roles of the emergent Kitaev, Heisenberg, Dzyaloshinskii-Moriya, and symmetric-off-diagonal spin interactions are investigated on the stability of the zigzag order. While the DM interactions are found to destabilize the zigzag order, the secondary spin-dependent hopping terms (associated with structural distortions) are shown to strongly stabilize the zigzag order and account for magnetocrystalline anisotropy, easy axis, and spin wave gap. The calculated spin wave dispersion and energy scale are in good agreement with inelastic neutron scattering measurements on $\alpha - \text{RuCl}_3$ and Na_2IrO_3 .

1. Introduction

Involving strong spin-orbit coupling (SOC), the $4d$ and $5d$ transition metal oxides are of considerable recent interest in view of potential technological importance and novel electronic and magnetic properties such as topological band or Mott insulators, quantum spin liquids, field-induced topological order, topological superconductors, and spin-orbital Mott insulators. The honeycomb lattice compounds such as $\alpha\text{-RuCl}_3$ and Na_2IrO_3 , in which Ir (Ru) and O (Cl) ions form edge-sharing octahedra giving rise to O (Cl) assisted hopping between different Ir (Ru) orbitals, exhibit collinear zigzag antiferromagnetic (AFM) ground state as confirmed by both resonant magnetic X-ray scattering and neutron scattering experiments [1–5].

Inelastic neutron scattering (INS) and resonant inelastic X-ray scattering (RIXS) experiments on the above two compounds show dispersive spin wave excitations with very low energy scale. For Na_2IrO_3 , spin wave excitations have been identified below 6 meV in INS studies with a sinusoidal decrease of energy at low Q [2], and found extending up to 35 meV in RIXS studies, with additional peaks in the range $0.4 < \omega < 0.8$ eV associated with the excitonic modes [6]. For $\alpha - \text{RuCl}_3$, INS measurements show spin wave gap of ~ 2 meV around the M' point of the Brillouin zone [7]. In both systems, the Néel temperature (~ 15 K) is low compared to the Curie-Weiss temperature (~ -100 K) [2,5].

Band structure calculations carried out within density functional theory (DFT), dynamical mean-field theory (DMFT), and three-orbital model yield insulating AFM ground state and show significant role of

SOC and electron correlation in determining the electronic structure for both compounds [8–12]. The insulating nature of Na_2IrO_3 has been probed by angle-resolved photoemission study (ARPES) [13], which reveal narrow electronic bandwidth (~ 100 meV) of the filled t_{2g} bands as well as large optical gap (~ 340 meV), and show little variation in photoemission intensity with momentum, suggesting relatively localized electronic states. The well gapped AFM insulating state, with the gap robust even above the Néel temperature, suggests Mott (not Slater) behavior [11]. In the case of $\alpha - \text{RuCl}_3$ also, ARPES experiments show weakly dispersing Ru d bands near the Fermi level and relatively large gap [14–16], establishing it as a Mott insulator. The three-orbital model parameters deduced from DFT calculations show that the largest hopping integral $t_{dd} \sim 270$ meV for Na_2IrO_3 and ~ 160 meV for $\alpha - \text{RuCl}_3$, which predominantly arise from hopping through the bridging ligand oxygen and halogen p orbital, respectively [8,17]. It should be noted that the spin-wave energy scale found experimentally is very low compared to these hopping energy scales.

Although the magnetic ions form a bipartite lattice, these systems do not exhibit the conventional Néel AFM ground state, highlighting the importance of anisotropic magnetic interactions. Arising from the spin-orbital entangled nature of the $J_{\text{eff}} = 1/2$ state and orbital mixing in the electron hopping, the anisotropic magnetic interactions in these d^5 compounds intrinsically frustrate the Néel state and naturally allows for novel magnetic states such as zigzag, stripy, incommensurate spiral and spin liquid [18].

Most of the earlier studies of magnetic ordering, excitations, and anisotropy in these systems have been carried out in terms of low

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Educational contribution of Emile Durkheim: a functional assessment

Subal Tandi

Abstract

Functionalism dominated sociology during the 1950s and 1960s that period is called stability period. The functional perspective of sociology of education which was contribution by Emile Durkheim that shaped more with logical and scientific discipline. It is argument here that functionalist theory of educational sociology emphasis on consensus and equilibrium of the society. The objective of the study to know the functional perspective education and social order which given by Emile Durkheim with the research question that is what is functional perspective on education given by Durkheim? Conclusion is drawn from discussion that the functionalist analysis of educational sociology tends to focus on the positive contributions made by education that maintenance of the social system.

Key Word- Consensus, Education, Equilibrium Functionalism and Sociology.

Introduction

Sociology born in the wake of the French and Industrial Revolution, similar to all disciplines has its origins and forefathers. August Comte and Durkheim are considered the 'fathers of sociology', although Edmund Burke expounded many sociological concepts before them Reflections on the Revolution in France. American sociology historically to its European forbearers but a little known American George Fitzhugh who was using the word sociology before the birth of Emile Durkheim and he published *Sociology for the South in 1854*, with Henry Hughes, *Treatise on Sociology*, the honour of being the first volume in English bearing the title of sociology (Mayes, 1980).

Sociological theories are statements of how and why particular facts about the social world are related. They range in scope from brief descriptions of a single social process to paradigms for analysis and interpretation. These theories also explain aspects of the social world and enable prediction about future events and others function as broad perspectives that guide further sociological analyses. There are important theoretical traditions that are functionalism, conflict, symbolic interactionism, feminism, modern, post-modern and utilitarianism. Modern sociological theory descends predominately from functionalist (Durkheim) and conflict-centered (Marx and Weber) accounts of social structure. The symbolic interactionist tradition consists of micro-scale structural (Simmel) and pragmatist (Mead, Cooley) theories of social interaction. Feminism (Wollstonecraft, Mitchell, Sartre) based on the gender inequality and oppression. Modern and post-modern (Derrida, Gidden and Foucult) give the important of knowledge, power and reality in the societies. Utilitarianism also known as rational choice and social exchange and often associated with economics, is an established tradition within sociological theory. Sociological theories rely on the scientific method, which aims for objectivity, and attempts to avoid passing value judgments. Despite it, educational sociology is also a theoretical model of sociological stream, so there are some definitions on educational sociology in the follows.

Definitions of educational Sociology

Sociology of education defined as the scientific analysis of the social system, order, consensus, patterns and processes which involved in the educational system.



Participation of Tribal Students in Higher Education: A study of Odisha

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Abstract

Background: Higher Education is a powerful tool to build knowledge-based society. Department of Higher Education of centre and state are focused, improve and expand education in all sectors and inclusion disadvantaged section like tribal, women and minorities class in the higher education sector by the help of programme implementation, policy formulation, research and innovation, knowledge management, training and capacity building. This paper analyses students participation in different way such as cultural participation, political participation, leadership participation, sport participation and community participation in the field of Sambalpur University who belong to Schedule Tribe and how far they satisfied or no ? **Objective:** the objectives of the paper study the socio-economic background of the respondents and find out the participation of tribal students in institutional activities with specific to ST category of Sambalpur University. **Methodology:** Sambalpur University was selected purposively from Odisha. From Fifteen departments with 30 P.G students were selected randomly. Participatory Observation and Interview Schedule and have been used for data collection. **Conclusion:** This research paper also highlights students' participation in the effective way of higher education and some barriers in their progress of higher educational institution.

(Key Word- Higher Education, Participation, Students, Tribal, University)

Introduction:

Education is the most important instrument for human resource development as well as a very important for his/her life circle. Education is widely accepted as the essential tool for the developmental goals and awareness of constitutional rights and duties among the people of a nation and has a great significance in the context of developing countries. Education is the key that opens the door of human life. It plays a pivotal role in social change and it brings perfect life, radical transformation in outlook an upward mobility in social status, and perception (Soren, 2016). In this study, researcher wants to discuss impact of education in participate of ST community in different activities of Sambalpur University, Sambalpur district, Odisha.

Historically, Schedule Tribes are the original inhabitants of India. They face exclusion from the mainstream society because of their physical isolation in remote parts of the country. Scheduled Tribes have been economically marginal, geographically, and socially isolated group. Generally, The Tribal people reside in isolated places situated in remote areas of forests, islands, hills etc. These communities are not able

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RESEARCH ARTICLE

Development-Induced Displacement and Policy Measures: A Case Study of Lower Suktel Irrigation Project of Balangir in Odisha

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ABSTRACT:

The study has attempted to examine the status of the displaced families of Lower Suktel Irrigation Project (LSIP), Balangir, in the Odisha State. The field survey was carried out to find out the implementation of Land Acquisition, Rehabilitation and Resettlement policy measures and their impact on the social-economic life of the displaced persons in LSIP and to scrutinise the issues which the displaced families are confronting due to the projects. The direct interview and focus group discussion was the method of primary data collection from 100 respondents in affected villages of the project. It was found that 70 percent of respondents are dissatisfied due to loss of sustainability livelihood, loss of forest, land and water, 70 percent respondent spent their compensation money in chit fund due to lack of awareness to investment in proper ways; they are depriving the facilities of all governmental programmes in their village for 14 years because they have received compensation amount. In addition to that, no civil society and government agency is working for awareness of their right and policy information with related to rehabilitation and resettlement measure. The results revealed that from the year of 2000 to 2018, the displaced families of the project have received the compensation and rehabilitation package without full-fledged process and having no alternative future subsistence, they are living as a crisis life without displacement.

KEYWORDS: Lower Suktel Irrigation Project, displaced family, compensation, Land Acquisition, Rehabilitation and Resettlement.

INTRODUCTION:

Developmental projects are needed to developing country like India. The development projects are classified into various type industrial, mining, urban, Irrigation projects. Irrigation project is one of them to take off the development of drought prone area.

Therefore, the concept of development induced displacement well known in the process of backward region like Balangir of KBK (Kalahandi, Balangir and Koraput) region of Odisha. The cultivated land (96 percent) in Balangir which is under rainfed agriculture because of the variability in date of onset of effective monsoon, higher initial and conditional probability of dry weeks are crucial factors for increasing drought vulnerability and risk in the region (Swain and Swain, 2011). Thus, the major irrigation project plays main role in development activities of this region. There are some contemporary problems present in Balangir District

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Impact of climate change on agriculture: A study of western Odisha

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Background

The work force deriving employment from agriculture sector represents 65 percent with 4.20 crores population of Odisha and as suc

Methodology

Kanbar village, Kanbar Barpali Block, Bargarh district of Western Odisha was purposively selected for the study because of high flu

Agriculture, Climate Change, Crop Failure Rainfed, Temperature.

We recommend

Climate change and food production in North West India

([Impact of Climate Change on Farm Households in Odisha](https://rev.trendmd.com/open/qmalfluxeyJzb3VyY2VUeXBlljoyLCJzb3VyY2VUcmwiOiJodHRwczovL3d3dy5pbmRpYW5qb3VybmF: Ahlawat Savita, Indian Journal of Agricultural Research, 2015)</p></div><div data-bbox=)

([Growth and instability in agricultural productivity in Odisha](https://rev.trendmd.com/open/j9msfykeyJzb3VyY2VUeXBlljoyLCJzb3VyY2VUcmwiOiJodHRwczovL3d3dy5pbmRpYW5qb3VybmF: Usha Das, Journal of Community Mobilization and Sustainable Development, 2018)</p></div><div data-bbox=)

([Contingency crop planning for dryland areas in relation to climate change](https://rev.trendmd.com/open/l5shss1eyJzb3VyY2VUeXBlljoyLCJzb3VyY2VUcmwiOiJodHRwczovL3d3dy5pbmRpYW5qb3VybmF: Senapati Asis Kumar, Agricultural Economics Research Review, 2019)</p></div><div data-bbox=)

([Study of cropping pattern and profitability analysis of major crops of north eastern Ghats agro-climatic zone of Odisha](https://rev.trendmd.com/open/2c10omueyJzb3VyY2VUeXBlljoyLCJzb3VyY2VUcmwiOiJodHRwczovL3d3dy5pbmRpYW5qb3Vybm: Joshi N.L., Indian Journal of Agronomy, 2009)</p></div><div data-bbox=)

([Increasing Trend of Extreme Rain Events Over India in a Warming Environment \(https://rev.trendmd.com/open/hy6lrwyeyJzb3Vy B. N. Goswami, Science, 2006\)](https://rev.trendmd.com/open/p36hkp9eyJzb3VyY2VUeXBlljoyLCJzb3VyY2VUcmwiOiJodHRwczovL3d3dy5pbmRpYW5qb3VybmF: Sahoo Prangya Paramita, Economic Affairs, 2023)</p></div><div data-bbox=)

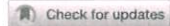
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Impact of climate change on agricultural production: A case of Rasuwa District, Nepal (https://rev.trendmd.com/open/3sr3wnyeyJzb3VyY2VUeXBlljoyLCJzb3VyY2VUcmwiOiJodHRwczovL3d3dy5pbmRpYW5qb3VybmF: Regional Sustainability, 2022)

Livelihood vulnerability of smallholder farmers to climate change: A comparative analysis based on irrigation access in South Sulaw: ([Powered by TREND MD \(<https://www.trendmd.com/how-it-works-readers>\)](https://rev.trendmd.com/open/h80s5eleyJzb3VyY2VUeXBlljoyLCJzb3VyY2VUcmwiOiJodHRwczovL3d3dy5pbmRpYW5qb3VybmF: Regional Sustainability)</p></div><div data-bbox=)

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Structural, Mechanical and Dielectric Properties of Microwave-Assisted High-Energy Ball Milling Synthesis of Hydroxyapatite

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ABSTRACT

In the present work, the effect of high-energy ball milling (HEBM) of starting precursors of hydroxyapatite ($\text{Ca}_{10}(\text{PO}_4)_6(\text{OH})_2$)/HA system on the processing temperature, morphological, mechanical, and electrical properties are highlighted. Calcination and sintering of HA system were carried out in microwave furnace. XRD study confirmed the evolution of HA phase and EDX analysis confirmed Ca/P ratio ~ 1.65 . Grain size of HA samples, synthesized by using microwave-assisted HEBM technique was found to be in the order of 54–75 nm. Enhanced dielectric and mechanical properties were obtained in HA samples.

ARTICLE HISTORY

Received 1 October 2018
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KEYWORDS

Hydroxyapatite; high-energy ball milling; microwave


1. Introduction

Nowadays, biomaterials are given attention for replacing human bone without any harm to the natural environment of the body. Biomaterials are classified into four main groups, i.e. metals, polymers, ceramics, and composites. Bioceramic has been used in applications like replacing many parts of body like hip, knee, teeth, ankle, elbow, and other joint damages. Human bone is a complex living tissue with an organic composition like type-1 collagen fibers has occupied 30–35% of human bone weight and inorganic composition like hydroxyapatites has occupied (65–70%) [1]. For biomedical application like bone ingrowth requirement, densified and porous ceramic (HA) has been widely used [2]. Protein adsorption required for better adhesion, proliferation, differentiation, and ECM formation takes place in the HAP surface which includes nano-roughness, nanoporosity, and high surface energy [3]. HA has high bioactivity, biocompatibility, and mechanical properties, it is being used as the implant material [4]. It is a well-known fact that mechanical property of a ceramic sample is influenced by its grain size and density. Dense nano, a combination of nano-grains with higher density, can enhance the mechanical properties of HA samples. High-energy ball milling (HEBM) is a widely used technique to produce nano-HA powder. Microwave heating

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Photophysical Properties of Coumarin 1 in Bile Salt Aggregates: An Insight into the Role of Bile Salt Structure on the Aggregation Behavior

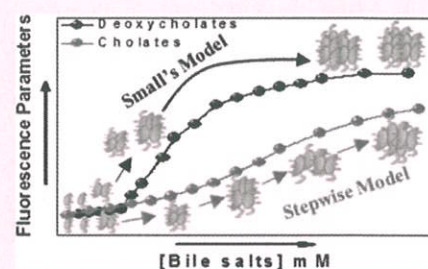
Smruti Snigdha Mishra,^{†,§} Subhrajit Mohanty,^{†,§} Jhili Mishra,[‡] and Usharani Subuddhi^{*,†,§}

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Supporting Information

ABSTRACT: The photophysical behavior of Coumarin 1 (Cou1), a well-known 7-aminocoumarin derivative, is very sensitive to the microenvironment in which it resides. In the present study, the effect of six bile salt variants on the photophysical behavior of Cou1 has been investigated. Dihydroxy (deoxycholates) as well as trihydroxy (cholates) bile salts with conjugated and unconjugated side chains have been chosen to get insight into the role of bile salt structure on the microenvironment of Cou1. Cou1 photophysics was found to be extremely sensitive to the aggregation process of the bile salt variants. The reduced polarity of the micellar environment stabilizes the planar intramolecular charge transferred state of Cou1, resulting in significant modulation in its photophysics in the bile salt media. The changes in the fluorescence parameters such as fluorescence intensity, emission energy, fluorescence quantum yield, anisotropy, and lifetime of Cou1 reveal that there is a distinct difference in the aggregation behavior of deoxycholates from that of cholates. The deoxycholates form micelles more or less critically similar to those of conventional surfactants, whereas the cholates self-assemble rather noncritically over a wide concentration range, thus signifying the vital role of the extra hydroxyl group in the aggregation pattern of trihydroxy bile salts. The conjugated bile salts are found to provide a relatively more compact, rigid, and hydrophobic microenvironment to Cou1 as compared to their unconjugated counterparts. Considering the significant modulation in the photophysical properties of Cou1, it has been employed as a molecular reporter for monitoring the aggregation process of bile salt variants and important information could be obtained about the effect of bile salt structure on the aggregation pattern and also about the micellar properties.



INTRODUCTION

Coumarins represent an important class of natural products found in many plants and medicines. Many of their analogues are found to be biologically active and exhibit tremendous pharmacological potential. Apart from their pharmacological activities, substituted coumarins have also been appraised for their fascinating photophysical properties with versatile applicability.^{1–4} 7-Aminocoumarins, undeniably the most important group of coumarins, have been the focus of intense study owing to their interesting photophysical properties and widespread applications.⁵ The photophysics of these molecules is strongly dependent on their local environment, especially the polarity and microviscosity, and this dependence varies with the specific 7-aminocoumarin derivative.^{6–9}

7-Diethylamino-4-methylcoumarin also known as Coumarin 1 (Cou1, Scheme 1) is one such 7-aminocoumarin that has garnered immense scientific attention due to its fascinating photophysical properties. Cou1 exhibits a strong fluorescence in the visible region and also finds application in the study of solvatochromic properties owing to the large Stokes' shift, which is sensitive to the polarity and viscosity of the surrounding solvent environment. The excited state properties

and photophysics of Cou1 have been a topic of extensive investigation.^{5,10–25} The chemical structure of this molecule comprises an electron donor (diethylamino group, 7-NEt₂) and an acceptor unit (pyrone moiety) connected via a π -conjugation system that facilitates intramolecular charge transfer (ICT) from the donor to acceptor.^{5,15–18} The planar ICT excited state, with a considerably large dipole moment ($\mu_e = 5.13–10.9$ D),^{11,13} is stabilized by moderate- to high-polarity solvents with orientation polarizability value (Δf) ≤ 0.28 , and as a result, it exhibits polarity-dependent Stokes' shift, quantum yield, and fluorescence lifetime that follow a more or less linear correlation with the solvent polarity function Δf .^{13,15,16} In nonpolar solvents such as hexane, cyclohexane, etc., Cou1 is known to adopt a nonpolar pyramidal configuration and the 7-NEt₂ group of the molecule becomes out of resonance from the 1,2-benzopyrone moiety; consequently, the fluorescence parameters deviate from the correlation and display unusual behavior in these solvents.¹⁶ On the other hand, in highly polar

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EVALUATING THE POLITICAL RELEVANCE OF INTERNATIONAL RELATIONS THEORY

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ABSTRACT

The “gap bridgers” and the “gap minders” are the two broad positions, which dominate the debate at present that is significance to the theory of international relations (IR). Nonetheless, absent from this discussion is a wider theoretical in the context, that helps us to step beyond their differences. This article, therefore gives a theoretical account of the relation between politics and information. Scientific knowledge has the political relevance that gets distancing itself in the modern context that happens in a particular politics over the theorizing. In the abstraction, there is political relevance at different stages, which has the relationship in paradoxical that rise in the dimension in three different ways. Politics has the modern concept that has a crucial role for establishing that plays a meta-theory; political space is established by the theories as well as policies have a specific influence on empirical studies. Considering this specific circumstance, also, requires a reassessment of center highlights of the order: its destitution, fracture, and irresponsibility are normal to every advanced science; they work as a driver of logical advancement; and meta-theoretical discussions deal with the political element of advanced sciences. Therefore, IR “s democratic wellspring has significance in its imaginary institutions.

KEYWORDS: International Relations Theory & Modern Politics

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1. INTRODUCTION

The case that the control of IR neglects to satisfy its core vocation to create politically pertinent work isn't new (for instance, Wallace 1996). Today, in any case, this case is rehashed and talked about in standard and internet based life (Kristof 2014) and illuminates look into financing arrangements (Bastow, Dunleavy and Tinkler 2014; Desch 2015). The issue of these lines of critical significance for the control and has offered ascend to an energetic discussion. While the objective of creating politically important information is generally shared among IR researchers, the significance of this term and the way to attain the exceptionally challenged. Two expansive positions have emerged.

The “gap bridgers” (Parks and Stern 2014) hold that a lot of IR grant, both standard and basic, is politically insignificant - to a large degree because it focuses on conceptual and meta-theoretical topics of minor concern and makes use of on-screen political characters.

Diplomatic importance is here comprehended as policy relevance and prompts a call for more approach, which is investigation so as to connect the extending gap among speculation and exercise (Avey and Desch 2014; Mearsheimer and Walt 2013; Kurki 2011; Lowenthal et al., 2014). In opposition, the “gap minders” notice to fluctuated types of their communication among legislative issues and the scholarly world that require a more

Impact of COVID-19 on Market Risk: Appraisal with Value-at-risk Models

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Nupur Moni Das¹ and Bhabani Sankar Rout² 

Abstract

COVID-19 has traumatised the whole world in every aspect ranging from normal day-to-day activities to complete halt of the economies. This piece of work attempted to examine the response of the stock markets to the outbreak of COVID-9 by considering stock indices of five leading countries and comparing the risk with other periods of crisis viz. global financial crisis of 2007-2008 and stock market fluctuation in 1992. Both negative and positive fluctuation are examined, however special emphasis is placed on downside risk. The risk is measured using Value-at-Risk models with different distributional assumptions. The main observation of the study points towards gravity of this deadly virus as the volatility in the stock markets of all the countries is higher even compared to the global crisis of 2008 except China which is quite absurd. On the other hand, global markets are found to be highly correlated in the COVID-19 period. However, investors are also found to be reacting positively when favourable news is transmitted. The findings of this paper will help the investors in understanding the short-run dynamics of the stock markets and use such information in future for investment in similar circumstances.

Jel Classification: G01, G15, I15, G17, G28

Keywords

COVID-19, stock indices, VaR, Monte Carlo simulation

1. Introduction

The stock market has always been subject to fluctuation and depends on idiosyncratic and systemic risk. Risk to an extent is inevitable and necessary to yield sizeable returns. However, it brings disaster if it crosses a certain extent. If the returns bend towards the positive side, it is not at all a concern, but if it moves downwards, it takes a great toll on investors and the functioning of the economy. There has been a lot of attention showered from the researchers to study the stock market behaviour, especially during crises. As per Carp (2012), stock markets may hurt the economic development due to their vulnerability of market failure due to creeping up of crises. Health crises are considered to be more serious, as it takes

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COVID-19 and market risk: An assessment of the G-20 nations

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The study has attempted to study the impact of COVID-19 on downside stock market risk in the G-20 nations using Vaue-at-Risk models. The findings of the study suggest that all the G-20 nations have experienced very high level of risk during Global Financial Crisis and COVID-19 as all the countries' stock markets are critical during these two periods, but the magnitude of risk is found to be highest during COVID-19 period compared to other regimes in most of the countries. However, one shocking revelation is that China is found to be on safe zone having very less market risk, whereas all other countries are found to be critical.

1 | INTRODUCTION

Black Death was the most devastating pandemic of the last millennium, which played an important role in economic, social, and political change, particularly in Europe. Jorda, Singh, and Taylor (2020) are of the view that global pandemic leads to low return on assets, fall in interest rates, and loss of investment. In England, 25–40% drop in labor supply, approximately 100% increase in real wages, and a decrease in rates of return on land from about 5–8% was experienced due to Black Death followed by peasant revolution (Clark, 2010). Impact of crisis, especially epidemics and pandemics on the economy is also evident from the chapter of severe acute respiratory syndrome (SARS), 2003. It had a major impact on the economy, especially on the tourism sector in the Asian region (Page, Yeoman, Munro, Connell, & Walker, 2006). Kuo, Chen, Ju, and Huang (2008) observed the same phenomenon. China was affected most; not only was tourism impacted but also retail sales, restaurants, hotels, and the air transport industry (Keogh-Brown & Smith, 2008). Further impact of SARS was not limited to affected countries (Lee & McKibbin, 2003). McKibbin and Sidorenko (2006) estimated 300 million US dollars to 4.4 trillion US dollars economic cost in response to pandemic. As stated by Rassy and Smith (2013), the economic H1N1 influenza of 2009 in Mexico led to adverse impact on economy but the impact was short lived. Instances from Ebola and Arab Spring also demonstrate the serious consequences of the health crises, where Del- Giudice and Paltrinieri (2017) confirm the impact on the fund flows, performance of the funds, spending, and returns of the market. Mike Patton, senior contributor at Forbes on February 28, 2020, stated that during Spanish Flu, 1918 at worst, the market was down by 21%, while during swine

flu within less than 1 year from the start of Swine flu, market rose by 40 % as the stocks were already undervalued due to the global crisis.

COVID-19, whose first case was officially reported in China in December 31, 2019 is becoming too daunting as it has already affected 10,644,353 and 515,413 deaths as of July, 2020 (worldometers). As per IMF's estimate, the global economy is growing at –3% in 2020 which are worse than the 2009 global financial crises. Economies such as the United States, Japan, the United Kingdom, Germany, France, Italy, and Spain are expected to contract this year by 5.9, 5.2, 6.5, 7, 7.2, 9.1, and 8%, respectively (Indian Express, 2020, May 16). Government is continuously undertaking several measures to contain the spread of Covid-19, including closing schools, cancelling mass events, and the shutting down universities from March 14 onwards. However, the cost is enormous for such suppression strategy (Ferguson et al., 2020). BIS (March,1, 2020) reported that Stock market rolled downwards, U.S. dollar strengthened, bond yield declined. However, resumption of trade stabilized during the fluctuations.

1.1 | Pandemics and stock market

Stock market is considered to be an important pillar of the financial sector. Pearce (1983) stated that variation in stock prices impacts aggregate spending and thus direction of the economy can be predicted. Rising stock market leads to larger spending followed by higher economic growth and vice versa. Comincioli (1995) added that the stock prices mirror potential about profitability, thus directly linked to economic activity. However, As per Carp (2012), sometimes stock market is also seen as an agent who hurts economic development due to their susceptibility market failure. Creeping up of crisis

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Banks' capital adequacy ratio: a panacea or placebo

Nupur Moni Das · Bhabani Sankar Rout

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Abstract The changing paradigm of the banking sector regulation has prompted to investigate the inter-linkage of different banking sector variables, viz. capital adequacy ratio, profitability, risk, efficiency and other controlled variables. The study is designed with data for the period 1996–2016 and 43 Indian Commercial Banks. The result of two-stage least squares method reflects that CAR bears a positive association with the risk taking behaviour of the banks. Second, it has been seen that CAR is having a positive association with profitability, but it is adversely associated with efficiency.

Keywords Capital adequacy ratio · Efficiency · Risk · Profitability · Simultaneous equations

Introduction:

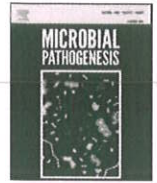
Money that raises profit may dig a bank into losses. The financial institutions are the most trusted body where a depositor invests his money as a liability to the bank believing that he would get his principal with a stipulated interest amount. It is obvious that the faith on financial institutions is directly tilted towards strong regulations and supervision by the apex bank. But the gap between reachability of banking awareness to public at larger is a question of fact. People considered bank as treasury rather a financial institution, so here the role of a regulator is much crucial. The survival of banks in the current deregulated, free, open and competitive markets depends on their performance and efficiency (Maghyereh and Awartani 2014). The regulator may cross-check the bank's health periodically, so that it can retain the investor's faith.

The liability side of the bank balance sheet has a maximum share of deposit by the investors so it may consider as a highly sensitive part for both bank and investors. Banks have the tendency to substitute capital with debt to maximize the return on capital and satisfy their investors which raise the risk followed by eroded returns and capital. Any mis-happening to the capital, profit, and efficiency along with other drivers has high chance that the bank comes to an end. The other part of a balance sheet ties with lending activities by the bank against deposit by the

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Microbial communities modulating brain functioning and behaviors in zebrafish: A mechanistic approach

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ABSTRACT

Microbiota plays a vital role in maintaining their host's physiology, development, reproduction, immune system, nutrient metabolism, brain chemistry and its behavior. How the gut microbiota modulates the brain function altering cognitive and fundamental behavior patterns related to specific functional changes is unclear. Recent studies provide holistic approaches which show gut microbiota can greatly sway all aspects of physiology including gut-brain communication, brain function and behavior by establishing a bi-directional link between the gut and brain. Among these studies, to our knowledge, the present review focus on the new mechanistic basis that relates the microbiota of the intestine with diseases of the nervous system causing behavioral alteration in zebrafish (*Danio rerio*) during development. The current review on microbiota-gut-brain axis communication showed a high instability of the microbiome at early stage of development in zebrafish. Probiotics restore the composition of the gut microbiota by producing neuroactive compounds and introduce beneficial functions to gut microbial communities, resulting in amelioration of gut inflammation and other intestinal disease phenotypes. Therefore, the present review mainly highlights the mechanistic way of gut-brain function, including neuronal, hormonal, immunological signaling with production of bacterial metabolites. This study consider current knowledge that may enable us to increase our understanding to know how the gut microbiota establishes a connection with brain modulating the gut-brain signaling by alteration of the neurochemistry such as GABA and serotonin levels in brain to control host behavior. Further studies are needed to define the exact microbial and host mechanism in GI disease states and functional syndromes.

1. Introduction

Zebrafish (*Danio rerio*) is a tropical, freshwater fish that has been extensively used as a vertebrate animal model in research due to its many advantageous properties. The use of both adult and larval zebrafish in modern science has shown an increase in the last decades. This vertebrate species has high physiological and genetic similarity with humans. Since it possesses similar central nervous system (CNS) morphology and genetics with humans, the utility of its genetic manipulation is worth studying. However, recent evidence depicts that microbiota, especially gut microbiota, can sway all aspects of physiology [1] by establishing communication between gut-brain as well as proper functioning of the brain. There is now compelling evidence for various links between microbiota of the intestine with diseases of the nervous system in host and its possible treatment [2]. In the field of microbiology and neuroscience, recently, the use of modern medicine has emerged as a forerunner without being directly focusing on the reaction

of host tissues to different infectious agents [3]. Zebrafish, having innate and adaptive immune systems similar to higher vertebrates [4,5] has become an extensive model for studying host-microbe interactions altering behavior. In this review, we screened the studies depicting various approaches that gut microbiota modulates the brain function and behavior.

2. Gut microbiota

The gut is home to a diverse array of trillions of microbes, mainly bacteria, but also archaea, yeasts, helminthes parasites, viruses, and protozoa [6]. Gut microbiota plays a crucial role in the development and functionality of the innate and adaptive immune system, maintaining homeostasis between intestinal barrier, nutrient absorption and distribution of fat. Any disruption of the commensal relationship of microbiota and the gastrointestinal (GI) tract [7,8] disturbs host functions and, contributes to a leaky gut-immune barrier [8,9] which leads

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State and Government in a Feudatory Kingdom A Case Study of Pre-merger Bonai

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Abstract


Princely states numbering 562, covering 40 per cent of the total area of India, and having 25 per cent of its population, presented altogether a different domain in the administrative history of colonial India. After 1858 movement the British Government of India interfered in the affairs of these states on many pretexts, such as interest of the state, interest of the whole of India, interest of the subjects of the state or to realise the new ideals of administration. In name the states were free, enjoying internal autonomy, but in reality every sphere of their activities were regulated by the British Government. In Orissa these princely states known as Garhjat (Gadjat), numbering 26 were no exception to these principles. Often branded as 'Andhari Mulaka' or dark domain these feudatory states were a kind of administrative division protected by British paramountcy where subjects had little liberty as compared to direct administered areas. The nature of the state and government in these Garhjat were traditional. However, after promulgation of the Government of India Act 1858, we find some changes in the administrative set up of these states. This article attempts at throwing some light on the nature of the state and Government in the feudatory state of Bonai, which merging with another feudatory state called Gangpur formed the present district of Sundargarh on 01 January 1948.

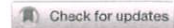
Keywords: Garhjat (Gadjat), Bonai State, Royal Family, Dewan, Administration, Land Revenue

1.0 Introduction

Bonail, a B class state¹ and one of the 26 Garhjats of Orissa (now spelt Odisha) was, as the name suggests (from *bana* means forest) a small forested region shut on all sides by rugged forest clad hills. It was fifty eight miles in greatest length from east to west and thirty seven miles in width from north to south with a total area of 1296 square miles. Bonai as Colonel T. Dalton, the Commissioner of Chotanagpur reported in 1863-64 was not a thickly inhabited

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Some properties of isoclinism in Lie superalgebras

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ABSTRACT

Isoclinism of Lie superalgebras has been defined and studied currently. In this article, it is shown that for finite dimensional Lie superalgebras of same dimension, the notation of isoclinism and isomorphism are equivalent. Furthermore, we show that covers of finite dimensional Lie superalgebras are isomorphic using isoclinism concept.

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1. Introduction

In 1940, P. Hall introduced an equivalence relation on the class of all groups called isoclinism, which is weaker than isomorphism and plays an important role in classification of finite p -groups [7]. In 1994, K. Moneyhun [8, 9] gave a Lie algebra analog of the concept of isoclinism. Furthermore, Saeedi and Veisi [13] have defined the same notation for n -Lie algebras. Similarly, isoclinism has been defined and studied for Lie superalgebras recently [12].

Definition 1.1. Let L and K be two Lie superalgebras, $\varphi : \frac{L}{Z(L)} \rightarrow \frac{K}{Z(K)}$ and $\theta : L' \rightarrow K'$ be Lie superalgebra homomorphisms such that the following diagram is commutative,

$$\begin{array}{ccc} L/Z(L) \times L/Z(L) & \xrightarrow{\mu} & L' \\ \downarrow \varphi^2 & & \downarrow \theta \\ K/Z(K) \times K/Z(K) & \xrightarrow{\rho} & K' \end{array}$$

where $\mu((\bar{l}, \bar{m})) := [l, m]$ for $l, m \in L$ and similarly for $\rho((\bar{r}, \bar{s})) := [r, s]$ for $r, s \in K$. Or, equivalently φ and θ are defined in such a way that they are compatible, i.e., $\theta([l, m]) = [k, r]$, where

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Magnetic reorientation transition in a three orbital model for Ca_2RuO_4 —interplay of spin–orbit coupling, tetragonal distortion, and Coulomb interactions

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Abstract

Including the orbital off-diagonal spin and charge condensates in the self consistent determination of magnetic order within a realistic three-orbital model for the $4d^4$ compound Ca_2RuO_4 , reveals a host of novel features including strong and anisotropic spin–orbit coupling (SOC) renormalization, coupling of strong orbital magnetic moments to orbital fields, and a magnetic reorientation transition. Highlighting the rich interplay between orbital geometry and overlap, SOC, Coulomb interactions, tetragonal distortion, and staggered octahedral tilting and rotation, our investigation yields a planar antiferromagnetic (AFM) order for moderate tetragonal distortion, with easy a – b plane and easy b axis anisotropies, along with small canting of the dominantly yz, xz orbital moments. With decreasing tetragonal distortion, we find a magnetic reorientation transition from the dominantly planar AFM order to a dominantly c axis ferromagnetic order with significant xy orbital moment.

Keywords: spin–orbit coupling, anti-ferromagnetic and ferromagnetic orders, three orbital model, Coulomb interactions, tetragonal distortion, orbital off-diagonal condensates

(Some figures may appear in colour only in the online journal)

1. Introduction


The interplay of spin–orbit coupling (SOC) with electronic correlations and crystal field splittings has been found to drive various topologically nontrivial phases in condensed matter systems such as topological Mott insulators, quantum spin liquids, and superconducting states [1, 2]. The $4d$ and $5d$ transition metal oxides containing Ru^{4+} , Os^{4+} , Ir^{4+} , Ir^{5+} ions have emerged as promising candidates exhibiting SOC-induced exotic ground states, magnetic anisotropy effects, and intriguing collective excitations. SOC effects in the d^5 systems are more transparent and well understood in terms of the spin–orbital entangled electronic states with nominally filled $J = 3/2$ quartet and half-filled magnetically active $J = 1/2$

doublets [3]. The isospin dynamics involving J states provides insight into the experimentally observed magnetic behavior in perovskite iridates as well as iridate heterostructures which are gaining interest as their magnetic properties are much more sensitive to structural distortion compared to pure spin systems due to spin–orbital entanglement [4–7].

However, the situation is very different in d^4 systems with four electrons per metal ion. For strong SOC, all four electrons fill the $J = 3/2$ sector, leaving the $J = 1/2$ sector empty and naturally leading to non-magnetic insulating behavior [8]. Similarly, for strong Hund's coupling, total spin moment $S = 1$ antiparallel to the orbital moment $L = 1$ leads to total angular momentum $J = 0$ on every metal ion with no magnetism. Thus, both scenarios lead to the non-magnetic $J = 0$ singlet ground state for d^4 systems. However, magnetism has been revealed in some double perovskite iridates and

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Pseudo-spin rotation symmetry breaking by Coulomb interaction terms in spin–orbit coupled systems

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Abstract

By transforming from the pure-spin-orbital (t_{2g}) basis to the spin-orbital entangled pseudo-spin-orbital basis, the pseudo-spin rotation symmetry of the different Coulomb interaction terms is investigated under $SU(2)$ transformation in pseudo-spin space. While the Hubbard and density interaction terms are invariant, the Hund's coupling and pair-hopping interaction terms explicitly break pseudo-spin rotation symmetry systematically. The form of the symmetry-breaking terms obtained from the transformation of the Coulomb interaction terms accounts for the easy x – y plane anisotropy and magnon gap for the out-of-plane mode, highlighting the importance of mixing with the nominally non-magnetic $J = 3/2$ sector, and providing a physically transparent approach for investigating magnetic ordering and anisotropy effects in perovskite (Sr_2IrO_4) and other d^5 pseudo-spin compounds.

Keywords: spin–orbit coupling, Coulomb interaction terms, spin-orbital entanglement, magnetic ordering and anisotropy, magnon excitations, three-orbital model, Hund's coupling

(Some figures may appear in colour only in the online journal)


1. Introduction

Arising from a novel interplay between crystal field, spin–orbit coupling (SOC) and intermediate-strength Coulomb interactions, the emergent quantum states which essentially determine the electronic and magnetic properties of the iridium based transition-metal oxides involve correlated motion of electrons in spin-orbital entangled states [1–3]. In the spin–orbit Mott insulator Sr_2IrO_4 with d^5 configuration, electronic states near the Fermi energy have dominantly $J = 1/2$ character, and important magnetic properties such as in-plane canted antiferromagnetic (AFM) order and magnon excitations have been extensively discussed in terms of the effectively single pseudo orbital ($J = 1/2$) picture [4–7]. Finite-interaction and finite-SOC effects are responsible for the strong zone-boundary magnon dispersion measured in resonant inelastic x-ray scattering (RIXS) studies, highlight-

ing the observable effect of mixing between $J = 1/2$ and $3/2$ sectors [8].

The Dzyaloshinskii–Moriya (DM) and pseudo-dipolar (PD) anisotropic interactions in the $J = 1/2$ sector, although weakly affected by the tetragonal splitting [9], are not the source of true anisotropy in Sr_2IrO_4 , as they yield pseudo-spin canting with no magnon gap due to compensation. True anisotropy has been ascribed to the Hund's coupling term (J_H) using strong-coupling expansion (including virtual excitations to $J = 3/2$ states) and numerical self-consistent calculation [10–14]. While Coulomb interactions were considered within the pure-spin-orbital basis (t_{2g} orbitals, pure spins) in above approaches, their treatment within a pseudo-spin-orbital basis, and the role of weak magnetism in the other two pseudo orbitals ($J = 3/2$ sector) on the J_H -induced easy-plane magnetic anisotropy and magnon gap (~ 40 meV), as measured in recent resonant inelastic x-ray scattering (RIXS) studies [15–17], have not been elucidated. Furthermore, the pseudo-spin-orbital based approach can allow for a unified study

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Research articles

Correlated motion of particle-hole excitations across the renormalized spin-orbit gap in Sr_2IrO_4

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ABSTRACT

The high-energy collective modes of particle-hole excitations across the spin-orbit gap in Sr_2IrO_4 are investigated using the transformed Coulomb interaction terms in the pseudo-spin-orbital basis constituted by the $J = 1/2$ and $3/2$ states arising from spin-orbit coupling. With appropriate interaction strengths and renormalized spin-orbit gap, these collective modes yield two well-defined propagating spin-orbit exciton modes, with energy scale and dispersion in excellent agreement with resonant inelastic X-ray scattering (RIXS) measurements.

1. Introduction

The iridium based transition-metal oxides exhibiting novel $J = 1/2$ Mott insulating states have attracted considerable interest in recent years in view of their potential for hosting collective quantum states such as quantum spin liquids, topological orders, and high-temperature superconductors [1]. The effective $J = 1/2$ antiferromagnetic (AFM) insulating state in iridates arises from a novel interplay between crystal field, spin-orbit coupling (SOC) and intermediate Coulomb correlations. Exploration of the emerging quantum states in the iridate compounds therefore involves investigation of the correlated spin-orbital entangled electronic states and related magnetic properties.

Among the iridium compounds, the quasi-two-dimensional (2D) square-lattice perovskite-structured iridate Sr_2IrO_4 is of special interest as the first spin-orbit Mott insulator to be identified and because of its structural and physical similarity with La_2CuO_4 [2,3]. It exhibits canted AFM ordering of the pseudospins below Néel temperature $T_N \approx 240$ K. The canting of the in-plane magnetic moments tracks the staggered IrO_6 octahedral rotations about the c axis. The effectively single (pseudo) orbital ($J = 1/2$) nature of this Mott insulator has motivated intensive finite doping studies aimed at inducing the superconducting state as in the cuprates [4–10].

Technological advancements and improved energy resolution in resonant inelastic X-ray scattering (RIXS) have been instrumental in the elucidation of the pseudospin dynamics in Sr_2IrO_4 . Recent measurements point to a partially resolved ~ 30 meV magnon gap at the Γ point [11], which has been further resolved via high-resolution RIXS and inelastic neutron scattering (INS), both of which indicate another magnon gap between 2 and 3 meV at (π, π) [12]. These low-energy features correspond to different magnon modes associated with basal-

plane and out-of-plane fluctuations, indicating the presence of anisotropic spin interactions. In addition to magnon modes, RIXS experiments have also revealed a high-energy dispersive feature in the energy range 0.4–0.8 eV. Attributed to electron-hole pair excitations across the spin-orbit gap between the $J = 1/2$ and $3/2$ bands, this distinctive mode is referred to as the spin-orbit exciton [13–17].

Among the theoretical approaches, the spin-orbit exciton was identified as a bound state in the spectral function of the two-particle Green's function within the multi-orbital itinerant electron picture [16]. However, the full dispersion was not obtained, and the original t_{2g} basis was employed instead of the more natural SOC-split J states with intrinsic spin-orbit gap. In another approach, the exciton dispersion was obtained in analogy with hole motion in an AFM background [13,15]. However, the bare exciton dispersion was neglected, and an approach which allows for a unified description of both magnon and spin-orbit exciton on the same footing will be desirable as both excitations are observed in the same RIXS measurements.

In this paper, we therefore plan to investigate the correlated motion of inter-orbital particle-hole excitations across the renormalized spin-orbit gap (between $J = 1/2$ and $J = 3/2$ sectors), along with detailed comparison with RIXS data for the spin-orbit exciton modes in Sr_2IrO_4 . Similar comparison for the magnon dispersion involving intra-orbital ($J = 1/2$) particle-hole excitations has provided experimental evidence of several distinctive features associated with the rich interplay of spin-orbit coupling, Coulomb interaction, and realistic multi-orbital electronic band structure, such as (i) finite- U and finite-SOC effects, (ii) mixing and coupling between the $J = 1/2$ and $3/2$ sectors, and (iii) Hund's-coupling-induced true magnetic anisotropy and magnon gap [18–20].

The structure of the paper is as follows. After a brief account of the

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CLASSICAL THINKERS OF SCIENTIFIC RESEARCH: WITH SPECIAL REFERENCE TO CONSTRUCT RESEARCH PROPOSAL IN SOCIAL SCIENCES

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ABSTRACT

The systematic investigation into and study of materials and sources, in order to establish facts and reach new conclusions is called research. The aim of this paper is contribute in some way to the existing knowledge we have in a particular field. A research project or thesis is a documented record of what that contribution is and how it was achieved so that it is clear here that we have to know that how to construct research proposal in particular. The paper concludes that it needs to thoroughly research what is already known in your field, identify an area that needs further research, and then make claims based on your findings. The claim should be the most reasonable based on the available evidence.

Keyword: Research, Systematic, Research Proposal

1. INTRODUCTION

Research means technical and organized search for relevant information on a particular topic. It is defined as an academic activity that involves identifying the research problem, formulating a hypothesis, collecting and analyzing data and reaching specific conclusions in the form of solutions or general theories. The primary objective of research is to find solutions for problems in a methodical and systematic way. A research depends on the field in which the research work is performed. Various types of researches can be done for different fields, like fundamental research for identifying the important principles of the research field and applied research for solving an immediate problem. However, all these researches primarily follow two approaches, quantitative and qualitative. The quantitative approach focuses on the quantity of the data obtained from the research, while the qualitative approach is concerned with the quality of the obtained data (Lovely Professional University, 2012).

2. RESEARCH OBJECTIVES

Research is an art of scientific investigation. It is also a systematic design, collection, analysis and reporting the findings & solutions (Ibid, p.3). Research is required because of the following reasons:

1. To identify and find solutions to the problems

2. To help making decisions

3. To develop new concepts

4. To find alternate strategies

3. HISTORICAL BACKGROUND OF SCIENTIFIC RESEARCH APPROACH

The scientific approach to knowledge was established in Europe which began to experience the growth of industry and the development of large cities. Those cities were filled with uneducated factory labourers. This created a need for increased productivity in agriculture among those not engaged in industrial work. Optimism for science ran high, as it became obvious that the new method for acquiring knowledge about natural phenomena promised bigger crops, more productive industry, and more successful military campaigns. The organizing mandate for the French Academy of Science in 1666 included a modest proposal to study "the explosive force of gunpowder enclosed (in small amounts) in an iron or very thick copper box" (Easlea 1980:207, 216 cited in Bernard, 2006, P.10). As the potential benefits of science became evident, political support increased across Europe. More scientists were produced; more university posts were created for them to work in. Journals and learned societies developed as scientists sought more outlets for publishing their work. Sharing knowledge through journals made it easier for scientists to do their own work and to advance

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Abstract

There are some common factors in the higher education system in India. Higher educational institutions in India are controlled and regulated by the Government. However, many major problems exist in the country such as high population growth, poverty, lack of funding, others economical and political parameters. In view of this, the paper tries to look into the various aspects and dimensions of higher education in India. The paper finds that the present system of higher education of India has been growing rapidly after independence but as less comparative with western as well as neighbouring countries because status of Indians decides on the basis of economic and political parameters rather than education.

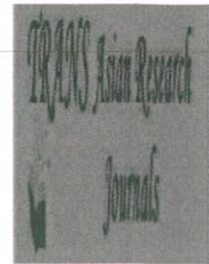
Key Words: Higher Education, Institutions, India

Introduction

Education is general and higher education in particular have passing through many crisis. After independence of India, a number of higher educational institutions emerged in all over the India. The higher education in India has evolved through different periods, viz., ancient, medieval, colonial, post-independence and contemporary era. Higher learning started with an ancient system of education in the Vedic period in which two types of educational system were present there such as the Brahminical and the Buddhist systems of education. The Brahminical system of education was regulated by religious values, while the Buddhist form of education was 'secular' in nature. But the major change in Indian higher education

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THE COOPERATION OF HIGHER EDUCATION BETWEEN INDIA AND CHINA**Roshan Ekka*; Subal Tandi****

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ABSTRACT

Background- *The paper studies the cooperation between India and China on Higher Education System. Both Countries signed Education Exchange Programme (EEP) in 2006 which is an umbrella agreement for educational cooperation between them. Under this agreement, government scholarships are awarded to 25 students, by both sides, in recognized institutions of higher learning in each other's country. There are 25 scholarships awarded by India and sponsored by Indian Council for Cultural Relations (ICCR). During the visit of Prime Minister Narendra Modi to China, both the countries have signed fresh Education Exchange Programme (EEP) on May 15, 2015. The same provides for enhanced cooperation between institutions in the field of vocational education; collaboration between Institutes of higher learning, etc. 25 Chinese students have been selected to join Hindi language course for the academic year 2017-18 under EEP scholarship awarded by ICCR. Apart from this, Chinese students are also annually awarded scholarships to study Hindi at the Kendriya Hindi Sansthan, Agra to learn Hindi. There are 5 Chinese students who have been selected to study in Agra under this scheme in 2017-18. Prakash Javadekar, Minister of Human Resource Development, attended BRICS Ministers of Education on 5th July, 2017 at Beijing, China and he told that the creation of institutional mechanism in the form of BRICS Network University and BRICS Think Tank Council. There are 12 universities from each of the 5 countries engage with each other in education research and innovation which is another commendable initiative at BRICS Network*

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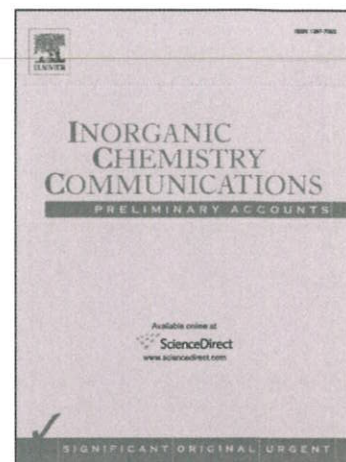
Facile synthesis of new hybrid electrode material based on activated carbon/multiwalled carbon nanotubes@ZnFe₂O₄ for supercapacitor applications

Manoranjan Mandal, Subhasri Subudhi, Injamul Alam, B.V.R.S. Subramanyam, Santosini Patra, Jagatpati Raiguru, Sonali Das, Pitamber Mahanandia

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Facile synthesis of new hybrid electrode material based on activated carbon/multiwalled carbon nanotubes@ZnFe₂O₄ for supercapacitor applications

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Abstract

A new hybrid composite of activated carbon (AC)/multiwalled carbon nanotubes (MWCNTs)-ZnFe₂O₄ has been prepared by the modest and low-cost method for its application as supercapacitor electrode material. The carbon-based composite electrode gives excellent cycle stability with moderate capacitance. So the capacitance of carbon-based composite electrode could be further improved by incorporating metal oxides as they involve reversible redox reaction. In this regard, zinc ferrite (ZnFe₂O₄) among various metal oxides is being considered as important additive material towards supercapacitor (SC) applications owing to its excellent physical and chemical properties. Hence, ZnFe₂O₄ is integrated with the carbon composite of MWCNTs and AC for better SC performance and cycle stability. The composite has resulted in maximum specific capacitance of 613 F/g at 5 mV/s when measured from cyclic voltammetry (CV) in 3M KOH electrolyte. The measurement from galvanostatic charge-discharge (GCD) on synthesised composite has shown capacitance of 609 F/g at 1 A/g and that implying the significant storage performance of the prepared hybrid material. The stability, which is vital for the application of the composite, has been subjected for stability test and found that it retained 91% of the capacitance even after 10000 cycles. Further, the synthesised materials have been characterized by powder X-ray diffraction (XRD), Raman spectroscopy, scanning electron microscope (SEM), transmission electron microscope (TEM), high-resolution transmission electron microscope (HRTEM), Brunauer-Emmett-Teller (BET) and Barrett-Joyner-Halenda (BJH). The variation of current as a function of the applied voltage was analysed by current-voltage (I-V) measurements. These results suggest that the prepared composite can proficiently serve as a reliable choice for the electrode material for high-performance supercapacitor applications.


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Synthesis of carbon dots from spider silk: Conversion of waste to valuable product

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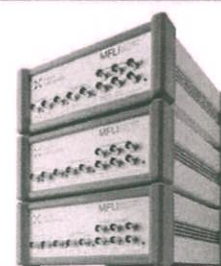
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Synthesis of Carbon Dots from Spider silk: Conversion of waste to valuable product

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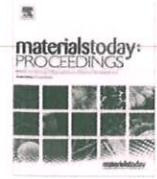
Abstract. Utilization of biomass as renewable and sustainable resource has attracted much attention of scientific community around the world. Herein, for the first time we report a green synthesis approach for carbon dots (CDs) from spider silk (*Crossopriza lyoni*) done by simple thermal pyrolysis at low temperature of 250°C. The synthesized CDs are comprehensively characterized by XRD, Raman, UV-visible and photoluminescence spectroscopy. The obtained higher band gap confirms the formation of CDs. The obtained results demonstrate that the prepared CDs have great potential application towards bio sensing, photovoltaic application, bio imaging and even disease diagnosis.

Keywords: Carbon Dots, Spider silk (*Crossopriza lyoni*), Pyrolysis, Raman spectroscopy.

INTRODUCTION

In recent years, a new emerging class of carbon nanomaterial like carbon dots (CDs), size ranges below 10nm have drawn major attention of scientific community owing to their outstanding fluorescence properties for various optoelectronic applications.¹ Many unique properties such as stable photoluminescence, high water solubility, chemical inertness, low toxicity, excellent biocompatibility and low cost makes CDs a potential material for photovoltaic devices, photo catalysis, cell imaging, fluorescent inks, medical diagnosis, chemical sensors, and biosensors. Their bio compatibility and cost effectiveness makes them more interesting in compared to traditional quantum dots. Carbonization of several organic compounds like glucose, sucrose, glycerol, citric acid, ascorbic acid, etc. have been utilized previously to produce CDs.² However, the time consuming and sophisticated nature of the mentioned approach limits their practical applications. There are many reported proves for CDs synthesis from carbonaceous materials like graphite and carbon nanotubes by physical methods like laser ablation, microwave-assisted methods, hydrothermal methods, ultrasonic treatment, arc discharge, plasma treatment and chemical methods like electrochemical oxidation, thermal oxidation, and vapor deposition of soot, wet chemical and electrochemical method. All this technique to synthesis procedures have been limited to smaller range spectral efficiency, low product yields. An alternative way to produce high yield CDs from commercially available food products, like bread, sugar, jiggery etc. due to the presence of carbohydrates.³ Now-a-days, researchers are finding an eco-friendly way to produce nanomaterial by using renewable resources as precursors for environmental concerns and the increasing rates of pollutions. Green synthesis of CDs from sources like prawn shells, cotton, orange peels, rice husk, lychee seeds, peanut skin, hair and peanut shells have been reported.⁴ Green chemistries is the only way towards sustainable processes which can be achieved by minimizing the waste produced, whose primary motto is to use non-toxic starting materials, environment friendly chemicals. The advantages of green synthesis of CDs are, it is less time consuming and doesn't require higher temperatures and also biocompatible in nature and cost effective. The parameters for altering size of CDs are the starting materials and duration of the process. In this work, for the first time, we have demonstrated the synthesis of fluorescent CDs using *Crossopriza lyoni* spider dragline silk (spider silk) as a carbon source by a simple


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Applications of carbon nanotubes in different layers of P3HT: PCBM bulk heterojunction organic photovoltaic cells

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ABSTRACT

Carbon nanotubes (CNTs) have been synthesized by a simple and efficient pyrolysis technique, and composites of CNTs with PEDOT:PSS, and with P3HT:PCBM blend have been prepared by a modest solution treatment. Bulk heterojunction organic photovoltaic cell (OPVC) has been fabricated by spin coating technique with configuration ITO/PEDOT:PSS/P3HT:PCBM/Al to serve as reference OPVC. Three more OPVCs have been fabricated by the same procedure, the first one with CNTs/PEDOT:PSS composite replacing PEDOT:PSS, second one with CNTs/P3HT:PCBM composite replacing P3HT:PCBM blend, and the third one with both replacements. The performances of all the OPVCs at room temperature have been compared and CNTs have been observed to cause extraordinary increment in the power conversion efficiency (PCE) as well as other electrical parameters of all the devices depending on the layer in which they have been incorporated. To extend the study for understanding further advantages of CNTs incorporation in fighting against degradation, all the fabricated OPVCs have been exposed to open atmosphere and their electrical properties have been measured at room temperature in regular intervals. Encouragingly positive outcomes have been attained, demonstrating not only a well maintained enhancement in the PCE, but also a considerably improved device stability. The best performing OPVC has achieved 24% more PCE and 67% more lifetime in open atmosphere than the reference device, which clearly does indicate the significance of applications of filler CNTs to improve not only the performance but also the stability of OPVCs.

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1. Introduction

In this era of incessantly growing global population, solar energy is the best option to fulfil the extensive energy deficiency. Among the various photovoltaic technologies used to harness solar energy, bulk heterojunction organic photovoltaic cells (OPVCs) have been observed to have a significant role owing to their advantages like cost effectiveness, easy processing techniques, light weight, and mechanical flexibility. However, material degradation and comparatively low power conversion efficiency (PCE) are still hampering the progress of OPVCs by standing as serious obstacles in the path of their commercialization [1–3]. Hence in order to productively meet the future energy demands, OPVCs need to have

enough modifications to face against the aforementioned problems, for which the incorporation of materials with significant physical properties in the electrode layer as well as the active layer of the OPVCs can offer a considerable assistance. Carbon nanotubes (CNTs) are among the few materials of choice for this purpose, owing to their extraordinary aspect ratio, high surface area, ballistic axial charge transport, low reflectance, mechanical stability, and electron accepting nature [4] Table 1.

Park et al. have discussed the dependence of electrical properties of CNTs/PEDOT:PSS composites on the amount of CNTs in their report [5]. Singh et al. have shown enhancement of PCE from 1.33% to 2.71% by incorporation of CNTs in P3HT:PCBM OPVC [6]. The improved physical properties of polymers due to the incorporation of CNTs, and enhanced performances of OPVCs fabricated using such composites can be found in many other reports [7–12]. However, to the best of the authors' knowledge, the combined effects of

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Enhanced stability of bulk heterojunction organic solar cells by application of few layers of electrochemically exfoliated graphene

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ABSTRACT

Few layers of electrochemically exfoliated graphene (FLECEG) of high quality have been synthesized by a modest method, and their composites with PEDOT:PSS and P3HT have been prepared by a simple solution process. The increase in filler FLECEG wt. % in the polymer has been observed to cause attractive modifications in the physical properties of all the composites, encouraging for their applications in energy systems. Conventional bulk heterojunction organic solar cells (OSCs) have been fabricated by separately using the composites as additional electrode layers and in the active layer of the device. A significant enhancement in the magnitude of device parameters of the OSCs due to the incorporation of FLECEG has been perceived compared with the corresponding reference devices. The caustic effects of intrinsic and additional extrinsic degradation processes on the output of the OSCs have been studied by periodically measuring the device's electrical properties under different environmental conditions. When compared with the performance of reference devices, OSCs manufactured by the application of the composites in both the charge transport layer and the active layer have been noticed to be sustaining with a remarkable stability, while the increment in power conversion efficiency is well maintained. This report has the potential to provide motivation for concentrating advanced research towards the development of composite materials for their applications in manufacturing more stable and efficient organic optoelectronic devices.


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I. INTRODUCTION

The provisions of renewable energy have become extremely essential now to support the survival of humankind against intensive problems like rapid escalation in the energy demands of growing population, scarcity of non-renewable energy resources, and uncontrollably rising pollution. Owing to the incessant and extensive research carried out for a long time, photovoltaic technology has demonstrated its worth to be at the apex among all the other amiable solutions that are assisting to fight against the globally mounted and disturbing energy concerns. Among the different photovoltaic technologies, organic solar cells (OSCs), which belong to the third generation, are of exceptional reputation as they are inexpensive, non-toxic, light weighted, mechanically flexible, and operable at large scale due to their integrability, and promisingly can be manufactured via simple and less energy consuming fabrication techniques using materials that are not only abundant, but also have properties that can be tuned and tailored.¹⁻³ However, in a race to take over and rule the international markets, OSCs are still far behind their opponent technologies because

of many contributing aspects, among which the two most important factors are the degradation of materials used for their fabrication, resulting in shorter device lifetime, and the low power conversion efficiency (PCE) compared to first and second generation photovoltaic cells.⁴⁻⁷ It is, hence, important to concentrate on more research efforts to provide a rigid foundation for building a commercialized platform for OSCs by improving both their stability and output, not only to sustain among other well-established competing technologies, but also to strengthen their integration with different energy storage systems to empower smart, effective, and multipurpose applications like organic solar batteries or organic solar capacitors.

The commercialization of any photovoltaic technology depends typically on the device efficiency, operational lifetime, and the total cost of fabrication as well as maintenance, and these characteristic features in turn depend on the configuration of the cell, materials that are considered for the fabrication of device, and the environmental conditions under which the cell is performing. Of all the modest configurative approaches adopted to fabricate OSCs, the bulk heterojunction


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A few layers of graphene sheets prepared by an electrochemical method enhance the performance of organic photovoltaic device

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Electrochemical exfoliation

Conducting polymer

ABSTRACT

A composite has been prepared by incorporating few layers of graphene sheets (FLGS) synthesized by an electrochemical method in poly (3-hexylthiophene-2, 5-diyl) (P3HT): [6,6]-phenyl-C61-butyric acid methyl ester (PCBM). The composite has been used as active layer in the photovoltaic device (ITO/FLGS:P3HT:PCBM/Al) and the device characteristics were investigated. The as prepared FLGS has been characterized by X-ray diffraction (XRD), scanning electron microscope (SEM), transmission electron microscope (TEM), Fourier-transform infrared spectroscopy (FTIR), Ultraviolet-visible spectroscopy (UV-Vis), and Raman spectroscopy. The performance of the composite based device has been studied under illumination and the results have been compared with the reference device (ITO/P3HT:PCBM/Al). Short circuit current density (J_{sc}) of $6.24 \text{ mA}\cdot\text{cm}^{-2}$, open circuit voltage (V_{oc}) of 0.54 V, Fill factor (FF) of 44.22% and solar power conversion efficiency (PCE) of 1.49% have been obtained for reference photovoltaic device. After introducing FLGS in the active layer with P3HT:PCBM blend, improvement of J_{sc} of $8.2 \text{ mA}\cdot\text{cm}^{-2}$, V_{oc} of 0.57 V, FF of 42.15% and solar power conversion efficiency of 1.97% have been observed. The performance improvement in FLGS incorporated device compared to the reference device is attributed to the advantage of electron accepting feature and high electron transport capability of FLGS. © 2020 Elsevier Ltd. All rights reserved.

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1. Introduction

The progress in photovoltaic (PV) devices fabricated by the applications of organic materials is an eye-catching research because of their low cost and eco-friendly working methods. The advantages of organic solar cells (OSC) like practicability on enormous regions, deposition on flexible and light-weight substrates [1] have made them preferable even if they exhibit lower efficiencies than inorganic devices centered on crystalline silicon. In most common fabrication approaches of OSC, the photo-electron is persuaded by the institution of the bulk heterojunction notion and is transferred from polymer to fullerene molecules [2]. The blend of P3HT:PCBM is highly adopted as an active layer in the organic photovoltaic device configuration, where P3HT operates as an electron donor and PCBM operates as an electron acceptor. For the excel-

lence in device performance, a combination of 1:1 is taken to succeed a large amount of exciton photo generation and dissociation, along with a widespread clarification network for electron and hole transport. However, the power conversion efficiency (PCE) is ominously restricted due to the recombination of electron-hole pairs and poor transport of charge carriers [3]. In this regard, application of graphene which has great electron transportation properties [4,5] is encouraged for its magnificent enforcement in OPV devices as both an electron acceptor [6] and as a transparent electrode, substituting the ITO [7]. There are reports regarding the potential applications of carbon nanostructures in various device layers to improve their performance [8–10]. In this work, we report the photovoltaic device performance in which the active layer is the composite prepared by incorporating few layers of graphene sheets (FLGS) prepared by an electrochemical method in poly (3-hexylthiophene-2, 5-diyl) (P3HT): [6,6]-phenyl-C61-butyric acid methyl ester (PCBM). The FLGS in the device active layer are expected not only to operate as an electron acceptor, but also to

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EVALUATING THE POLITICAL RELEVANCE OF INTERNATIONAL RELATIONS THEORY

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ABSTRACT

The “gap bridgers” and the “gap minders” are the two broad positions, which dominate the debate at present that is significance to the theory of international relations (IR). Nonetheless, absent from this discussion is a wider theoretical in the context, that helps us to step beyond their differences. This article, therefore gives a theoretical account of the relation between politics and information. Scientific knowledge has the political relevance that gets distancing itself in the modern context that happens in a particular politics over the theorizing. In the abstraction, there is political relevance at different stages, which has the relationship in paradoxical that rise in the dimension in three different ways. Politics has the modern concept that has a crucial role for establishing that plays a meta-theory; political space is established by the theories as well as policies have a specific influence on empirical studies. Considering this specific circumstance, also, requires a reassessment of center highlights of the order: its destitution, fracture, and irresponsibility are normal to every advanced science; they work as a driver of logical advancement; and meta-theoretical discussions deal with the political element of advanced sciences. Therefore, IR “s democratic wellspring has significance in its imaginary institutions.

KEYWORDS: International Relations Theory & Modern Politics

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1. INTRODUCTION

The case that the control of IR neglects to satisfy its core vocation to create politically pertinent work isn't new (for instance, Wallace 1996). Today, in any case, this case is rehashed and talked about in standard and internet based life (Kristof 2014) and illuminates look into financing arrangements (Bastow, Dunleavy and Tinkler 2014; Desch 2015). The issue of these lines of critical significance for the control and has offered ascend to an energetic discussion. While the objective of creating politically important information is generally shared among IR researchers, the significance of this term and the way to attain the exceptionally challenged. Two expansive positions have emerged.

The “gap bridgers” (Parks and Stern 2014) hold that a lot of IR grant, both standard and basic, is politically insignificant - to a large degree because it focuses on conceptual and meta-theoretical topics of minor concern and makes use of on-screen political characters.

Diplomatic importance is here comprehended as policy relevance and prompts a call for more approach, which is investigation so as to connect the extending gap among speculation and exercise (Avey and Desch 2014; Mearsheimer and Walt 2013; Kurki 2011; Lowenthal et al., 2014). In opposition, the “gap minders” notice to fluctuated types of their communication among legislative issues and the scholarly world that require a more





Dielectric phase transition and ferroelectric properties of neodymium-doped $\text{BaBi}_4\text{Ti}_4\text{O}_{15}$ layered ceramics

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ABSTRACT

The dielectric and ferroelectric properties of $\text{Ba}_{1-(3/2)x}\text{Nd}_x\text{Bi}_4\text{Ti}_4\text{O}_{15}$ (BNBT) ceramics prepared by using the solid-state reaction route have been studied. X-ray diffraction study revealed that all the samples are in the orthorhombic symmetry with space group $A21am$. The dielectric study as a function of temperature demonstrated a ferroelectric to paraelectric transition is of diffuse type. The transition temperature (T_c) was found to be increased from 420 °C ($x = 0$) for BNBT to 500 °C ($x = 0.40$) at 500 MHz, thus broadening the utilization temperature range of the ceramics. Sample $x = 0.40$ with the lowest $TK\epsilon$ value, indicating the best dielectric temperature stability in all samples. The very high oxygen vacancy of the sample $x = 0.40$ partially contributes to its higher T_c . However, $x = 0.10$ sample shows the lowest $\tan \delta$ at 300 °C, which shows the lowest electrical conductivity in all the samples. The effect of Nd additives on the degree of diffuseness of the dielectric constant curves of BNBT was discussed by using modified Curie–Weiss law. The ferroelectric nature of the samples has been confirmed from the measurement of the hysteresis loop at room temperature.

1 Introduction

Bismuth layered structured ferroelectrics (BLSF) have been widely investigated for their high dielectric constant, diffuse phase transition, giant electrostriction, and relaxor ferroelectric properties that are useful for application in piezoelectric transducers, sensors, ferroelectric non-volatile memories (FeRAM), etc. [1]. Polycrystalline $\text{BaBi}_4\text{Ti}_4\text{O}_{15}$ (BBT) lies under the four-layered perovskite structure having


Ba^{2+} (Barium) and Bi^{3+} (bismuth) ions at site-A and Ti^{4+} (titanium) ions at the site-B of its each orthorhombic perovskite block. The crystal chemistry associated with the origin of the ferroelectric behavior and dielectric phase transition in $\text{MBi}_4\text{Ti}_4\text{O}_{15}$ of BLSFs and they found that the size of M cation and the number of perovskites units in these compounds play a major role in the change in phase transition temperature (T_c) [2, 3]. This exhibits that the dielectric behaves like a relaxor with appreciable piezoelectric

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Does Commodity Derivatives Function Effectively? A lengthy Discussion

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Bhabani Sankar Rout¹, Nupur Moni Das² and K. Chandrasekhara Rao³

Abstract

The present work has been designed to intensely investigate the capability of the commodity futures market in achieving the aim of price discovery. Further, the downside of the cash and futures market and transfer of the risk to other markets has also been studied using VaR, and Bivariate EGARCH. The findings of the work point that the metal commodity derivative market helps in the efficient discovery of price in the spot market except for nickel. But, in the case of the agricultural commodities, the spot is found to be leading and thus there is no price discovery except turmeric. On the other hand, the volatility spillover is bidirectional for both agri and metal commodities except copper, where volatility spills only from futures to spot. Further, the effect of negative shock informational bias differs from commodity to commodity, irrespective of metal or agriculture.

Keywords

Price discovery, downside potential, parametric VaR, informational bias, volatility spillover

Introduction

Commodity derivatives trading has travelled a long time since 1875 in India. As India is a commodity-based country, the volume of trading has been rising gradually in this market along with other financial markets. India captures 7 per cent geographical share of the overall commodity derivatives market worldwide (Kapil & Kapil, 2010). Further, a large number of investors have been increasingly including commodity derivatives in their portfolios as investors, since history has shown that the risk in commodity derivative market is lesser compared to equity and debt markets (Sehgal & Pandey, 2012) and returns from this market are also noticed to be higher compared to other markets (Srivastava, 2013). On the other hand, price instability is the chief issue that has raised attention of the commercial traders/hedgers to participate in this market. Apprehension about price of commodity oscillation resulted in enveloping policy intrusion by Central

government, for instance physical buffer stock schemes, stabilization funds, variable tariff schemes and marketing boards (Bose, 2008). However, such policies failed to provide long-term results. On this note, commodities futures markets are advocated by various economists as feasible substitutes to price stabilization schemes. Futures contracts are thus believed to be an insurer against risk and futures market is the place where producers seek to hedge and speculators wish to insure them (Fantacci et al., 2010).

An efficient market is necessarily unavoidable for efficient functioning of the derivatives market. Fama (1970) has defined it as 'a market is one in which prices always fully reflect available information and where no traders in the market can make profit with monopolistically controlled information'. Nargunam and Anuradha (2017) complimentarily articulated that when price is instantaneously detected on efficient market, it directs the road for evaluation of risk and return. Thus, it leads to price discovery. As defined by Sendhil et al. (2013), 'price

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Functional Effectiveness of Commodity Futures Market: A Comparative Assessment of Agricultural and Metal Commodities

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Abstract

The study focuses on examining the price discovery process, short run disturbances and hedging mechanism of agricultural and metal commodities futures market for the period January 2010 to December 2018. Contango and normal backwardation have also been taken into deliberation for select commodities which are traded in MCX and NCDEX, India which is a valuable addition to the existing body of literature in derivatives market. Johansen's co-integration, VECM, Granger causality test and OLS are employed for understanding the price discovery and constant hedging for select commodities. Further, existence contango and normal backwardation have been observed by comparing the spot and futures prices. It has been found that spot market is acting as a leader in the longer period and laggard in short run investors can be benefitted to take short run or long run investment decision.

Keywords

Price discovery, lead–lag affiliation, influential direction, short-run disturbance approach, contango and normal backwardation, hedging

Introduction

Commodity derivatives are an emerging asset group for investors. Forwards, futures, swaps and options are among the most commonly used derivatives instruments. However, futures contracts are ruling the

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Competence and efficacy of commodity futures market: Dissection of price discovery, volatility, and hedging

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Competence and efficacy of commodity futures market: Dissection of price discovery, volatility, and hedging

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Short title: Competence and efficacy of commodity futures market in India

Abstract

The paper is an attempt to assess the Indian agricultural commodity futures market in terms of price discovery, hedging efficiency, and volatility. Cointegration test, Granger causality test, and vector error correction (VEC) model, ordinary least squares (OLS) regression, exponential generalised autoregressive conditional heteroskedasticity (EGARCH) model, value-at-risk (VaR) model are employed to achieve the objectives of the study. It is observed that the spot market leads the futures market. The lead-lag relationship varies from commodity to commodity. Additionally, downside risk exists in both the markets, and volatility is transmitted



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Research Article

Study of effect of industrial pollutants on morphological and biochemical parameters of some common fruit yielding plants around Vedanta Aluminium Limited, Jharsuguda

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ABSTRACT

Industrial pollutants contribute a major source of air pollution throughout the world. It not only has a negative impact on animals but also on plants. Several morphological and vital physiological processes are affected negatively by these pollutants. Present investigation explains the studies on comparative account on the impact of industrial pollutants from Vedanta Aluminium Limited, Jharsuguda. The leaf samples of *Carica papaya*, *Psidium guajava*, *Mangifera indica* and *Atrocarpus heterophyllus* were collected from areas with potentially higher and lower levels of industrial pollution. Average leaf area, dust load on leaf, pH, photosynthetic pigments such as chlorophyll-a, chlorophyll-b, carotenoid and pheophytin were quantified. There is a significant reduction in leaf area, pH, chlorophyll and carotenoid content of plants with increase in dust content at polluted site as compared to non-polluted site. But there is dramatic rise in pheophytin content showed the resistant of plants towards industrial pollutants. As it was observed that the plants under experimentation show sensitive to industrial pollutants, thus may cause decrease the economic and nutritional value of the fruit yielding plants.

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Investigation of spin-phonon coupling and local magnetic properties in magnetoelectric Fe_2TeO_6

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ABSTRACT

Spin-phonon coupling originated from spin-lattice correlation depends upon different exchange interactions in transition metal oxides containing 3d magnetic ions. Spin-lattice coupling can influence the coupling mechanism in magnetoelectric material. To understand the spin-lattice correlation in inverse trirutile Fe_2TeO_6 (FTO), magnetic properties and phonon spectra are studied. Signature of short-range magnetic correlation induced by 5/2–5/2 dimeric interaction and magnetic anomaly at 150 K is observed apart from the familiar sharp transition ($T_N \sim 210$ K) corresponding to long-range order by magnetization and heat capacity measurements. The magnetic transitions and the spin dynamics are further locally probed by muon spin resonance (μSR) measurement in both zero fields (ZF) and longitudinal field (LF) mode. Three dynamically distinct temperature regimes; (i) $T > T_N$, (ii) $T_N > T > 150$ K, and (iii) $T < 150$ K, are observed. A change in the spin dynamics is realized at 150 K by μSR , though previous studies suggest long-range antiferromagnetic order. The renormalization of phonon frequencies observed in Raman spectra below 210 K suggests the existence of spin-phonon coupling in the material. The coupling strength is quantified as in the range $0.1\text{--}1.2\text{ cm}^{-1}$ following the mean-field and two-spin cluster approximations. We propose that the spin-phonon coupling mediated by the Fe-O2-Fe interbilayer exchange play a significant role in magnetoelectric ME coupling observed in the material.

1. Introduction

The cross-coupling of spin, lattice, charge, and orbital degrees of freedom breed out large cornucopias of materials having dramatically complex electronic ground states with numerous intriguing and novel physical phenomena like high- T_C superconductivity, colossal magnetoresistivity, magnetoelectric (ME) multiferroicity, etc. [1–5]. Research interest on the coupling between lattice and spin degrees of freedom, known as spin-phonon coupling (SPC), is continuously reviving from the perspective of ME multiferroic [5–8]. The success of SPC to explain thermal Hall Effect in some multiferroic drives more attention to understand the SPC in multiferroic material [9]. SPC can be employed to determine the spin relaxation time in spintronic applications like quantum computation [10]. The origin of SPC in transition metal oxides containing 3d and 4d ions depends upon the different exchange interactions present in the system [11]. Hence, the study of SPC, i.e., the interdependency of spin and lattice in the magnetically ordered state is very important to understand magnetoelectricity and other coexisting phenomena in a multiferroic material.

The inverse trirutile ($P4_2/mnm$) Fe_2TeO_6 (FTO) is a collinear antiferromagnetic (AFM) material possessing ME coupling below its AFM transition T_N at 210 K [12–14]. Magnetic correlation above T_N is suspected in FTO as the presence of a broad anomaly precedes the sharp transition in magnetization at T_N [15,16]. A sharp rise in magnetization is also observed below 50 K, as reported earlier. Based on macroscopic magnetic behavior, different distinct regions of interest can be identified in the material; (i) broad transition around above $T_N \sim 210$ K, (ii) sharp fall below T_N , and (iii) a sharp rise below 50 K. The spin dynamics of the system in all these three regions are essentially important to understand the ME coupling in the material. Some isostructural compounds of the inverse trirutile compounds are reported to possess short-range dimeric interaction well above T_N [17,18]. In this regard, muon spin relaxation (μSR) is an efficient technique that can be carried out in true zero fields (ZF). ZF- μSR is an extremely sensitive probe detecting tiny internal fields on the order of 0.1G [19]. It is also a very sensitive probe to study the magnetic fluctuation in the range of 10^4 to 10^{12} Hz.

Recently, FTO is observed to show ME coupling and ferroelectricity above T_N in both bulk and nano polycrystalline form [20,21]. ME

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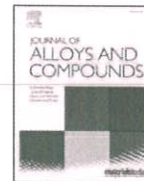
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Strong spin-phonon coupling and large dielectric constant observed in quasi-two-dimensional layered perovskite SrLaCo_{0.5}Mn_{0.5}O₄



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ABSTRACT

Recently from our group, we reported giant exchange bias value of 5.5 kOe at 5 K in a quasi-two-dimensional single layered polycrystalline Ruddlesden-Popper (RP) compound SrLaCo_{0.5}Mn_{0.5}O₄. Here, a detailed temperature dependent Raman and dielectric spectroscopic studies are carried out on SrLaCo_{0.5}Mn_{0.5}O₄ to understand the spin-phonon coupling and dielectric properties, respectively. A strong spin-phonon coupling constant of $\lambda = 2.72 \text{ cm}^{-1}$ is evident which is associated with Mn/Co–O bonds. A large dielectric constant of $\epsilon' = 2904$ at 1 kHz frequency at 297 K is found in this system.

Data availability: The data that supports the findings of this study are available within the article [and its supplementary material]. Please see supplementary material for details of the impedance spectroscopy analysis.

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Novel magnetic materials with emergent phenomena such as high T_c superconductivity, colossal magnetoresistance, and exchange coupling at the interface of ferromagnet and antiferromagnet accelerated the development of modern storage devices that arise due to the coupling of various degrees of interactions from spin, orbital, phonon, charge, and lattice [1,2]. Perovskite-related structures, such as quasi-two-dimensional (Q2D) Ruddlesden-Popper type compounds (A_{n+1}B_nO_{3n+1} where A = rare earth or alkaline earth ion B = transition metal ion and O = oxygen and n = 1, 2, ...) show many emergent phenomena that include temperature and field-driven spin reorientation [3], charge ordering [4], Mott insulator [5], orbital ordering [6], hybrid improper ferroelectricity [7], magnetoelectric [8], giant exchange bias [9,10] and isospin-phonon coupling [11].

SrLaCo_{0.5}Mn_{0.5}O₄ (SLCMO) is a Q2D layered variation of double perovskite La₂CoMnO₆ (LCMO) compound (LCMO exhibits monoclinic (P2₁/n) or orthorhombic (Pbnm) structure depending on the Co/Mn site ordering), where the perovskite slabs are stacked layer by

layer with an intercalated Sr/LaO rock salt layer. The presence of a nonmagnetic rock salt layer creates a large interlayer separation between the adjacent magnetic planes along the c direction leading to a quasi-two-dimensionality. Very recently, our group reported an in-depth study on the magnetic properties of polycrystalline SLCMO compound and found the presence of a giant exchange bias effect of ~5.5 kOe at 5 K which arises from competing magnetic interactions between nanoscale domain interfaces [9].

The perovskite analog (LCMO) of the present compound is a ferromagnetic insulator exhibiting multifunctional properties with strong spin-phonon coupling, relaxor dielectric behavior, magneto-capacitance, and magnetoresistance characteristics [12–15]. Such multifunctionality is not explored yet in the single-layered SLCMO RP compounds. Hence, in the present manuscript, we investigate the spin-phonon coupling and dielectric relaxation to understand the spin, phonon, and dipole orientations in this Q2D layered compound.

Synthesis of a polycrystalline sample of SLCMO along with detailed structural and magnetic characterizations have been reported earlier [9]. The same sample was used here for Raman and dielectric spectra analysis. The relative density of the obtained SLCMO ceramics was found to be 94.2% using the Archimedes method. Temperatures variation Raman spectra were recorded between 90 and 300 K temperature range using a micro Raman spectrometer (Horiba Jobin Yvon LabRam HR800 UV), spectral resolution up to 1.5 cm⁻¹ equipped with Linkam THMS 600 heating-stage. The measurements were carried out using an excitation source of wavelength 488 nm

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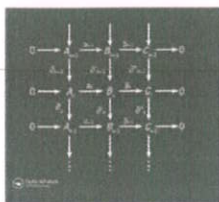
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Detecting capable Lie superalgebras

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Detecting capable Lie superalgebras

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ABSTRACT

In this article, we show that distributive law holds for non-abelian tensor product of Lie superalgebras under certain direct sums. Thereby we obtain a rule for non-abelian exterior square of a Lie superalgebra. We define capable Lie superalgebra and then give some characterizations. Specifically, we prove that epicenter of a Lie superalgebra is equal to exterior center. Finally, we classify all capable Lie superalgebras whose derived subalgebra dimension is at most one. As an application to those results, we have shown that there exists at least one non-abelian nilpotent capable Lie superalgebra each of dimension (m/n) when $m + n \geq 3$.

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1. Introduction


Lie superalgebras have applications in many areas of Mathematics and Theoretical Physics as they can be used to describe supersymmetry. Kac [14] gives a comprehensive description of mathematical theory of Lie superalgebras, and establishes the classification of all finite dimensional simple Lie superalgebras over an algebraically closed field of characteristic zero. In the last few years, the theory of Lie superalgebras has evolved remarkably, obtaining many results in representation theory and classification. Most of the results are extension of well-known facts of Lie algebras. But the classification of all finite dimensional nilpotent Lie superalgebras is still an open problem like that of finite dimensional nilpotent Lie algebras.

In 1904, Schur introduced the Schur multiplier and cover of a group in his work on projective representation. Batten [3] introduced and studied Schur multiplier and cover of a Lie algebra and later on, studied by several authors [4, 5]. For a finite dimensional Lie algebra L over a field \mathbb{F} the free presentation of L is the exact sequence, $0 \rightarrow R \rightarrow F \rightarrow L$, where F is a free Lie algebra and R is an ideal of F . Then the Schur multiplier $\mathcal{M}(L)$ is isomorphic to $F' \cap R/[F, R]$. Moneyhun [15] proved that for a finite dimensional Lie algebra L of dimension n , $\dim \mathcal{M}(L) = \frac{1}{2}n(n-1) - t(L)$, where $t(L) \geq 0$. This bound is used to classify finite dimensional nilpotent Lie algebras L with some small values of $t(L)$. Specifically, the complete classification of L with $t(L) \leq 8$, has been depicted in [5, 12, 13, 22]. An improved bound for $\dim \mathcal{M}(L)$ for a non-abelian finite dimensional nilpotent Lie algebra L is further given by Niroomand and Russo [21], and using this some classifications of L are done with lesser effort [23].

The notion of multiplier and cover for Lie algebras is generalized to the case of Lie superalgebras and studied in [17–19]. Some bounds are given for the dimension of multiplier of Lie

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Coupled spin–orbital fluctuations in a three orbital model for 4*d* and 5*d* oxides with electron fillings $n = 3, 4, 5$ —application to NaOsO₃, Ca₂RuO₄ and Sr₂IrO₄

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Abstract

A unified approach is presented for investigating coupled spin–orbital fluctuations within a realistic three-orbital model for strongly spin–orbit coupled systems with electron fillings $n = 3, 4, 5$ in the t_{2g} sector of d_{yz} , d_{xz} , d_{xy} orbitals. A generalized fluctuation propagator is constructed which is consistent with the generalized self-consistent Hartree–Fock approximation where all Coulomb interaction contributions involving orbital diagonal and off-diagonal spin and charge condensates are included. Besides the low-energy magnon, intermediate-energy orbiton and spin–orbiton, and high-energy spin–orbit exciton modes, the generalized spectral function also shows other high-energy excitations such as the Hund’s coupling induced gapped magnon modes. We relate the characteristic features of the coupled spin–orbital excitations to the complex magnetic behavior resulting from the interplay between electronic bands, spin–orbit coupling, Coulomb interactions, and structural distortion effects, as realized in the compounds NaOsO₃, Ca₂RuO₄, and Sr₂IrO₄.

Keywords: coupled spin–orbital fluctuations, 4*d* and 5*d* oxides, generalized fluctuation propagator, antiferromagnetic order, strong spin–orbit coupling, magnetic anisotropy

(Some figures may appear in colour only in the online journal)

1. Introduction

The 4*d* and 5*d* transition metal (TM) oxides exhibit an unprecedented coupling between spin, charge, orbital, and structural degrees of freedom. The complex interplay between the different physical elements such as strong spin–orbit coupling (SOC), Coulomb interactions, and structural distortions results in novel magnetic states and unconventional collective excitations [1–6]. In particular, the cubic structured NaOsO₃ and perovskite structured Ca₂RuO₄ and Sr₂IrO₄ compounds, corresponding to d^n electronic configuration of the TM ion with electron fillings $n = 3, 4, 5$ in the t_{2g} sector, respectively, are at the emerging research Frontier as they provide

versatile platform for the exploration of SOC-driven phenomena involving collective electronic and magnetic behavior including coupled spin–orbital excitations.

The different physical elements give rise to a rich variety of nontrivial microscopic features which contribute to the complex interplay. These include spin–orbital-entangled states, band narrowing, spin–orbit gap, and explicit spin-rotation-symmetry breaking (due to SOC), electronic band narrowing due to reduced effective hopping (octahedral tilting and rotation), crystal field induced tetragonal splitting (octahedral compression), orbital mixing (SOC and octahedral tilting, rotation) which self consistently generates induced SOC terms and orbital moment interaction from the Coulomb interaction terms, significantly weaker electron correlation term U compared to 3*d* orbitals and therefore critical contribution

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Research articles

Role of orbital off-diagonal spin and charge condensates in a three orbital model for Ca_2RuO_4 – Coulomb renormalized spin-orbit coupling, orbital moment, and tunable magnetic order

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Orbital off-diagonal condensates

ABSTRACT

Strongly anisotropic spin-orbit coupling (SOC) renormalization and strongly enhanced orbital magnetic moments are obtained in the fully self consistent approach including the orbital off-diagonal spin and charge condensates. For moderate tetragonal distortion as in Ca_2RuO_4 , dominantly planar antiferromagnetic (AFM) order with small canting of moments in and about the crystal c axis are obtained. For reduced tetragonal distortion, we find a tunable regime wherein the magnetic order can be tuned (AFM or FM) by the bare SOC strength and octahedral tilting magnitude. In this regime, with decreasing tetragonal distortion, AFM order is maintained by progressively decreasing octahedral tilting, as observed in $\text{Ca}_{2-x}\text{Sr}_x\text{RuO}_4$. For purely planar order, the only self consistent solution is FM order along crystal b axis, which is relevant for the bilayer ruthenate compound $\text{Ca}_3\text{Ru}_2\text{O}_7$.

1. Introduction

The ruthenium-based quasi-two-dimensional (2D) square-lattice compounds A_2RuO_4 ($\text{A} = \text{Sr}, \text{Ca}$) with $4d^1$ electronic configuration have attracted renewed interest due to the sensitivity of the low-energy physics of these systems to the complex interplay between spin-orbit coupling (SOC), Coulomb interaction terms, tetragonal distortion, and octahedral tilting and rotation. This complex interplay has a crucial role in the gradual transition from strongly correlated metallicity in Sr_2RuO_4 to unusual magnetism in Ca_2RuO_4 [1–12], which exhibits coupled spin-orbital excitations with energy decreasing from zone center to zone boundary, and pressure and chemical substitution induced magnetic reorientation transition from antiferromagnetic (AFM) to ferromagnetic (FM) order, which is driven by octahedral de-flattening and accompanied with decreasing octahedral tilting. Recent investigations on related compounds include comparative study of magnetic excitations in Ca_2RuO_4 and the bilayer ruthenate $\text{Ca}_3\text{Ru}_2\text{O}_7$ using Resonant Inelastic X-ray Scattering (RIXS) [13], and the co-existence of superconductivity and ferromagnetism in a Ca_2RuO_4 nanofilm crystal [14].

The ground state in the isoelectronic series $\text{Ca}_{2-x}\text{Sr}_x\text{RuO}_4$ has been successively driven from an AFM insulator ($x < 0.2$) to AFM correlated metal ($0.2 < x < 0.5$), a nearly FM metal ($x \sim 0.5$), and finally to a non-

magnetic Fermi liquid ($x \sim 2$). The dominant effects are only structural modifications due to the larger Sr ionic size, since the substitution is isovalent [15]. With increasing x , the distortion occurs in steps, resulting in removal of first the flattening of the octahedra, then the tilting, and finally the rotation around the c axis [16–18]. Although the substitution is isovalent, only the magnetism of $\text{Ca}_{2-x}\text{Sr}_x\text{RuO}_4$ is affected in the sequence given above. The bilayer series $(\text{Sr}_{1-x}\text{Ca}_x)_3\text{Ru}_2\text{O}_7$ also exhibits complex magnetic ground states, ranging from itinerant metamagnet to quasi-2D heavy-mass nearly FM metal, and finally to long-range AFM order. The increase in Ca concentration is associated with a similar tuning of distortion manifested as octahedral rotation, tilting, and flattening [19].

The Ca_2RuO_4 compound undergoes a peculiar non-magnetic metal–insulator transition (MIT) at 356 K and a magnetic transition at $T_N \approx 113$ K with observed magnetic moment of $1.3\mu_B$ [20–22,16]. The MIT is associated with a structural transition from L-phase (long octahedral c -axis) to S-phase (short c -axis) due to the continuous flattening of octahedra till the onset of magnetic order at T_N [23]. Compared to the isoelectronic member Sr_2RuO_4 [15,16], this system has severe structural distortions due to the small Ca^{2+} ionic size, resulting in a compression, rotation, and tilting of the RuO_6 octahedra. Thus, the low-temperature phase is characterized by highly distorted RuO_6 octahedra and canted

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Title

HIGHER EDUCATION SYSTEM OF INDIA AND NEW EDUCATION POLICY: AN EXPLORATORY STUDY.

Authors

Tandi, Subal

Abstract

In the future years, India will encounter numerous problems, some of which are economic, others social, and yet others technological. Despite the fact that it is a developing country that has greatly decreased extreme poverty over the previous two decades and has opted to pursue sustainable development goals (World Bank, 2020). There are still significant tasks to be completed, particularly concerning poverty, inequalities, employment, and the educational outcomes students achieve in this country. Education plays a critical and decisive role in this scenario of contingencies. The National Education Policy 2020 has become the framework for educational reform in India, assisting the country in the development of a new educational system while also bolstering those economic and social indices that still need to be improved. This new educational Policy comprises significant and comprehensive reforms that will affect all academic stages and areas and the curriculum structure. The keys to this reform can be summarised as follows: promoting equity, developing a holistic learning model, improving student access to various educational levels, establishing a multidisciplinary higher education institution, strengthening an inclusion school and education model, or improving teacher and professional training.

Subjects

HIGHER education; EDUCATION policy

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Postmodern Thinkers and Higher Education: A Sociological Study

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Abstract

In sociological perspective, postmodernism has important for generating new and exciting ideas and postmodernism has produce academic controversies that have lasted for decades. A major arena for postmodern intellectual warfare occurred in institutions of higher education. In the process of post modernization, universities and colleges has been the development of knowledge specialization controlled primarily by professors and contained within the borders of academic disciplines. The related questions have guided postmodernist research into higher education. The first asks, what are contributions of postmodern thinkers on higher education for society? The second question asks how this contribution helps to develop for society. As with postmodernist analysis in general, the postmodernist view of higher education tends to focus on the positive contributions which are knowledge, power, simulation and reality etc. The objective of this paper is to discuss the contribution of postmodern thinkers of sociology with higher education. The methodology based on descriptive in nature as well as secondary sources.

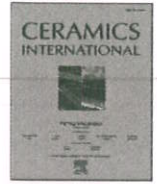
Keywords: Post-Modern, Higher Education, Academic, Universities, Colleges.

Introduction

In postmodern society's education provides to the state as a matter of right for all the people. Formal institutions like schools, colleges and universities are organized for this purpose. They are staffed by fulltime professional practitioners like teachers and lectures. Education is provides free of charge, through ultimately it is paid for by the taxpayer. Although free compulsory state education is largely taken for granted today and regarded as a perfectly normal and natural state of affairs. It is important to remember that it is a very recent development in the history of man (Haralambos and Heald, 1980, 1981, and 2004).

Postmodernity refers to a break from modernity, the emergence of a new epoch or era. Postmodernity signals the emergence of a period of multiple changes in society, involving information advances, consumerism, the omnipresence of simulations, and the rise of a postindustrial order (Brooker, 1999, p. 174; Featherstone, 1991, p. 3 cited in Bloland, 2005, p.123). In the 1960s, the postmodern debate began in the United States in the humanities, increased momentum in the 1970s in the arts and social theory, and by the early 1980. Our interest of postmodernism has captured because it involves a spectacular critique of modernism, the foundation upon which our thinking and our institutions have rested. Now-a-day, modernist values and institutions are increasingly viewed as harmful, inadequate and costly. Postmodernists have been attacking the validity and legitimacy of the most basic assumptions of modernism (Bloland 1995, p.521).

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Microstructural, mechanical and electrical properties of BT, BZT-BCT, and BNT-BT-BKT ferroelectrics synthesized by mechanochemical route

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ABSTRACT

BaTiO₃ (BT), 0.5Ba(Zr_{0.2}Ti_{0.8})O₃-0.5(Ba_{0.7}Ca_{0.3})TiO₃ (BZT-BCT), 85.4(Bi_{0.5}Na_{0.5})TiO₃-2.6(BaTiO₃)-12(Bi_{0.5}K_{0.5})TiO₃ (BNT-BT-BKT) lead free ferroelectric ceramics were synthesized by high energy ball milling (HEBM) assisted solid-state reaction route. The Crystallite size of the HEBM powders was found to be in the nano-range. XRD, SEM, dielectric, polarization vs. electric field (*P-E*) loop and mechanical characterizations and analysis of these sintered ceramics were carried out. Lower calcination and sintering temperatures along with better densification with the lower average grain size of these ceramics were optimized and obtained compared to the same systems synthesized by the solid-state reaction route. Enhanced values at room temperature (RT) of ϵ_r —2875, 5133, and 1701 and lower values of $\tan\delta$ —0.013, 0.015, and 0.058 were obtained for BT, BZT-BCT, and BNT-BT-BKT sintered ceramics, respectively. Well saturated *P-E* loops were obtained for all the ceramics, which confirmed their ferroelectric behaviour. Hardness value ~7.23 GPa, 5.53 GPa, and 5.16 GPa were found for BT, BZT-BCT, and BNT-BT-BKT sintered ceramics, respectively. The temperature coefficient of capacitance, TCC, was obtained within $\pm 15\%$ in the temperature range from RT to 135 °C for BT ceramics with high ϵ_r and low value of $\tan\delta$, which suggested its usefulness for multilayer ceramic capacitor (MLCC) applications.

1. Introduction

Lead-free ferroelectrics have a wide range of applications in various fields such as multilayer ceramic capacitors (MLCC), sensors, resistive switching, biomedical etc. [1–4]. BaTiO₃ (BT), 0.5Ba(Zr_{0.2}Ti_{0.8})O₃-0.5(Ba_{0.7}Ca_{0.3})TiO₃ (BZT-BCT), 85.4(Bi_{0.5}Na_{0.5})TiO₃-2.6(BaTiO₃)-12(Bi_{0.5}K_{0.5})TiO₃ (BNT-BT-BKT) are the promising lead free ferroelectric materials, showing excellent dielectric, ferroelectric and piezoelectric properties [2,5,6]. For multilayer ceramic capacitors, value of dielectric loss ($\tan\delta$) should be as low as possible, because it is directly proportional to the heat dissipation of materials under the application of the electric field. Maximum allowed dielectric losses of ceramic capacitors, used in capacitor industries are normally around 5–10% [7]. Properties of any functional ceramic are greatly influenced by different parameters such as starting precursors particle size, processing temperatures and morphology of the sintered product [1]. Mechanical properties of ferroelectric ceramics are important for determining their reliability in actuators, MLCC and for biomedical device applications [8,9]. In the solid-state reaction route, the reaction between the precursors takes place at the surfaces of the reactants by diffusion of thermally activated

atoms, moving through interfaces. The diffusion of atoms across the interface depends on the particle size of the starting precursors. The smaller particle size of the starting precursors results in a higher diffusion rate. This hints that the particle size of the starting precursors affects the processing time and temperatures. Presently, various synthesis methods like sol-gel, hydrothermal, and wet chemical precipitation routes have been used to obtain nanoparticles of the starting precursors [10–12]. Recently, the mechanochemical method has been used to produce nanoparticles of the starting precursors [13,14]. This process involves mechanical activation of starting precursors, placed in a vial/ball mill, and subjected to high energy collisions, induced by stiff balls. This technique is quite simple, cheap and can be scaled up to yield tonnage quantities of materials [15]. In mechanochemical milling, reduced particle size results in more area of contact between the reactant particles, which favour the diffusion process during sintering [16]. Consequently, mechanochemical synthesis requires low processing temperatures and time compared to normal ball-milled synthesis [13].

In the present study, starting precursors of lead-free BT, BZT-BCT, BNT-BT-BKT systems were obtained in nano-size order by HEBM. Structural, microstructural, dielectric, *P-E* hysteresis loop and various

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Article

Mechanical, Electrical, and Biological Properties of Mechanochemically Processed Hydroxyapatite Ceramics

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Abstract: The effect of the sintering temperature on densification and the resultant mechanical, electrical, and biological properties of mechanochemically processed hydroxyapatite (HAp) samples was investigated. HAp samples were sintered at 1200, 1250, and 1300 °C for 4 h, respectively. HAp samples sintered at 1250 °C showed better mechanical properties, which was attributed to their smaller grain size compared to HAp samples at higher sintering temperatures. The nearly identical value of the dielectric constant (ϵ_r) and better cell proliferation was exhibited by HAp samples sintered at 1250 and 1300 °C, respectively. At ~210 °C, in all the samples sintered at different temperatures, a dielectric anomaly was obtained, which was attributed to the phase transition temperature of the HAp system. Dielectric properties near the phase transition temperature showed a dielectric relaxation-type of behavior, which was attributed to the re-orientational motion of OH⁻ ions in the HAp system. Higher cell proliferation and viability were exhibited by the HAp1300 samples, whereas comparatively equivalent cell growth and higher mechanical strength were observed in the HAp1250 samples.

Keywords: hydroxyapatite; dielectric constant; cell proliferation; fracture toughness



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1. Introduction

HAp, a calcium phosphate-based bioceramic, is an extensively used biomaterial for bone substitution [1]. This is because the HAp system has a similar chemical composition as that of human bones, excellent biocompatibility, and good osteoconductive properties, which make it one of the important implant materials for orthopedic-related treatments [2,3]. The HAp system also shows excellent stability in an aqueous medium above pH 4.3, which is within the range of the pH of human blood [4]. Several studies have shown that, for load-bearing applications, a dense form of HAp ceramic is required [5]. The well-defined particle morphology of HAp powder makes it quite effective in biomedical applications [4]. The microstructural, biological, and mechanical properties of the HAp system are mainly influenced by its particle size, crystallinity, morphology, stoichiometry, and composition. In this regard, synthesis precursors and processing techniques become important [6]. The HAp system starting powders in the nano range are obtained by different techniques like wet chemicals, sol-gel, precipitation, hydrolysis techniques, etc. The high-energy ball-milling (HEBM) method (also known as the mechanochemical method) is a novel technique used for obtaining nanoparticles of the starting precursors [7,8]. In terms of obtaining nano-size powders, the HEBM method has various advantages over other techniques, including being economical and highly scalable [9]. The HEBM technique involves mechanochemically activated solid-state reactions among the starting precursors. Nanoparticles, resulting from



Identification of effective and specific serotonin_{1B} receptor ligands by structure-based virtual screening and molecular dynamics

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Abstract

The serotonergic systems are the most important therapeutic targets for neurological disorders. Many serotonergic drugs have been used to treat neurological disorders, which are well known for their adverse side effects because of the off-target interactions. Development of selective ligands for a specific target is the suitable approach to minimize the off-target interactions and side effects. To identify selective ligands for serotonin 1B receptor (5-HT_{1B}R), the structural analogs of inverse agonist methiothepin (MT) and natural products were screened against 5-HT_{1B}R and other 5-HTR subtypes (5-HT_{2A}R, 5-HT_{2B}R, and 5-HT_{2C}R). In the present study, five compounds were selected out of 9963 screened compounds having higher binding affinity with 5-HT_{1B}R over other 5-HTRs. Amongst them, ZINC31166967 and ZINC31162553 exhibited relatively higher binding affinity towards 5-HT_{1B}R with the binding energy of -10.1 and -9.1 kcal/mol, respectively. The pharmacokinetic assessments considered them safe and non-toxic. Molecular dynamics (MD) simulation revealed the stability of these compounds within the active site of the receptor. The overall analysis suggested that ZINC31166967 and ZINC31162553 may be considered as the selective ligands for 5-HT_{1B}R. However, detailed experimental investigations will be required to substantiate the findings.

Keywords Serotonin receptor · 5-HT_{1B} receptor · Natural products · Drug-like molecules · Virtual screening · MD simulation

Introduction

The G protein-coupled receptors (GPCRs) are the largest family of cell surface receptor proteins in mammalian genome (Fredriksson et al. 2003) and are targeted by approximately 34% of the Food and Drug Administration (FDA) approved drugs (Hauser et al. 2018). Amongst all, serotonin (5-hydroxytryptamine or 5-HT) receptors have been considered as suitable therapeutic targets because of their association with diverse signaling pathways related to several physiological and behavioral functions (Berger et al. 2009). The serotonin 1B receptors (5-HT_{1B}Rs) are involved

in locomotion, sleep, thermoregulation, mood disorder, pain modulation, impulsivity, aggression, memory and learning (Cao et al. 2013; Tiger et al. 2018; Lanfumey and Hamon 2004; Sari 2004). Upon agonist binding, 5-HT_{1B}R is negatively coupled with G_{i/o} family of proteins and inhibits adenylyl cyclase (AC) that leads to decrease in the formation of cyclic adenosine monophosphate (cAMP) and consequently, results in the reduction of 5-HT release. In contrast, the selective antagonist binding increases 5-HT release in synaptic cleft which is the basis of designing of the potential antidepressant drugs (Yin et al. 2018). The 5-HT_{1B}R agonists are being used clinically as antimigraine drugs and potential therapeutics for anti-aggressive, bipolar disorder, gastric motor effects, and autism. On the other hand, antagonists are considered effective antidepressant agents (Slassi 2002).

Many serotonergic drugs show adverse side effects because of the off-target interactions. Thus, attention to the development of selective agonists and antagonists for 5-HT_{1B}R has been increased enormously. It is challenging to design subtype-specific serotonergic ligands due to

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Study of electrical properties of a few layers of graphene sheets under Ultraviolet and Visible light irradiation

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Abstract

Graphene is an excellent 2D material due to its exceptional electrical properties which can be potentially used in optoelectronic. In order to use graphene in optoelectronics, the electrical properties need to be tuned. To tune electrical properties, few-layer graphene sheets (FLGS) prepared by electrochemical method have been used. The prepared FLGS has been characterized by Field Emission Scanning Electron Microscope (FESEM), Transmission Electron Microscope (TEM), X-ray Diffraction (XRD), Ultraviolet-Visible Spectroscopy (UV-Vis), Fourier Transform Infrared (FTIR), and Raman Spectroscopy. The optimized FLGS by characterization has been employed to tune the electrical properties in the presence and absence of water drop under ultraviolet and visible light. The obtained current of FLGS thin film is $\sim 0.8\text{mA}$ whereas; the measured current under ultraviolet light is $\sim 1.7\text{mA}$ and under visible light $\sim 1.07\text{mA}$. However, it has been observed that the measured current has decreased to under ultraviolet $\sim 0.645\text{mA}$ and visible light $\sim 0.96\text{mA}$ in the presence of water drop in FLGS film. Therefore, the findings suggest that the electrical properties of FLGS can be tuned for various applications in optoelectronic devices.

Keywords: FLGS, Ultraviolet light, Visible light, Irradiation, Optoelectronic.

1. Introduction

Since its invention in 2004[1], graphene has to pay devotion to the worldwide research community owing to its excellent physical properties [2,3]. The exciting physical properties are high thermal conductivity [4], high young modulus, high specific surface area [5], quantum hall effect [6], [7], large range ballistic transport [8,9], first-rate sensitivity of gas molecules [10], high carrier mobility [11], etc. These exciting properties of graphene demonstrates potential applications such as optoelectronics [12], transparent electrodes[13]–[15], sensors [16], [17], and so on. Graphene is a zero bandgap semimetal. For application, the electronic properties of graphene need to be improved. Various methods such as chemical doping, metal doping, and also irradiated by the application of high energy electrons or ions [10,18–20], substitutional doping, oxygen plasma technique have been adopted to modify the electronic properties of graphene. But in most of the above-mentioned methods, the structural disorder [21–29] is induced as the main drawback. Theoretically, photo-oxidation is the appropriate method to tune the electrical properties of graphene without any structural disorder [30]–[32]. The influence of ultraviolet light on pristine and functionalized graphene prepared by the CVD method [33]–[35] have been demonstrated experimentally. Iqbal et. al. [36] have reported tuning of electrical properties of a single layer, double layers, and triple layers graphene using deep



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Simple and cost-effective synthesis of activated carbon@few layers of graphene composite electrode for supercapacitor applications

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Abstract. We report a simple and low-cost technique to prepare a composite comprising of activated carbon and few layers of graphene sheets and fabricated as electrode material for supercapacitor (SC) applications. The composite is characterised by using Raman spectroscopy, powder X-ray diffraction (XRD), scanning electron microscope (SEM) and current-voltage (I-V) measurements. The synthesized composite is investigated by using galvanostatic charge-discharge (GCD) and cyclic voltammetry (CV) measurements in 3M KOH aqueous electrolyte to evaluate its electrochemical performance. The composite results high specific capacitance from 173 to 564 F/g at different scan rates (100-5 mV/s), analysed by CV and the capacitances resulted in GCD measurement were 196 to 587 F/g at various current densities (5-1 A/g). The cycle stability of the as-prepared AC/graphene composite is also tested and observed that 89% of capacitance is retained even after 5000 cycles which reveals the excellent long term charge-discharge stability of the prepared composite. Therefore, the composite performs very well in storage as well as life cycling. The obtained results suggest that AC/graphene composite can be a suitable electrode material for high-performance SC.

Keywords: Activated carbon, graphene, cyclic voltammetry, supercapacitor, scanning electron microscope


1. Introduction

The enormous population growth and development of portable electronic devices, a novel storage device with high energy and power efficient is the crucial demand. Supercapacitors (SCs) are the electric double-layer capacitor (EDLC), that bridges the gap between conventional batteries and traditional dielectric capacitors in terms of power/energy. It has high power density, fast charge/discharge rate, low equivalent series resistance, operation in extended temperature range and long cycle life (> 100000 cycles) that are essential for practical applications [1-5]. Therefore, SC has potential applications such as in industrial power supplies, hybrid electric vehicles, consumer electronics and memory back-up systems. However, the SC fall behind in many potential applications due to its significantly low energy density. Therefore, enhancement of energy short of dropping its power density for SC device is the most important challenge for the researcher now a day. People have given many efforts to design the SC devices taking various electrode materials to enhance the overall energy and power performance. SCs devices fabricated by carbon-based electroactive materials, metal oxide/hydroxide and electrochemical

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ORIGINAL RESEARCH ARTICLE


Simple and Cost-Effective Synthesis of Activated Carbon Anchored by Functionalized Multiwalled Carbon Nanotubes for High-Performance Supercapacitor Electrodes with High Energy Density and Power Density

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We prepared a composite using activated carbon and functionalised multi-walled carbon nanotubes by a simple and cost-effective process and investigated its use for supercapacitor application. The electrochemical performance of the prepared composite has been investigated by galvanostatic charge-discharge (GCD) and cyclic voltammetry (CV) measurements in a three-electrode set-up. The composite resulted in maximum specific capacitance of 395 F/g at 5 mV/s as measured by CV, and of 372 F/g at 60 A/g by GCD measurement in 3M KOH aqueous electrolyte. High power and energy density of 75.27 kW/kg and 25.31 W-h/kg at 60 A/g have been respectively obtained for composite using GCD measurement. The long-term charge-discharge stability has been performed for the composite electrodes, and it is observed that 89% of capacitance is retained even after 5000 cycles. The achieved results suggest that the prepared activated carbon/multiwalled carbon nanotube composite can be a potential electrode material in high-performance supercapacitors for energy storage applications.

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Hydrothermal synthesis of MnO_2 @graphene/activated carbon composite electrode with enhanced electrochemical performance for supercapacitor applications

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Abstract

We report the preparation of an electrode material made up of MnO_2 / graphene/ activated carbon ternary composite by hydrothermal method for supercapacitor (SC) applications. The prepared ternary composite has been characterized by using scanning electron microscopy (SEM), powder X-ray diffraction (XRD), energy dispersive spectroscopy (EDS) and Raman spectroscopy measurements. The prepared objective electrode has been investigated using galvanostatic charge-discharge (GCD) and cyclic voltammetry (CV) measurements in a 3-electrode system using 3M KOH aqueous electrolyte for the analysis of their electrochemical performance. The prepared MnO_2 /graphene/activated carbon composite results in maximum capacitance of ~ 493.57 F/g at 5 mV/s using CV and moreover the highest capacitance obtained from the GCD measurement is ~ 485.29 F/g at 1 A/g. The long-term cycle stability of the composite electrode is also demonstrated and it shows outstanding cyclic performance where 97% of capacitance is left over 5000 cycles at 1 A/g. Therefore, the composite shows good charge storage performance, as well as tremendous cycle stability and that, reveal the synthesized ternary composite can be a suitable electrode for SC applications.

Keywords: Activated carbon, graphene, galvanostatic charge-discharge, MnO_2 , cyclic voltammetry

1. Introduction

During the decades, a crucial amount of effort has been given to develop high energy storage and conversion device owing to the growing demands for power systems. Supercapacitors (SCs) are the novel class of storage device having high power density (20-30 times) compare to conventional batteries and more energy density than the commercial dielectric capacitors [1-4]. Due to their fast charging-discharging capabilities, long cycle life (> 100000 cycles), high output power supply in a short time and simple operation process, SC has applications in many fields including hybrid electric vehicles, memory back-up systems, consumer electronics and industrial power supplies [5]. However, low energy density and very fast discharging of SCs limits its applications in many energy-demanding fields. Therefore, most researchers in this field have given special attention to enrich the energy performance of SCs short of losing their power performance and cycle



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Graphene field-effect transistor using gated ferroelectric thin film

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Highlights

- Few-layer graphene sheets (FLGS) and barium titanate (BTO) particles were well prepared by an electrochemical and a sol-gel method.

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- Fabricate a graphene-based ferroelectric field-effect transistor (GFE-FET) using a sol-gel spin coating method, where FLGS and BTO act as a channel layer and gate insulating layer.
- The field-effect mobility of fabricated GFE-FET is approximate $4.2 \times 10^4 \text{ cm}^2\text{V}^{-1}\text{S}^{-1}$ with an on/off ratio of about 10^3 .
- The excellent results of the fabricated GFE-FET give an incredible opportunity in the electronic industry as an alternative to semiconductors.

Abstract

A graphene-based ferroelectric field-effect transistor (GFE-FET) has been fabricated using few-layer graphene sheets (FLGS) as channel layer and barium titanate (BTO) as gate insulating layer. The FLGS and BTO were prepared by electrochemical and sol-gel methods respectively. The prepared materials have been characterized by XRD, SEM, UV-Vis, FTIR, and Raman spectroscopy. The performance of GFE-FET was assessed and obtained reasonably high field-effect mobility $\sim 4.2 \times 10^4 \text{ cm}^2\text{V}^{-1}\text{S}^{-1}$ with on/off ratio of about 10^3 . The obtained results of the fabricated GFE-FET ensure incredible opportunity for various applications mostly in the electronic industry as an alternative to semiconductors.

Introduction

With excellent carrier mobility and speed, graphene [1] empowers the probability of faster electronics material than semiconductors. The intrinsic mobility of single-layer graphene is about $100000 \text{ cm}^2\text{V}^{-1}\text{S}^{-1}$ at room temperature which is greater than the mobility of III-V compounds [[2], [3], [4]]. Chen et al. derived the mobility value about $3.0 \times 10^5 \text{ cm}^2\text{V}^{-1}\text{S}^{-1}$ using first principle calculation for a perfect single layer graphene [5]. Kim et al. obtained mobility value about $200000 \text{ cm}^2\text{V}^{-1}\text{S}^{-1}$ experimentally from a suspended single layer graphene [6]. However, many experimental investigations demonstrated that the mobility of graphene on substrates are reduced drastically with the values of $7000 \text{ cm}^2\text{V}^{-1}\text{S}^{-1}$ [7], $10000 \text{ cm}^2\text{V}^{-1}\text{S}^{-1}$ [1,8], etc. On the other hand, the practical use of graphene mostly depends on the optimum choice of electrophysical, physicochemical, and electromechanical properties of their substrates, gates, and interfaces which are the most challenging. Currently, the choice of the substrates in a given two-dimensional material with additional functionality is vital [9,10]. In this regard, different ferroelectric substrates with graphene are being considered. The

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Equity Price Risk of Commercial Banks in India

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Abstract

This study is directed at gauging the equity price risk of the Indian commercial banks for the period 2003–2020. Parametric value-at-risk (VaR) is employed to estimate the downside risk. Further, the univariate exponential generalized autoregressive conditional heteroskedasticity (EGARCH) model is also used to find out the existence of stylised aspects of volatility. The outcomes point towards the existence of volatility clustering, persistence and asymmetry, but differ from bank to bank. Furthermore, the parametric VaR model that assumes normal distribution and student's *t*-distribution is not found to be an accurate model for all the banks. Tail risk is also found to be significant, and thus, justifies the Basel Committee's decision to shift towards an expected shortfall. However, these conventional VaR models should be supplemented by internal models, taking into consideration, bank-specific characteristics.

JEL: G01, G15, I15, G17, G28

Keywords

Risk, value at risk, bank, informational biasness

I. Introduction

Risk is a phenomenon experienced by every kind of business, banks as well. The opening up of economies has elevated the quantum of risk assumed by various institutions due to increased competition, technology, cross-border trade and various other factors. More specifically, the market risk of commercial banks has


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Compressibility of structural modulation waves in the chain compounds BaCoX_2O_7 ($X = \text{As}, \text{P}$): a powder study

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Keywords: incommensurate structural modulation; first-order structural phase transition; high-pressure Raman spectroscopy; high-pressure X-ray diffraction; DFT-relaxed structural models.

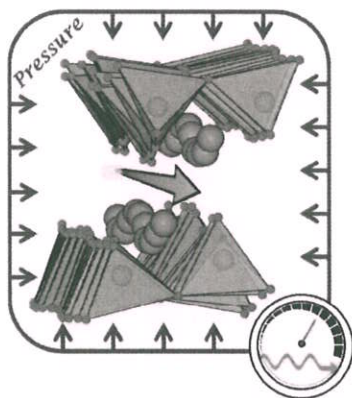
Supporting information: this article has supporting information at journals.iucr.org/b

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BaCoX_2O_7 ($X = \text{As}, \text{P}$) are built on magnetic 1D units in which strong aperiodic undulations originate from incommensurate structural modulations with large atomic displacements perpendicular to the chain directions, resulting in very unique multiferroic properties. High-pressure structural and vibrational properties of both compounds have been investigated by synchrotron X-ray powder diffraction and Raman spectroscopy at room temperature and combined with density functional calculations. A structural phase transition is observed at 1.8 GPa and 6.8 GPa in $\text{BaCoAs}_2\text{O}_7$ and BaCoP_2O_7 , respectively. Sharp jumps are observed in their unit-cell volumes and in Raman mode frequencies, thus confirming the first-order nature of their phase transition. These transitions involve the disappearance of the modulation from the ambient-pressure polymorph with clear spectroscopic fingerprints, such as reduction of the number of Raman modes and change of shape on some peaks. The relation between the evolution of the Raman modes along with the structure are presented and supported by density functional theory structural relaxations.

1. Introduction

The physics of $\text{BaCo}(X_2\text{O}_7)$ ($X = \text{P}, \text{As}$) quasi one-dimensional (1D) magnetic materials is governed by a strong spin–spin coupling along the 1D-direction, together with much weaker exchange along the other directions (David *et al.*, 2013). In the case of highly anisotropic spins such as Co^{2+} in the chain-like units, field-induced phenomena such as metamagnetic transitions aligning isolated magnetic units (Lenertz *et al.*, 2014; Singh *et al.*, 2012) or incommensurate spin density waves may occur (Canévet *et al.*, 2013) with interesting theoretical insights. The possibility of enhanced magnetoelectric exchanges along magnetization steps have attracted considerable attention. In that context, the low-dimensional compounds $\alpha\text{-BaMX}_2\text{O}_7$ ($M = \text{Co}, \text{Ni}, \text{Fe}; X = \text{P}, \text{As}$) are relevant cases due to their incommensurately modulated structures with large atomic displacements (Riou *et al.*, 1988). They consist of one-dimensional (1D) anti-ferromagnetic (AFM) chains undulated by the incommensurate modulation, giving a mixed 1D/2D ‘real’ magnetic topology with a metamagnetic scenario. In BaCoX_2O_7 , the modulated distribution of Ising-spin exchanges induces a magnetic complex phase diagram with competition between



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Magnetic rare-earth ion mediated 4f-3d interlayer coupling and giant exchange bias in single layered Ruddlesden-Popper perovskites $\text{SrLnCo}_{0.5}\text{Mn}_{0.5}\text{O}_4$ ($\text{Ln} = \text{Pr}, \text{Nd}$)

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Highlights

- $\text{SrRCO}_{0.5}\text{Mn}_{0.5}\text{O}_4$ (R= Pr/Nd) compounds were synthesized using the sol-gel method.
- Three magnetic transitions observed viz., FM (T_C) at ~ 178 K and 172 K followed by AFM (T_N) at ~ 90 K and 100 K and a glassy magnetic transition (T_g) at ~ 35 K and 25 K for SPCMO and SNCMO respectively.
- Presence of interlayer interactions along the pathways of B/B'-O-A/A'-O-B/B' arising from 4f-3d interactions.
- Giant exchange bias of -3.6/-1.7 kOe at 5 K under 50 kOe cooling field is observed in $\text{SrRCO}_{0.5}\text{Mn}_{0.5}\text{O}_4$ (R= Pr/Nd) compound.


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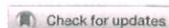
Abstract

We report an in-depth study on exotic magnetic nature including giant exchange bias in single layered Ruddlesden-Popper structure polycrystalline perovskites $\text{SrRCo}_{0.5}\text{Mn}_{0.5}\text{O}_4$ ($R = \text{Pr}$, and Nd). X-ray diffraction, neutron diffraction, and Raman spectroscopic studies on both compounds confirm tetragonal crystal structure with $I4/mmm$ space group. Temperature evolution of dc magnetization and ac susceptibility show multiple magnetic phase transitions in both the compounds, i.e., high temperature ferromagnetic transition ($T_C = 178/172\text{K}$) followed by antiferromagnetic transition at an intermediate temperature ($T_N = 90/100\text{K}$) and finally entering to a glassy magnetic state at lower temperatures ($T_g = 35/25\text{K}$). Neutron powder diffraction confirms the absence of long-range magnetic order in both compounds. Atomically disordered $(\text{Co}/\text{Mn})\text{O}_2$ layers give rise to intralayer short range $3d-3d$ magnetic interactions resulting in co-existence of ferromagnetic and antiferromagnetic regions producing frozen magnetic state below T_g . Present experimental results and analysis show giant exchange bias of $-3.6/-1.7\text{kOe}$ (Pr/Nd systems) under cooling field of 50kOe at 5K , which stems from the inherent magnetic inhomogeneity. Our results reveal that magnetic rare-earth ion (Pr/Nd) induces a pathway of interlayer $4f-3d$ magnetic interactions leading to antiferromagnetic interaction between adjacent $(\text{Co}/\text{Mn})\text{O}_2$ layers, and this has a significant influence on the exchange bias values at low temperature.

Introduction

Magnetism in two dimensional (2D) materials has received special attention in recent years due to its role in bringing out exotic functionalities where electronic and magnetic interactions are predominantly two-dimensional. Few of such 2D layered materials with coveted magnetic properties were discovered recently, such as room temperature ferromagnetism VSe_2 [1], ferromagnetism in a van der Waals 2D bulk crystal $\text{Cr}_2\text{Ge}_2\text{Te}_6$ [2], observation of Higgs mode in a two-dimensional antiferromagnet Ca_2RuO_4 [3]. In recent times, one of the most popular quasi-two-dimensional layered perovskites is Ruddlesden-Popper (RP) [4] compounds with formula $A_{n+1}B_n\text{O}_{3n+1}$ (where A is rare earth ion, or alkaline ion, B is a transition metal ion and O is oxygen, and n represents the number of layers of perovskite blocks between two rock-salt layers of AO within the unit cell). These oxides have been explored due to their exceptional functionalities such as charge ordering [5], orbital ordering [6], spin and orbital ordering [7], [8], emergent ferroic order [9], superconductivity [10], colossal magnetoresistance (CMR) [11], metal-insulator transitions [12], and giant exchange bias [13], [14] etc.

An advantage for the $n=1$ RP compounds is that the magnetic and electronic properties can be tuned effectively by a suitable choice of both the magnetic rare earth ions at the A



Superderivations of direct and semidirect sum of Lie superalgebras

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ABSTRACT

It is well known that superderivation of a Lie superalgebra is certain generalization of derivation of a Lie algebra. This paper is devoted to investigate the structure and dimension of superderivation algebra $Der(G)$ of G where G is a direct sum of two finite dimensional Lie superalgebras L and K having no non-trivial common direct factor. We also introduce some of its subalgebras. Moreover, we create a condition which shows the isomorphism between superderivation of direct sum and direct sum of superderivations of two Lie superalgebras. Later on, we take G as a semidirect sum of two Lie superalgebras and obtain the structure of $Der(G : K)$ which is a subalgebra of $Der(G)$ that contains those superderivations mapping K to itself. Finally, we give some conditions under which $Der(G : K)$ is also a semidirect sum.

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Cohomology of Lie superalgebra; direct sum; semidirect sum; superderivation

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17B05; 17B40; 17B56

1. Introduction

Derivation algebra(superalgebra) is an important topic in Lie algebras(superalgebras) that has widespread applications in physics and geometry. In recent years, there has been a surge in interest in investigating the derivations of Lie algebras. The most efficient results on generalized derivation algebras of a Lie algebra and their subalgebras was given by Leger and Luk [7]. For a Lie algebra L , the set of all derivations L is denoted by $Der(L)$ that itself forms a Lie algebra. The relationship between the structure of L and $Der(L)$ are studied by various authors in [3, 4]. In particular, they gave the structure of the generalized derivation algebra and characterized the Lie algebras satisfying certain conditions.

Lie superalgebras are the \mathbb{Z}_2 -graded Lie algebras which was introduced by Kac [6]. These are too interesting from a purely mathematical point of view. Later, Zhang and Zhang in [14] generalized the results of Leger and Luk [7] to the case of Lie superalgebras. Wang studied the structure of superderivations of Lie superalgebras in [13].


The aim of this article is to generalize some results of [1] and [2] to the case of Lie superalgebras. In particular, we seek to understand the structure of superderivations in Lie superalgebras by using direct and semidirect sum. We characterize the Lie superalgebras for which the superderivation of Lie superalgebras or their subalgebras satisfy some special conditions.

Let $\mathbb{Z}_2 = \{0, 1\}$ be the field of two elements. Throughout the paper, we denote \mathbb{F} as a field of characteristic zero and all vector superspaces are considered to be finite dimensional over \mathbb{F} . A superspace is a \mathbb{Z}_2 -graded vector space $V = V_0 \oplus V_1$. A *subsuperspace* is a \mathbb{Z}_2 -graded vector space

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Inner Superderivation of n -Isoclinism Lie Superalgebras

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K. C. Pati

Abstract. In this paper, we consider any two ideals I and J of a finite-dimensional Lie superalgebra G . Then we define the set $\text{Sder}_J^I(G)$, which contains the set of all superderivations of G which take J to zero and whose images are contained in I and the set $\text{Sder}_c^n(G)$, which contains the set of all superderivations δ of G such that $\delta(g) \in [g, G^n]$ for all $g \in G$. In this article, we have shown that if (φ, θ) is an n -isoclinism between two finite-dimensional Lie superalgebras G and H , then there exists an isomorphism from $\text{Sder}_{Z_n(G)}^{G^{n+1}}(G)$ to $\text{Sder}_{Z_n(H)}^{H^{n+1}}(H)$. Also, we prove the necessary and sufficient conditions under which $\text{Sder}_c^n(G)$ is isomorphic to certain special sub-superalgebras of $\text{Sder}(G)$.

Mathematics Subject Classification. Primary 17B70, Secondary 17B40.

Keywords. lie superalgebra, n -isoclinism, superderivation .

1. Introduction and Preliminaries

Let $\mathbb{Z}_2 = \{\bar{0}, \bar{1}\}$ be a field. A \mathbb{Z}_2 -graded vector space V is simply a direct sum of vector spaces $V_{\bar{0}}$ and $V_{\bar{1}}$, i.e., $V = V_{\bar{0}} \oplus V_{\bar{1}}$. It is also referred as a superspace. We consider all vector superspaces and superalgebras are over field \mathbb{F} (characteristic of $\mathbb{F} \neq 2, 3$). Elements in $V_{\bar{0}}$ (resp. $V_{\bar{1}}$) are called even (resp. odd) elements. Non-zero elements of $V_{\bar{0}} \cup V_{\bar{1}}$ are called homogeneous elements. For a homogeneous element $v \in V_{\sigma}$, with $\sigma \in \mathbb{Z}_2$ we set $|v| = \sigma$ is the degree of v . A subsuperspace (or, subspace) U of V is a \mathbb{Z}_2 -graded vector subspace where $U = (V_{\bar{0}} \cap U) \oplus (V_{\bar{1}} \cap U)$. We adopt the convention that whenever the degree function appears in a formula, the corresponding elements are supposed to be homogeneous.

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Detecting capable pairs of some nilpotent Lie superalgebras

Ibrahim Yakzan Hasan · Rudra Narayan Padhan · Manjula Das

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Abstract In this article, we define the capable pairs of Lie superalgebras. We classify all capable pairs of abelian and Heisenberg Lie superalgebras. After that we discuss on pairs of Lie superalgebras with derived subalgebra of dimension one and a non-abelian ideal. Finally, we determine the structure of the Schur multiplier of pairs of Heisenberg Lie superalgebras.

Keywords Heisenberg Lie superalgebra · Multiplier · Capability · Non-abelian tensor and exterior product

Mathematics Subject Classification Primary 17B10 · Secondary 17B56

1 Introduction

In the twentieth century numerous studies have been conducted on the classification of p -groups. A group G is said to be capable if there exists a group K such that $G \cong K/Z(K)$. The notion of capable group was introduced by Baer [2] and he classified all finitely generated capable abelian groups. Hall [16], pointed out that a capable group plays an important role in order to classify p -groups. Beyl et al. [7] defined the epicenter $Z^*(G)$ of a group G , and they proved that a group G is capable if and only if $Z^*(G) = 1$. Further, exterior square of a group was studied for the first time in [10], which has an interesting relation with the capability of a group. Exterior center $Z^\wedge(G)$ of a group G is defined as $Z^\wedge(G) = \{g \in G \mid g \wedge h = 1, \forall h \in G\}$. Ellis [13] proved that $Z^\wedge(G) = Z^*(G)$. For more details on classification of capable abelian groups and capable extra-special p -groups one can go through [2, 8, 38]. In 1996, Ellis [14] generalized the notion of capability of group to pair of groups (G, N) where N is a normal subgroup of G . He investigated capability, Schur multipliers, and central series for pairs of groups, and classified all finitely generated abelian capable pairs.

Analogous to the notion of capable group, for Lie algebra capability has been defined and a lot of investigation has been done [1, 4–6, 9, 11, 12, 17–19, 21, 23, 30–33]. Recently, capability of pair of Lie algebras has been defined and classified for the capable pairs of abelian and Heisenberg Lie algebras [19].

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Spin–orbit coupling, orbitally entangled antiferromagnetic order, and collective spin–orbital excitations in Sr_2VO_4

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Abstract

With electron filling $n = 1$ in the Sr_2VO_4 compound, the octahedrally coordinated t_{2g} orbitals are strongly active when the tetragonal distortion induced crystal field is tuned by external agent such as pressure. Considering the full range of crystal field induced tetragonal splitting in a realistic three-orbital model, collective spin–orbital excitations are investigated using the generalized self-consistent plus fluctuation approach. At ambient pressure, an entangled orbital + antiferromagnetic order is found to be stabilized beyond a critical value (~ 30 meV) of spin–orbit coupling which is in the realistic range for 3d ions. The behavior of the calculated energy scales of collective excitations with crystal field is consistent with that of the transition temperatures with pressure as obtained from susceptibility and resistivity anomalies in high-pressure studies.

Keywords: strontium vanadate, spin–orbit coupling, staggered orbital order, entangled orbital order, antiferromagnetic order, ferromagnetic order, coupled spin–orbital excitations

(Some figures may appear in colour only in the online journal)

1. Introduction


The origin and nature of the different phases observed in the transition metal oxide Sr_2VO_4 has been a recurrent theme despite early synthesis and significant effort made afterwards in both theoretical and experimental directions [1, 2]. Sr_2VO_4 was considered a promising candidate for unconventional superconductivity [3], mainly because the layered crystal structure consisting of VO_6 octahedra having V^{4+} ions with

$3d^1$ configuration bears a remarkable similarity (in view of electron–hole symmetry) to the parent compound La_2CuO_4 of high- T_c cuprates having Cu^{2+} ions with $3d^9$ configuration in CuO_2 layers [4]. While superconductivity remains elusive, the origin of phases including the magnetically ordered one are not well understood. Unlike the cuprates, the complexity in understanding the vanadate system stems from factors including the active orbital degree of freedom, non-negligible spin–orbit coupling (SOC), Coulomb interaction induced orbital mixing terms and electron–lattice coupling.

Sr_2VO_4 crystallizes into K_2NiF_4 -type structure found in compounds such as La_2CuO_4 [1]. The octahedral crystal field

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Saivism in Western Odisha (India): a historical journey from ancient period

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Abstract

Western Odisha is the meeting ground of all religions. The paper finds the fusion of Hindu beliefs and local faiths. Local faiths are found assimilated in the Saivite religion of Western Odisha. Many fairs and festivals are observed in this region that profoundly impact our society. Many kings patronized Saivism along with Vaisnavism and Saktism in this region. So this region became a confluence of Saivism with Vaisnavism and the Sakta cult. As a result, they paid attention to the construction of monuments in different parts of Western Odisha to spread the religion. One thing is noticed that the Thanapatis (non-Brahmin caste) worship Lord Siva in most of the temples of western Odisha. The Saiva worship develops the aesthetic sense in the human mind, and with this sense, they lead a peaceful social life. These Saivite Monuments are the rich legacies of the cultural development of western Odisha. These Saivite monuments are greatly responsible for enriching the art and architecture of Odisha (India) in general and Western Odisha in particular.

Keywords: aesthetic, cultural, religion, saivism, western odisha

Introduction


India is a land of religion, in which several deities were adored from time immemorial. Some of them had been quite prominent and were following never disappeared ever since. Their appearance on the Indian religious scene though some of them disappeared and vanished into oblivion as rapidly as they had mushroomed. God, worship and religion are in spirit, relative factor in the history of social progress of human society. Generally, God is a different type of personality; worship is the quintessence of religious life, and religion is the state of salvation in which man remains in the exclusive company of God. From remote past to the present day, it would be seen that where there is neither God nor religion, indeed there is the worship of full-fledged human life, and it fits into the aim and object of the liturgy of religions. To see or make life full-fledged was the humanitarian go, and it certainly was at work the dawn of civilization. At a given time, Siva happens to be one such deity whose antiquity has to the third millennium B.C. when the non-Aryan of the Indus valley appeared in the limelight of the Photo historical period as the worshippers of Pasupati, the prototype of Rudra Siva of the Vedic age (Bhandarkar, 1965) [9]. Archaeological remains of the Indus valley indicate that Saivism is Pre Aryan concept that seems to have been spread in different parts of India from 3000 BC. In Vedic literature, he was more popularly known as Rudra and was later known as Siva. In the earlier stages, he was known in abstract form as Rudra and was considered the God of mountains and storms (Bhattacharya, 1975) [7].

The Fair and Festivals are joyous feasting based on religious beliefs and rituals. It is a group observance on a specific

occasion, especially community worship. It is such an occasion that people who had avowed to worship the deities assembled and participated in the ceremonial ceremony. The celebration of the festivals continued in popular tradition, and once they had begun, they persisted through the ages (Agrawal, 1970) [1]. The fairs and festivals are the product of primitive religious beliefs taking a long time to assume their present forms through an evolutionary process. These are accompaniments to honour and appease the gods and spirits supposed to bring better crops, better health, better rain and protecting the community (Archak, 2002) [2].

Concept of saivism

Siva is also known as *Mahadeva*, *Dhurjati*, *Nilakantha*, *Trinetra* and also appears in *Saumya*, *Ugra* and *Samhara* forms in which different functions are attributed to him for the benefit of gods. Out of these forms, *Saumya-Murit* bestows his kindness and blessing to all. In his *Ugra* form, he kills the demons even punishes Kala, the God of death. In his *Samhara* form, he killed *Andhaka* and other terrific monsters. He is also the lord of dance and music. As *Nataraj*, he is the lord of dancers. Saivism, especially Saiva Siddhanta, developed a sophisticated symbolized in its fivefold activities *Panchakriyas*, (i) *Sristi* (Creation and evolution), (ii) *Sthiti* (Preservation and Protection) (iii) *Samhara* (Destruction) (iv) *Tirobhava* (embodiment and attraction) and (v) *Anugraha* (liberation grace and salvation). They reflect the cosmic activity, which is the central motif of the dance. The texts testify that creation arises from the drum variation, the *dambaru*, protection proceeds from the hand of hope, i.e.,


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Impact of e-learning on education system of India: A sociological study

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Women Participation: A Displacement Perspective

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Higher education system of India and new education policy: An explor

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Act East Policy and Its Strategy and Significance of the 21st Century towards South East Asia

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Abstract

The inclusive centre of importance for shifting to East Asia, due to its extraordinary economic enthusiasm from the rise of new command centre's and their self-assured attitudes also brings enormous security challenges for the Look east Policy in India. India is rejuvenate its age-old links with East Asian nations through the Act east Policy in 2014. After a long term interruption it is looking to East Asian nation once more to engage with huge aspiration and motivation through the "Act East Policy". It embarrassed by political and economic imperatives, India launched the Look East Policy in the early 1990s, under the Prime Ministership of P.V Narasimha Rao government which, in spite of its measured take-off it has evolved into a widespread engagement underpinned by a number of political institutional mechanisms, strong economic relationship through a variety of widespread cooperation agreements, and healthy defence links and security assistance towards the East Asian Nations. As a consequence, India has now become an unchallengeable part of the growing East Asian economic and security arranger. While India directly associates with the U.S., Japan and a small number of ASEAN countries through the regional and international organizations and also various bilateral forums to multilateral forum talks about the management of regional security prospective. Another factor is India's relations with China are undergoing major challenges as they become more and more complexity towards the maritime security in the sea route.

Key Words: Look East Policy, Act East Policy, China, ASEAN


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From Security Burden to a Land of Economic Opportunities: North East States of India in the Prism of India's Look East Policy to Act East Policy

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ABSTRACT

The year 1991 is regarded as a crucial year for India's foreign policy maker as a new chapter was added to India's foreign policy with the name of "India's Look East Policy" by the then Prime Minister P.V. Narashima Rao. This policy is regarded as a prolific shift in India's perspective towards South East Asia. The basic objective of this policy was to achieve better economic development of the country with the help of our Eastern neighbours having special focus on north east states (seven sister states). Terming it as Act East, India is sensing a gradual shift of economic power from west to east as necessitated by evolving geo-politics and trends in Asia's pacific. The Act East Policy is an integral part of North Eastern regions vision 2020- a roadmap for development of the region. As a part of this policy India has upgraded its relation to a new level not only with the ASEAN countries but also with countries like Australia, Japan, South Korea etc.. The north east is the gate way of connectivity between these countries. Since the arrival of Modi era Indian government has prime focus on this region. Which are historically regarded as burden States as far as economic development is concerned.

Key Words: North East India, ASEAN, Seven Sister States.

INTRODUCTION

From the very first year of its introduction the "Look East Policy" has been an important part of India's international diplomacy. The policy with time has enlarged its sphere from South East Asia to whole Asia's pacific zone. Under the realm of the Act East Policy India is strengthening its economic, political, culture and security and trade relation with the ASEAN and Non ASEAN countries like Australia, Japan, South Korea Etc.. It is interesting to mention that "Look East Policy" was initiated by the congress led government at centre with Prime Ministership of Mr. P.V. Narashima Rao in 1991, and subsequently followed by BJP led government under Prime Ministership of Sri Atal Bihari Vajpayee and Mr. Narendra Modi in current years. Generally it is a perception that policies change with change of government but surprisingly Look East Policy has added new feathers to its own with changing of government from time to time at the centre because of its strategic and commercial interest towards seven sister states.

North East region of India that includes Seven Sister States (Arunachal Pradesh, Assam, Meghalaya, Manipur, Mizoram, Nagaland, Tripura and Sikkim) on the prior to inclusion of the state of Sikkim into the North Eastern Region of India. However, assumes significant place due to its geographical proximity with the South Asian countries. The "Look East Policy" has always given special importance towards North East India. North East India is the "Physical and cultural bridge" between India, South East Asia and East Asia. The development of NES (North East States) also highly depends upon the bordering countries such as Bangladesh, Myanmar, Bhutan, China and Nepal.

The NER (North East Region) a Brief Sketch

The NER of India is located in the extreme north east of India at the foot hills of Sub-Himalayan region comprised of seven hilly states also known as (Seven Sisters). Historically this region is regarded as a backward region due to its uncanny features. The region is land locked and only connected to main land through a narrow corridor (Siliguri Corridor). As these regions has considerable international border sharing with countries such as Bangladesh, Myanmar and China it is considered as strategic and sensitive from the view of national defence. Even China's claim over some part of Arunachal Pradesh has made it more sensitive. Another factor is in the resistance policy of the communities against resource extraction, there are also voices of support from government officials, elected representatives, tribal elites and at times, sections of the rebellious groups. Most importantly, the combined opinion of a group of people find themselves questioned when class difference emerge over the past year from

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Foreign Policy in Kautilya's Arthashastra: A Critical Analysis of the Importance of Rajamandal theory in India's Foreign Policy in the 21st Century

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Abstract

Kautilya also known as Chanakya or Vishnugupta was a statesman and philosopher India has ever produced is famous for his epic writing title as "Arthashastra". Though the meaning of Arthashastra is related to gaining of wealth but the primary focus of this book is on statecraft diplomacy and strategy in maintaining relation with other states. Arthashastra is purely dedicated to national security issues and regarded as a handbook to run an empire by following all the advices of Kautilya written in Arthashastra Chandragupta Maurya was able to defeat the large Nanda Empire and established a stable kingdom of his own by following this. National security is the prime theme of Arthashastra systematically classified as Saptanga theory and the Mandala theory. The Mandala theory is at the core of Kautilya's conceptualization of state affairs primarily deals with security of the states which has practical relevance in current international relations today. The theory and principles of Rajamandala (the circle of kingdom) is followed not only by India but by other countries of the world in maintaining their foreign policy even in 21st century.

KeyWords: Mandala, Foreign Policy, Arthashastra, Saptang Theory

Introduction

The Arthashastra represents the original political thought of Kautilya was probably written in 250 CE. This book was regarded as guide book for those kings who want to run an effective government, though there is detail discussion about each and every activity a king should follow but the most prominent discussion is on war and diplomacy. Arthashastra is not only a hand book for king in running his day to day state affairs but also a path finder in making international relations with other countries. It is nothing but a book of certain laws followed by the king of ancient times for successfully governing a state there is quite similarity between

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The “New Great Game” of Central Asia: The Role of India on the Prospective of Energy and Security Strategy

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ABSTRACT: The significance of Central Asia to India has also grown as India has sought to diversify its energy sources by including such imports from the Central Asian region. Despite all Central Asian Republics having a higher per capita income than India, a central focus of India's relations with these countries has been through its development cooperation and energy strategy. Though Indian aid to this region constitutes less than one percent of the total volume of grants and Lines of Credit extended by India overseas, the number of Central Asian bureaucrats who have received training through the Indian Technical and Economic Cooperation (ITEC) training program is significant. In the Prospective of New Great Game strategy in the 21st Century is the vital factor for India's foreign policy towards Central Asia. However, the Indian prospective India is the emerging global powers in the great game politics. This brief analysis the scope and potential of closer ties between India and the Central Asian region, with a special focus on India's development partnerships through the Geostrategic significance and Security Prospective in their Broader region. This paper is an unpretentious attempt to focus on the strategic and diplomatic objectives of India in the Central Asian region in the light of the activities of major powers in the Central Asian region.

KEYWORDS: NEW GREAT GAME, ITEC, OBOR, INSTC

I. INTRODUCTION

The “Great Game” refers to the historical rivalry between Tsarist Russia and the British Empire in Indian-subcontinent and Central Asia. During 19th and 20th years the Central Asia and Indian-subcontinent was a territory of the power diversion between the historically known as the empires of British and Tsarist Russia. In the 19th century Russia got control of whole Central Asia till the end of 1990s, by this, the old Great game comes into an end. After the collapse of the Soviet Union, all countries of the world to conventional the diplomatic relations with the Republics of Central Asian Countries, but it was only after the US intervention in Afghanistan that all countries of the world show their interest in making good relations with these Republics. Therefore, after the 9/11 event new great game started between provincial and world powers in the Central Asian region. The foremost objectives of this study are to analyze the role of India in Central Asia after the US intervention in Afghanistan after 9/11 attack and subsequent withdrawal in 2021. After the 9/11 attacks and the succeeding United States (US) war on terror changed the international security picture. Dominance of security issues and its linkages with economics and politics became its major attribution.

As the significance of the various regions throughout the sphere unspecified the new geopolitical magnitude, Central Asian Region (CAR) received direct and highest attention on the Great Game politics. The geopolitical importance of the Central Asian states has been highlighted by the fact that the same has been labeled as Russia's intentional backyard”, Washington's Greater Middle East”, the new, Far West” of China and so forward. The vital resources of uranium, hydrocarbons and oil of the region and its physical convenience to South Asian region, made the region vital for every country, particularly for Europe and South Asia. The region's completely geopolitical location-between Russia and China (historically aggressive powers) invited the presence of provincial and trans-regional players since its beginning after the disintegration of the Soviet Union. As US decided to shift its focus to the Central Asian region (CAR) through the Great Game Politics, it devised an approach towards “Greater Central Asia” aiming to marginalize between Russia and China. The „New Great Game” was developed in Central Asia involving Russia, America, Europe, China and India as key players as well as Iran, Turkey and Pakistan as regional players in the present Scenario. America sees India as a corresponding power between Russia and China.

The role of different international and regional organizations such as the UN, NATO, and SCO attached with the



India and Central Asia Relation Connecting Policy through the Bilateral forum to Multilateral forum

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Abstract:

The geopolitical prominence of Central Asia for India was in no way in doubt in the past and is not in doubt at future. Indian strategic thinking towards Central Asia is considered as a part of its extended and strategic neighborhood. What is of prime importance for India is the stability and security of the region. In a way that is impossible to disentangle linked with India's concerns in Central Asia for the instability situation in Afghanistan, for the latter is part of the Central Asian geopolitical assemble as its hares boundaries with Tajikistan, Uzbekistan and Turkmenistan. Central Asia's rich natural resources, including significant reserves of oil, natural gas, hydrocarbon and its location in the center of Eurasia have attracted immense global attention. In the untouched strategic scenario, India seeks to reconnecting policy towards Central Asia in the twenty first century throughout the bilateral to multilateral forum and to play a constructive role in this region. Till now India has a limited presence in the region, Indian policy makers and administrator was attracted towards a cooperative strategy with the bilateral and multilateral presence through the regional and international organization. The presence of major powers in Central Asia constrains India as a latecomer to the region. It also shares the Central Asians own interest that no single power should govern role in this region. However, the interests of the major powers are balanced and Central Asia is not likely to be the show round where these reasonable relations turn in uncompromisingly. In the Indian and Russian perceptions about the future role of China in Central Asia is likely to be coinciding. Though India is highly vigilant about Chinese aims in Central Asia, its more immediate concerns are the stability and security of Central Asian region.

Key Words: Afghanistan, Geopolitics, SCO, Central Asian Connecting Policy

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Facile green synthesis of fluorescent carbon nanoparticles using spider silks

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Abstract


Carbon nanoparticles (CNPs) have emerged as a promising candidate because of their interesting properties. They can be synthesized by chemical method as well as through green chemistry. Herein, we report a green synthesis approach for the CNPs from spider silk by pyrolysis at temperature 400 °C without using any carbonizing or passivating agent. The structural and optical properties of the synthesized CNPs have been characterized by using X-Ray diffraction (XRD), Raman spectroscopy, SEM (scanning electron microscope) - Energy Dispersive X-Ray (EDAX) analysis, UV-Visible and photoluminescence (PL) spectroscopy. The results obtained show that prepared carbon nanoparticles (CNPs) have a great potential for bio-sensing, bio-imaging, disease diagnosis, and other different optoelectronic device applications.

Keywords: carbon nanoparticles, spider silk, pyrolysis, photoluminescence spectroscopy

1. Introduction



Nanotechnology (NT) is the most important research in the twenty-first century due to its wide range of applications from industries to biomedical including nanochemistry, nanoscience, nanomaterials, nanoelectronics, nanophysics, nanometrology, nano bionics, etc. [1]. Among them, nanoparticles can lead to new tools and technologies due to their unique compositions and functionalities [2]. Semiconductor nanoparticles produced from heavy metal elements show some excellent properties like high quantum yields, size-dependent emission properties, high chemical stability, and narrow spectral bands, etc. [3]. However, they are severely limited in terms of major health issues caused by precursor toxicity [4]. An alternative to this, recently nontoxic carbon nanoparticles (CNPs), a new category of carbon nanomaterial having ~ 2–100 nm size with interesting photoluminescence properties have developed to be one of the most extensive research topics nowadays [5]. There are several reasons why the scientific world is moving towards the CNPs. First, CNPs can be synthesized from naturally available carbon sources which are generally simple and economic. Second, the functionalization of the surface of CNPs is very easy, convenient, and adaptable. Third, CNPs have wonderful biocompatibility, excellent physical properties, and high aqueous stability. Fourth, the properties of CNPs can be increased by making a composite with other species. Recently, there is a great interest in the use of natural by-products as precursors for the synthesis of highly fluorescent non-toxic CNPs due to cost-effectiveness and biocompatibility [6]. The obtained CNPs possess some excellent properties like high quantum yield, low toxicity, broad absorption spectra, high fluorescent lifetime, high photostability, excitation-dependent emission intensity properties,




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In-situ synthesis of mixed-phase carbon material using simple pyrolysis method for high-performance supercapacitor

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Highlights

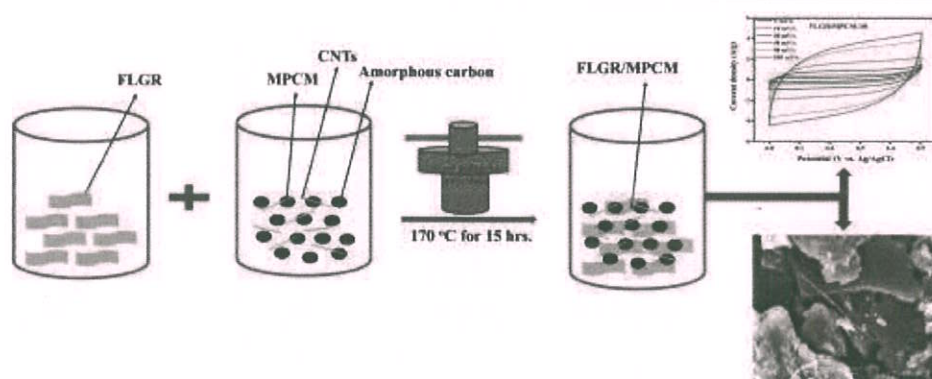
- A novel material is prepared using a simple pyrolysis and cost-effective method
- The prepared material contains both amorphous and crystalline phase
- The storage performance of mixed phase material is enhanced by few layer graphene
- A very low equivalent series resistance is achieved in the composite electrode
- An excellent cyclic stability is observed in composite electrode over 10,000cycles

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Abstract

We report a novel mixed phase carbon material that contains both amorphous as well as crystalline phases for supercapacitor application. The amorphous carbon and crystalline carbon nanotubes are present in this mixed phase material which is prepared using an in-situ process in a simple and cost-effective method. In supercapacitor devices, better performance is achievable when there is good surface accessibility in electrode material and decent ion mobility. Amorphous material provides good surface accessibility whereas crystalline offer better electrons and ions mobility. Hence, the prepared mixed-phase carbon material has advantages for the supercapacitor. The material is tested for supercapacitor application where the electrochemical performances are obtained using Cyclic voltammetry (CV), Galvanostatic charge-discharge (GCD) and Electrochemical impedance spectroscopy (EIS) measurements. The mixed-phase electrode results in a specific capacitance of 37.54Fg^{-1} at 1A g^{-1} and 36.80Fg^{-1} at 5mV/s . The storage performance of this material is further increased by integrating it with a few layers of graphene. The prepared composite with a 30 wt. percentage of few-layer graphene gives the better supercapacitive properties and the maximum capacitance achieved by the composite is 282.52Fg^{-1} at 1A g^{-1} and 281.84Fg^{-1} at 5mV/s . The fabricated mixed-phase composite (30wt% of few-layer graphene) offers excellent cyclic stability and 93% capacitance is retained even after 10,000cycles at 1A g^{-1} . These outcomes suggest the mixed-phase composite electrode could be the best choice for high performance supercapacitor applications.

Graphical abstract



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Introduction

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A new technique for synthesis of the Cu_3N and its structural indexing

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Abstract: We report the synthesis of the polycrystalline Cu_3N phase via a diffusion reaction between copper and nitrogen under extreme conditions. Herein, the solid-state diffusion mechanism for the synthesis of the Cu_3N phase was analyzed. Structural indexing of the new phase was confirmed using the X-ray diffraction technique. Synthesis of the above Cu_3N phase applying this novel technique is an inexpensive method for the industrial production of the material. The microstructure of the above solid was investigated under a high-resolution scanning electron microscope.

Keywords: Cu_3N Phase; Rapid quenching; X-ray indexing; Liquid nitrogen; Red-hot temperature

1. Introduction

Synthesis of the copper nitride (Cu_3N) phase is very challenging. It is because of the least reactivity (electron affinity + 119.24 kJ/mole) of copper ($[\text{Ar}]4s^1, 3d^{10}$) among 3d-transition metals. Again, nitrogen ($[\text{He}]2s^2, 2p^3$) with a half-filled p-sub shell and having high bond dissociation energy (− 946 kJ/mole) associated with the triple bond ($\text{N}\equiv\text{N}$) behaves like an inert gas with negative electron affinity (− 6.8 kJ/mole). Despite those challenges, Cu_3N is a topic of great interest for researchers because of its fundamental aspects and technological importance [1–18]. The unique properties of Cu_3N , viz. cubic anti-Re O_3 structure [19], hardness [16], low decomposition temperature ($\approx 300^\circ\text{C}$) [16–19], semiconducting nature [5, 7], complex optical nature [17], and electro-catalytic activity [6], attract the attention of scientists and technologists from diverse discipline. However, it is difficult to synthesize Cu_3N using conventional solid-state reaction techniques.


The solid Cu_3N phase was synthesized as reported for the first time by Juza et al. in the year 1939 [20] using a CuF_2 solid reacted with gaseous ammonia flowing under a

high-temperature and high-pressure environment. Again, a single crystal of the Cu_3N nanowire was fabricated by Zachwieja et al. [21] adopting the mixing technique of $\text{Cu}(\text{NH}_3)_4\text{NO}_3$ with liquid ammonia at room temperature and adding extra copper during the reaction. Applying the direct thermal decomposition reaction of $\text{Cu}(\text{NH}_3)_x\text{NO}_3$ in the absence of ammonia a polycrystalline Cu_3N was also synthesized by Zachwieja and Jacobs in the year 1990 [22]. Researchers successfully synthesized the nitride using a solvothermal reaction technique just by heating copper azide in organic solvents at a moderate temperature [23] or by using $\text{Cu}(\text{NO}_3)_2$ and primary amines as a capping agent [24, 25] or by reacting ammonia with copper(II) acetate monohydrate dispersed in long-chain alcohols [26, 27]. Moreover, it is even possible to utilize copper (I) oxide as a precursor using either ammonia gas or urea as a source of nitrogen for the synthesis of nitride [28]. The thin films of Cu_3N were synthesized by Terada et al. [29] using the magneto-sputtering technique for the growth of single-crystal and high-oriented epitaxial layers on solid substrates [29].

Several synthesis techniques, viz. direct current (DC) reactive magnetron sputtering [30–32], radio frequency (RF) reactive magnetron sputtering [33–36], molecular beam epitaxy (MBE) [29, 37, 38], pulsed laser deposition

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Does G7 Engross the Shock of COVID 19: An Assessment with Market Volatility?

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Abstract

The paper has emphasized on the downside potential of the stock market faced by G-7 countries in the times of COVID-19 relative to other economic crises. The results of VaR models, ES, and correlation suggests that most of the nations in G-7 group experienced highest risk during COVID-19 relative to other regimes and also increased inter-linkage of different markets within the group is visible during this period. The work can definitely be a reference to the investors for taking investment decisions as well as the governments and regulators for framing policies to keep the market stable by clinging to the policies of those markets which has managed to stay stable even at turbulent times. Moreover, the group as a whole can also rethink of policy measures together to beat the crisis.

Keywords COVID- 19 · GFC · Market risk · VaR · Pandemic · Economic crisis · KUPIEC test

1 Introduction

The eruption of COVID-19 has been taking a toll on health of people as well as of the economy. The epidemic appears to have wreaked havoc on developed economies, particularly those with specialized and sophisticated service sectors. As per

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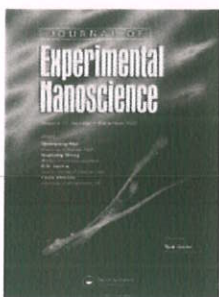
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Dillenia indica bark extract mediated bio-fabrication of copper nanoparticles: characterisation, antioxidant and anticancer activity *in vitro*

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Dillenia indica bark extract mediated bio-fabrication of copper nanoparticles: characterisation, antioxidant and anticancer activity *in vitro*

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ABSTRACT

Dillenia indica is a medicinal plant used in the indigenous system of medicine for plethora of diseases. In this study, the efficacy of ethanolic bark extract of *Dillenia indica* was investigated for green synthesis of copper nanoparticles (CuNPs). Obtained CuNPs were crystalline, spherical in shape within a size range of 20.87–45.73 nm, well dispersed showing strong negative zeta potential value (−41.8 mV) as analysed by XRD, TEM, FESEM and particle size analyser. The elemental composition of CuNPs was examined through EDX spectrum followed by field map analysis. FTIR spectra showed the presence of active biomolecules responsible for reduction of copper ions as well as for surface functionalisation of CuNPs. Synthesised CuNPs showed marked free radical scavenging efficacy at IC₅₀ of 37.2 µg/mL. MTT assay in CuNPs treated A549 and MCF-7 cancer cell lines for 24 and 48 h showed substantial decrease of cell viability with increase in concentration. Further, morphological alterations like cell shrinkage, nuclear fragmentation and blebbing were remarkably observed in CuNPs treated both the cell lines as assayed through AO/EtBr and DAPI staining methods. Thus, *D. indica* bark extract-mediated CuNPs were potential free radical scavengers and effective cytotoxic against A549 and MCF-7 cancer cell lines.

ARTICLE HISTORY

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KEYWORDS

Green synthesis; *Dillenia indica*; copper nanoparticles; antioxidant; anticancer

1. Introduction

In recent years' nanotechnology circumscribed an increasing impact on industrial and medical research accounting to find solutions across a wide range of physicochemical and biomedical science. Development of different inorganic and organic nanomaterials exhibit completely different properties, as they have distinct features including distribution, size and shape which act as crossroads of multiple applications in biotechnology including


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Exchange bias effect and inhomogeneous magnetism in 6H Ba₃CoFeRuO₉: Role of structural site disorder

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Highlights:

- Structural, magnetic and transport properties of triple perovskite Ba₃CoFeRuO₉ compound is investigated.
- Random site occupation of Co, Fe and Ru along with the specific 6H structure result in competing AFM and FM interactions.
- Short-range ordering are established through neutron diffraction, magnetisation and specific heat measurements.
- Enhanced site disorder on Co doping, coupled with mixed valency of B-site ions leads to exchange bias in our system.
- Electrical conduction above 150K is by tunnelling of carriers among isolated network of face sharing octahedra in a dielectric kind of medium.




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Abstract

Structural, magnetic, electrical and thermal investigations on ternary barium ruthenate $\text{Ba}_3\text{CoFeRuO}_9$ (BCFRO) reveal the role of the two different octahedral *B*-site in creating locally varying competing antiferromagnetic and ferromagnetic interactions. BCFRO forms in 6H hexagonal structure in the $P6_3/mmc$ space group. Neutron diffraction and specific heat capacity measurements affirmed the absence of any long-range ordering and structural transition in the compound. DC thermomagnetic studies evidences spin glass magnetism with $T_g \sim 50\text{K}$. A large exchange bias (EB) field of 3.48 kOe is obtained at 3K under a cooling field of 50 kOe. Careful analysis indicates, EB in our system stems from inhomogeneous magnetism owing to spatially varying chemical composition. Competing ferromagnetic and antiferromagnetic phases giving rise to spin glass behaviour is the manifestation of site disorder induced by mixed valences of magnetic ions. The exchange bias training effect in our system follows spin relaxation model of rotatable and frozen spins which are exchange coupled at the interface. Strong electron localisation occurs by virtue of the specific 6H structure with corner shared octahedral $2a$ site and face shared octahedral $4f$ site. The electrical and thermal transport in BCFRO follows Efros-Shklovskii variable range hopping (ES VRH) model below 150K. The high resistivity of BCFRO at low temperatures is also reflected in the low thermal conductivity and huge Seebeck coefficient.

Introduction

The discovery of unusual 4d magnetism in ruthenium oxides has kindled particular attention in the ruthenate compounds. SrRuO_3 ($n = \infty$) and Sr_2RuO_4 ($n=1$) of $\text{Sr}_{n+1}\text{Ru}_n\text{O}_{3n+1}$ series had intrigued researchers for their itinerant ferromagnetism and novel superconductivity[1], [2]. Unlike, its Sr and Ca counterparts BaRuO_3 does not crystallize in orthorhombic GdFeO_3 like perovskite structure. The larger ionic radii of A site cations in many of the ternary oxides owes to a structure with cubic or hexagonal stacking or alternative layers of both, resulting in corner sharing or face sharing oxygen octahedra. BaRuO_3 under ambient synthesis conditions crystallizes in 4H hexagonal or 9R rhombohedral phases. Here, numeral 4 and 9 represents the layer repeating number which is followed by the symmetry class in accordance with Ramsdell notation [3]. Barium ruthenates can also have several structural variants depending on the synthesis conditions. BaRuO_3 itself is reported to have four structural polymorphs [4]. In the hexagonal polymorphs, presence of corner shared and face shared octahedra gives rise to simultaneous Ru-Ru and Ru-O-Ru connectivities. This offers us to introduce different metal ions in the two octahedral sites to probe intriguing magnetic interactions. $\text{Ba}_3\text{MRu}_2\text{O}_9$ compounds, *M* (transition metal/rare-earth) ion doped BaRuO_3 usually crystallizes in 6H hexagonal structure. Among all other transition metals, Fe compound



Some properties of isoclinism in n -Lie superalgebras

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In this paper, we define isoclinism of n -Lie superalgebras of parity $\alpha \in \mathbb{Z}_2$ and study some of its properties. Furthermore, we prove that notion of isoclinism and isomorphism of two finite dimensional n -Lie superalgebras of same parity are equivalent.

Keywords: n -Lie superalgebras; isoclinism; factor set.

AMS Subject Classification: 17B30, 17B05


1. Introduction

In 1940, Hall [3] introduced isoclinism which plays an important role in classification of finite p -groups. Karpilovsky gave the theory of the Schur multipliers of p -groups [4]. Isoclinism for Lie algebras was introduced by Moneyhun [5, 6] in 1994. Further, this notion is carried forward to n -Lie algebras [2] and Lie superalgebras [8]. In [9], Saeedi and Veisi proved that an n -Lie algebra with finite dimensional derived subalgebra and finitely generated central factor is isoclinic to some finite dimensional n -Lie algebra. n -Lie superalgebras was introduced by Cantarini and Kac [1] which have more general structures. If we restrict the n -Lie superalgebras, then we can

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ସଚିରାଉତରାୟଙ୍କ କଥାସାହିତ୍ୟରେ ପ୍ରଗତିବାଦୀ ଚିନ୍ତନ

ସମାଜ, ଅର୍ଥନୀତି, ଜୀବନଧାରା ପ୍ରଭୃତି ବିକାଶ ମୂଳରେ 'ପ୍ରଗତି' ନିହିତ ଥାଏ । 'ବିକାଶ'ର ଅର୍ଥ ହିଁ ପ୍ରଗତି । ଆମ ସମାଜରେ ଯେଉଁ ସବୁ ପରିବର୍ତ୍ତନ ବେଶାଯାଏ ସାହିତ୍ୟରେ ତା'ର ପ୍ରତିବିମ୍ବ ପଡ଼ିଥାଏ ଏବଂ ଯେଉଁ ଆଦର୍ଶ ସମାଜକୁ ଅଗ୍ରଗତିର ଦିଗ ନିର୍ଦ୍ଦେଶ କରିଥାଏ, ଆଗକୁ ବଢ଼ିବା ପାଇଁ ପ୍ରେରଣା ଦେଇଥାଏ, ତାକୁ ପ୍ରଗତିଶୀଳ କୁହାଯାଏ । ପ୍ରଗତିଶୀଳ ସାହିତ୍ୟ କହିଲେ ମୁଖ୍ୟତଃ ମାର୍କସୀୟ ଦୃଷ୍ଟି ଓ ଦର୍ଶନ ଦ୍ଵାରା ଅନୁପ୍ରେରିତ ସାହିତ୍ୟକୁ ବୁଝାଇଥାଏ ।

ସମାଜରୁ ଶୋଷକ ଗୋଷ୍ଠୀର ଅନ୍ୟାୟ, ଅତ୍ୟାଚାର ବିରୋଧରେ ଦୃଢ଼ ପ୍ରତିବାଦ ସହିତ ଏହାର ମୂଳୋତ୍ପାତନ ପାଇଁ ଶତ ପ୍ରତିଶତ ପ୍ରଚେଷ୍ଟା ସାଜକୁ ଏକ ସୁସ୍ଥ ସୁନ୍ଦର ସମାଜ ଗଠନର ପରିକଳ୍ପନା ମଧ୍ୟରୁ ସୃଷ୍ଟି ହୋଇପାରିଛି 'ପ୍ରଗତିବାଦ' । ଏହି ଚିନ୍ତାଧାରାକୁ ମୁଖ୍ୟତଃ ଯେଉଁ ସାହିତ୍ୟ ରୂପ ଦେଇଥାଏ ତାହା ପ୍ରଗତିବାଦୀ ସାହିତ୍ୟ । ଓଡ଼ିଆ ସାହିତ୍ୟରେ ପ୍ରଗତିବାଦୀ ଚିନ୍ତାଧାରାର ଆନନ୍ଦନ ଘଟିଛି । ଏହାର ଅଭ୍ୟୁତ୍ଥାନ ସଂପର୍କରେ 'ବିଷୁପଦ ଦାଶ' କହନ୍ତି- "ବିଧିବଦ୍ଧ ଭାବରେ ଏହାର ବିକାଶ ପାଇଁ ଯେଉଁ ସମୟରେ ଗୋଷ୍ଠୀଗତ ଉଦ୍ୟମ ହୋଇଛି ତାହାରି ଆବେଦନକୁ ଭିତ୍ତିକରି ଏହି ଭାବଧାରା ବା ଲଜ୍ଜମ ଗୋଟିଏ ଯୁଗ ସାହିତ୍ୟ ସୃଷ୍ଟି କରିପାରିଛି । ଓଡ଼ିଆ ସାହିତ୍ୟରେ, ଭାରତୀୟ ସାହିତ୍ୟରେ ତଥା ବିଶ୍ଵ ସାହିତ୍ୟରେ ଏହିପରି ବିଧିବଦ୍ଧ ଫଳରେ ଏହି ଭାବଧାରା ଏକ ସାହିତ୍ୟ ଯୁଗ ପ୍ରତିଷ୍ଠା କରିପାରିଛି ।"

ପ୍ରଗତିବାଦର ଅନ୍ୟନାମ - ମାର୍କସବାଦ, ସାମ୍ୟବାଦ ବା ସମାଜବାଦୀ ଚିନ୍ତାଧାରା । ଏହା ଜନନାୟକ କାର୍ଲମାର୍କସଙ୍କ ଚିନ୍ତାଧାରାକୁ ନେଇ ପର୍ଯ୍ୟବେଶିତ ହୋଇଥିବାରୁ ଏହାର ଅନ୍ୟନାମ ମାର୍କସବାଦ । ଏହି ସାହିତ୍ୟ ଚଳୁ ସମାଜରେ ଦୃଷ୍ଟିଗୋଚର ହେଉଥିବା ଦୁଇଟି ଗୋଷ୍ଠୀ ଧନୀ-ଦରିଦ୍ର, ଜମିଦାର-କୃଷକ,

Spin-orbit coupling and magnetism in Sr_2CrO_4

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Abstract

With one electron in the degenerate yz, xz orbital sector, the Sr_2CrO_4 compound exhibits active orbital degree of freedom, resulting in strongly enhanced orbital and spin-orbital correlations due to Coulomb interaction induced renormalization of the otherwise weak bare spin-orbit coupling (SOC) in this $3d$ transition metal compound. Finite temperature orbital fluctuations strongly reduce spin-orbital correlations, effective SOC strength, and magnon excitation energy. Orbital and magnetic transition temperatures estimated from the calculated orbiton and (renormalized) magnon energies are in good agreement with the experimental values obtained from susceptibility and resistivity anomalies in recent high-pressure studies.

Keywords: spin-orbit coupling, crystal field, Coulomb interaction, magnon, orbiton, strontium chromate

(Some figures may appear in colour only in the online journal)


1. Introduction

Two-dimensional (2D) magnets are gradually taking an important role in future spintronic and magnonic elements [1–4]. Complex magnetic orders have been predicted, and recently observed in many such materials due to magnetic anisotropy, time-reversal, and inversion symmetry breaking [5, 6]. Spin-orbit coupling (SOC) is found to be a source for various exotic phenomena in these materials providing energy-efficient paths for spin generation, manipulation, detection, and device applications [7–9]. Among the materials, Cr-based 2D van der Waals ferromagnets CrI_3 and CrXTe_3 ($X = \text{Si, Ge}$) with honeycomb lattice exhibit topological magnon excitations [10, 11]. The topological magnonic states have the potential for applications in magnonics and topological

spintronics, such as quantized pumping of magnons, spin-wave beam splitter, magnon waveguides, chiral traveling-wave magnon amplifiers, and magnon-driven orbitronics [12–16]. Many layered perovskite magnetic insulators having active orbital and spin-orbital correlations—earlier treated on different footing without SOC—are now converging under SOC-induced nontrivial electronic state, composite spin-orbital excitations, and supports potential for spintronics, orbitronics, and magnonics applications.

Among layered perovskite structured $3d$ transition metal compounds Sr_2MO_4 where $M = \text{V, Cr, Mn}$ with $n = 1, 2, 3$ electrons in the t_{2g} sector, Sr_2CrO_4 presents a promising case for investigating SOC and Coulomb interaction effects in view of the rich spin-orbital physics exhibited by this compound. Among other members of the Ruddlesden–Popper series $\text{Sr}_{n+1}\text{Cr}_n\text{O}_{3n+1}$, the cubic perovskite SrCrO_3 ($n = \infty$) is known to exhibit weak antiferromagnetic (AFM) order accompanied with small tetragonal distortion and staggered yz/xz orbital order due to the $(xy)^1(yz, xz)^1$ electronic configuration [17–19]. The AFM state in the bilayer compound $\text{Sr}_3\text{Cr}_2\text{O}_7$

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IMPACT OF OUT MIGRATION ON INFORMAL LABOUR: A STUDY OF BOLANGIR DISTRICT OF ODISHA

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ABSTRACT

In Odisha, out-migration dominates migration for economic reasons. This paper discusses the causes and consequences of out-migration. The article is based on both primary and secondary sources to study. This paper finds that the poor are frustrated and depressed, especially in the lives of the rural people in particular. The people migrate to other states due to poverty and job opportunity; as a result, migrant people are deprived at their workplace. Our results have numerous potential policy implications, including the design of typical social; security schemes for Odisha.

Keyword: Migration, Frustration, Depression, Deprived, Workplace

1. INTRODUCTION

Migration is an essential component of the fight for survival by the rural, which entitles both the cost and economic wellbeing of migrants and societies. Agricultural production can meet all the basic needs of rural peoples, so seasonal and temporary migration for employment has become the most durable components of living strategies of people staying in rural areas in India (Deshingkar, 2003). The person from poor rural areas who follows the single cropping pattern depends on their livelihood's seasonal migration. The agricultural sector is the primary sector that gives enough food and the country's mass population. But as mass Indian follows the single cropping pattern, old methods for production and dependence on monsoon don't get job or food grain for the whole year. These mass unemployed people are forced to migrate to the cities to add some income to the mass population and fulfil their basic needs. Seasonal migration is working as a poverty-reducing and growth-producing factor for the rural poor. Seasonal and temporary migration has a significant impact on the livelihood of poor people across India. The low level of literacy, unskilled workers, lack of job opportunities at the origin forced these rural mass populations to migrate to the cities in search of better life and employments (Deshingkar et al. 2008).

2. ISSUES OF MIGRATION IN ODISHA:

The industrial sector's contribution to the State's GSDP was estimated at 33.45% in 2014-15. The

service sector contributed an estimated 51% to the GSDP in 2014-15. According to the 2011 Census of India, about 61.8% of the working population are engaged in agricultural activities. However, apart from all these positive indicators, the State suffers from interstate and intrastate migration issues. Migration has been considered a persistent problem of Odisha for a long time. The State suffers from distress migration mostly from southwest regions, including KBK districts. According to the 2011 Census of India, Odisha has got a working population of 17,541,589; among them, 61% are primary workers, and the rest are marginal workers. It had a rural unemployment rate of 8.7% and an urban unemployment rate of 5.8% as per the 68th National Sample Survey (2011-2012). The State witnessed the falling share of the agriculture sector to overall GSDP and fluctuating trend of growth rates for the last few years. Even though Odisha has been blessed with all-natural and mineral resources, ten out of thousand workers migrate to other states in search of work every year.

Chattejee (1998) study was based on the traditional Harris-Todaro version of Rural-urban migration of rural labour where the migrant labour risk is neutral. The intended migrant labour will enjoy higher utility if he finances his cost of migration from his savings rather than taking a loan from the professional money lender. In this model, the labourers of the formal urban sector are unionized and charged entry fees on the outsiders. Here outsiders are the labourers who have come to the urban area from the nearby



“Impact of Photography on Culture: A Visual Communication Study”

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Introduction :

People typically build their own theories about how the world works, which is a reflection of how rapidly societies change. This means that culture can never be uniform because it is created to meet the needs of individuals seeking to give their life purpose. These interpretations, however, are constantly changing as a result of intercultural communication, a process in which individuals from various cultures come together despite their differences to create a new culture that becomes shared by all at the national level, leading to the development of a national cultural identity. Thus, it may be claimed that while communication might provide insight into our cultural environment, it also minimizes this awareness. Although communication gives us a place in a country, it does not serve as a vehicle for our representation there. Thayer (1995) stated that “In naming the world, we name ourselves; in explaining the world, we explain ourselves; in defining the world, we define ourselves,” which is cited by Miri (2007: 81). In light of this, the notion of culture holds that individuals are fundamentally relational beings with the capacity to pursue oneness. This implies

that individuals are basically cultural beings who constantly engage in both the “constructing and deconstruction” (Baki-Miri, 2007) and “reconstructing” of cultures.

Objective of the Paper :

The objective of the paper discuss on the role of photography on culture.


Methodology :

This paper based on qualitative research with explorative research design.

Historicity of Photography :

The word “photography” comes from the Greek words “photos,” which means light, and “graphein,” which means to sketch. John F.W. Herschel coined the phrase in 1839. It is a technique for capturing photographs by using light or similar radiation and sensitive material (Bellis.).

Everywhere we look, we see pictures. It is printed on a variety of items, including toys, periodicals, newspapers, billboards, pamphlets, and parcels. There are a tonne of pictures on the internet. Over 4 billion images are available on Flickr alone. Every month, Facebook users upload more than 2 billion pictures (Stern, 2011). There wouldn't be any pictures, animation, movies,


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Idea of Karl Marx on theory of education

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Abstract

The purpose of this paper that Karl Marx's social theory and class conflict cause the society to transition from one historical period to the next. This class conflict was a result of different classes having unequal access to society's material foundation. Marx's theory thus has social, political, and cultural ramifications despite being primarily economic in character. He believed that social theory ought to be based on the reality of living humans struggling to survive in a generally hostile environment. He was a social scientist and revolutionary who believed social theorists should focus on the material circumstances that affect people's lives in general and education in particular.

Keywords: social theory, economic, political, education

Introduction

Instead of being an educational theorist, Karl Marx (5 May 1818 - 14 March 1883) was principally an economic, social, and political philosopher. The materialistic view of contemporary capitalist civilizations was something he had developed. Due to the fact that Marx (unlike Durkheim and Weber) spoke very little explicitly about education, there are some issues with Marxist viewpoints in the sociology of education (Moore 2004: 47) ^[6]. Although Marx and Engels did not write explicitly on education, Saha (2011: 300) ^[8] notes that their oblique references to the education of working-class children and education as a means of achieving socialist change are incredibly insightful. Education was never fully incorporated into Marx's theories of capitalism and social class. But in their works regarding the class struggle, he and Fredrick Engels did regularly bring up the topic of education. They supported universal education, but their main focus was on the sort of education provided to working-class children and how this education suited the interests of the ruling class (the bourgeoisie) in preserving their social domination. Despite the fact that Marx's theory of society did not explicitly address education, his concepts served as the foundation for the later development of the neo-Marxist sociology of education. This viewpoint has a strong connection to forms of reproduction theory, which holds that the class system in society can be reproduced through education, thereby reproducing the privileges of the dominant class (Ibid: 300). We have pieced together a Marxist theory of education from various works by Marx and Engels on the analyses of the transformation of capitalist and socialist societies as well as works by Marxists and neo-Marxists. We implore you to think of this theory as ideas presented in logical order rather than as theoretical constructions. The theories of Marxian analyses of contemporary society and societal development are only a portion of what Marx, Engels, and Marxists believed about

education. Therefore, before studying Marx's and neo-Marxists' perspectives on education as a social institution, you will first get an overview of the Marxian theory.

Methodology

This paper is based on the secondary literature and reviews of various journals and books on Marxian perspective of education and its link with Marxian theory and education. This paper also discusses the characteristic of theory of Marx and its perspective on education.

Defining characteristics of Marxist social theory

According to Karl Marx's social theory, class conflict causes society to transition from one historical period to the next. This class conflict was a result of different classes having unequal access to society's material foundation. Marx's theory thus has social, political, and cultural ramifications despite being primarily economic in character. He believed that social theory ought to be based on the reality of living humans struggling to survive in a generally hostile environment. He was a social scientist and revolutionary who believed that social theorists should focus on the physical factors that affect people's lives. Many believe that Marx's emphasis on materialism stands in stark contrast to Hegel's idealism. In *The German Ideology*, Marx himself criticizes the new Hegelians and charges them with "theoretical bubble blowing." Young Hegelians, according to Marx, only experience big revolutions in their minds because no buildings are destroyed, no one is hurt, and no one perishes (Turner, *et al*: 2012: 142) ^[10]. In truth, Marx's understanding of society's nature emerged in response to what he perceived as the Young Hegelians' idealistic nonsense. However, Marx's criticism of the Young Hegelians should not be interpreted as a complete denial of Hegel's theories. Hegel held a lifelong interest for him, and he kept coming back to him to emphasize both their points of agreement and difference.





The Geo-Strategic Position and Importance of Maldives for India's Security in 21st Century

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Abstract:

India and Maldives are very close neighbour's Maldives are very small nation in terms of the area of India. But its position on earth is at a very important strategic place. Maldives strategic location is in the south west of Indian and at the top of the Indian Ocean. The international transnational transport routes have been developed in the Indian Ocean near Maldives.

Now days every nation is building its dominance on the transport route as this is the Prime trade route between Southeast Asia and Africa. India is also working on enhancing its strategic security by participating in Maldives strategy. Maldives geopolitics has a huge impact on Indians security. Maldives geopolitics is important from India's security point of view. The elements of geostrategic relationship are always mutually exclusive. In a geo-strategic environment, relation with our neighbor is naturally very important. The situation in the neighbouring country affects the country the most. Maldives control three continents of Indian ocean that is Asia, Africa, and Australia. Maldives is a major water way hub with her important ports and bases. In recent days particularly in 21st century due to emergence of China as a global superpower with the ambition of expansion now it has become a challenge for India to maintain her dominant position in Indian Ocean. Today China is entering in Maldives for her economic development and domination in Indian Ocean. Presence of China in Maldives is an alarm to India's maritime and land security also. For maintaining her security and territorial integrity India needs to maintain a very warm and cordial relationship with Maldives as it has geo-strategic importance for India's security.

Key Words: Geo- Strategy, Geo-Politics, International Transport Route, Security, Global Super Power



The Long March of Federalism in India: Recent Trends and Challenges

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Abstract:

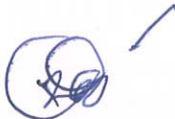
Indian political system is having her own uniqueness and dynamics features, out of many Indian federalism is the most debatable and discussed topic among the scholar of political sciences throughout the world. Though India got her independence 75 years back but the trace of sharing of power in the administrative system is found as long as history in Indian subcontinent. In a federal system there is existence of two types of government one at central level and another at provincial level, which can be easily accessed in the administrative setup of Mauryas, Shershah and even partially in Delhi sultanate also. But the modern form of federalism we adopted as part and parcel of our governance is through the adoption of our constitution in January 26, 1950. India, the largest democratic country in the world though following all the features of true federalism but it has her own version which sometimes is being criticise as half federalism.

Indian federalism which has wide influences of the Government of India act 1935 has its colour with changing of time. If we analysis the characteristics of the federal system in India, its amphibian in nature, sometimes shaping as a true embodiment of federalism and sometimes supporting centralism with less federal character.

Key Words: Delhi sultanate, half federalism, Govt of India act 1935, Amphibian

Introduction

If you ask a common man, what is federalism. His answer must be “division of power between central and state. Some other answer may be sharing of power, decentralization of power etc. According to oxford dictionary “federalism is a form of Govt. where most of the power is vested in association of constituent rather than by the central authority. In this line though India considers itself as a federation or country following federalism but the





Water Diplomacy In South Asia And Its Impact On India's Foreign Policy

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Abstract:

The politics of South Asian states has always attract the foreign policy exports towards it. Due to it's Volatile Nature. Though once upon a time these states were part of colonial empires but after getting freedom from their colonial masters forgetting their common history they rather focused on common geography for their unilateral development. This States has witnessed many war and conflicts between themselves on issues of border tensions. The recent one addition to the area of conflict is water. In one sentence it can be said the South Asia is swinging towards a future water war. The growing population and rapid industrialization has forced the state in this region to have a special look on transborder water resources. Lack of proper management system and wellbalanced treaties or negotiation mechanism has created the stage for a future intense war. From the Helmand to the Mekong, all the transborder rivers are now bone of conflicts between the developing countries of South Asia. India being situated at the heart of South Asia and a prime member of SAARC and ASEAN has always finds itself in the both side of water politics. Sometimes it has shown it's Big Brother attitude and sometimes it has become a victim of it. Presence of aggressive China and assertive Afghanistan and Pakistan is always a cause of concern for other peace-loving states in this region. Though there are many treaties on sharing of water between States but these are not sufficient and some among them has lost their relevance in 21st century with passing of times and situation. Now time has come that this state should develop a clear stands on the water issue to avoid the future mutual destruction. Being a leading country of South Asia and emerging actor of global politics India's foreign policy should also focusing on it in a serious manner.

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Hydrothermal synthesis of $ZnFe_2O_4$ anchored graphene and activated carbon as a new hybrid electrode for high-performance symmetric supercapacitor applications

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Highlights




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- Preparation of a new ZFO/FLGR/AC hybrid electrode using hydrothermal method.
- Enhancement of storage performance in carbon-based SC by using ZFO.
- Fabrication of symmetric SC device and LED testing.
- Low series resistance and excellent cyclic stability is attained in the device.
- Achievement of outstanding energy density and power density.

Abstract

We report a novel ternary hybrid composite of ZnFe_2O_4 @few-layer graphene/activated carbon prepared using the hydrothermal method and employed as an electrode for supercapacitor application. In recent years, the performance of supercapacitors has been gradually accelerated by using novel electrode materials and new designs. Hybrid electrodes with advanced architecture in supercapacitors offer excellent electrochemical performance to fulfill global energy needs. Among various materials, activated carbon is chosen as the host material, and its performance has been enhanced by employing few-layer graphene and ZnFe_2O_4 . The presence of few-layer graphene in activated carbon enhanced the SC performance and the fabricated few-layer graphene/activated carbon composite results in a maximum specific capacitance of 180Fg^{-1} at 5mV/s and 176Fg^{-1} at 1Ag^{-1} . Additionally, the supercapacitor properties of the prepared composite electrode were improved by integrating with ZnFe_2O_4 . The ternary composite electrode (ZnFe_2O_4 @few-layer graphene/activated carbon) has the highest capacitance of 533Fg^{-1} at 1Ag^{-1} from a 3-electrode measurement. One symmetric supercapacitor device was fabricated and investigated for practical application. The symmetric supercapacitor device resulted in outstanding capacitance, i.e., 156Fg^{-1} at 1Ag^{-1} . The maximum energy density and power density of the fabricated device were 5.42Wh/kg at 1Ag^{-1} and 4992W/kg at 10Ag^{-1} . Also, excellent cyclic stability has been achieved in the device and the retained capacitance was 96% over 10,000 cycles. The finding reveals outstanding energy/power performances and excellent cycle stability of the fabricated device.

Graphical abstract




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One-step green synthesis of in-situ functionalized carbon quantum dots from *Tagetes patula* flowers: Applications as a fluorescent probe for detecting Fe³⁺ ions and as an antifungal agent

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Highlights

- Green Synthesis of fluorescent carbon quantum dots (CQDs) from *Tagetes patula* flowers with a quantum yield of 29.88%.
- It exhibits fluorescence quenching behavior towards Fe³⁺ ions with a limit of detection of 0.32 μM.
- Investigation of antifungal activity of CQDs on the growth of pathogenic fungus (*Magnaporthe oryzae*).
- Study of the effectiveness of the CQDs on the growth of rice plant (*Oryza sativa*).

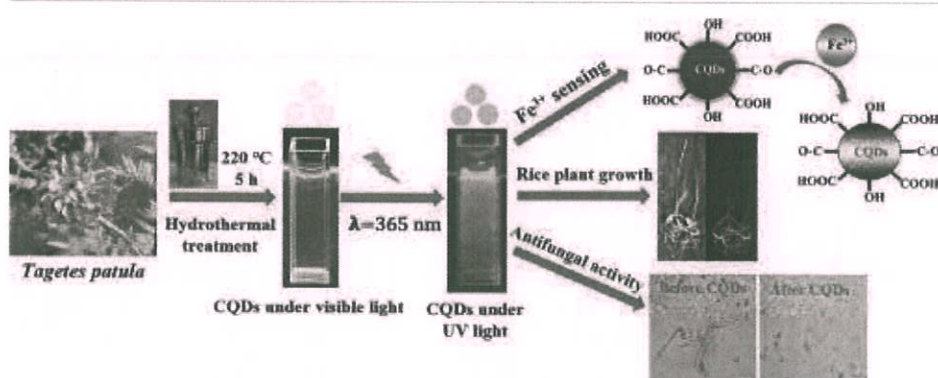


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Abstract

In this research, for the first time, fluorescent carbon quantum dots (CQDs) synthesized by using a green, simple, and efficient one-step hydrothermal carbonization technique from *Tagetes patula* flowers as carbon precursors without using any toxic chemicals are reported. The as-prepared CQDs have been characterized by Transmission electron microscope (TEM), Field emission scanning electron microscopy with Energy dispersive X-ray spectroscopy (FESEM-EDX), UV-Visible spectroscopy, Raman spectroscopy, X-ray Diffraction (XRD), zeta potential analysis, Fourier-transform infrared spectroscopy (FTIR), fluorescence spectroscopy, and X-ray photoelectron spectroscopy (XPS). As analyzed by TEM and XRD analysis, it is observed that the as-synthesized CQDs are spherical having an average particle diameter of about 5.15 nm. The quantum yield (QY) of the CQDs was calculated and found to be 29.88%. The as-synthesized CQDs show an excellent fluorescence quenching behavior towards Fe^{3+} ions as compared to other metal ions. Therefore, CQDs were used as a sensing probe for detecting Fe^{3+} ions in a linear range of 0–4 μM and a limit of detection (LOD) of 0.32 μM . A comprehensive study has been conducted to show the effectiveness of the CQDs on the growth of rice plants (*Oryza sativa*) and the antifungal activities of CQDs on the mycelial growth of *Magnaporthe oryzae* (a plant pathogenic fungus).

Graphical abstract



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Introduction

Recently, a novel class of carbon nanomaterials, carbon quantum dots (CQDs), having diameters less than 10 nm has attracted a great deal of interest from the scientific community [1]. CQDs were initially unexpectedly revealed in 2004, while single-walled carbon nanotubes (SWCNTs) were being purified [2], [3]. Fluorescent CQDs possess many

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Graphene field-effect transistor using gated ferroelectric thin film

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Highlights

- Few-layer graphene sheets (FLGS) and barium titanate (BTO) particles were well prepared by an electrochemical and a sol-gel method.
- Fabricate a graphene-based ferroelectric field-effect transistor (GFE-FET) using a sol-gel spin coating method, where FLGS and BTO act as a channel layer and gate insulating layer.
- The field-effect mobility of fabricated GFE-FET is approximate $4.2 \times 10^4 \text{ cm}^2 \text{V}^{-1} \text{S}^{-1}$ with an on/off ratio of about 10^3 .
- The excellent results of the fabricated GFE-FET give an incredible opportunity in the electronic industry as an alternative to semiconductors.


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Abstract

A graphene-based ferroelectric field-effect transistor (GFE-FET) has been fabricated using few-layer graphene sheets (FLGS) as channel layer and barium titanate (BTO) as gate insulating layer. The FLGS and BTO were prepared by electrochemical and sol-gel methods respectively. The prepared materials have been characterized by XRD, SEM, UV-Vis, FTIR, and Raman spectroscopy. The performance of GFE-FET was assessed and obtained reasonably high field-effect mobility $\sim 4.2 \times 10^4 \text{ cm}^2\text{V}^{-1}\text{S}^{-1}$ with on/off ratio of about 10^3 . The obtained results of the fabricated GFE-FET ensure incredible opportunity for various applications mostly in the electronic industry as an alternative to semiconductors.

Introduction

With excellent carrier mobility and speed, graphene [1] empowers the probability of faster electronics material than semiconductors. The intrinsic mobility of single-layer graphene is about $100000 \text{ cm}^2\text{V}^{-1} \text{ S}^{-1}$ at room temperature which is greater than the mobility of III-V compounds [[2], [3], [4]]. Chen et al. derived the mobility value about $3.0 \times 10^5 \text{ cm}^2\text{V}^{-1} \text{ s}^{-1}$ using first principle calculation for a perfect single layer graphene [5]. Kim et al. obtained mobility value about $200000 \text{ cm}^2\text{V}^{-1} \text{ s}^{-1}$ experimentally from a suspended single layer graphene [6]. However, many experimental investigations demonstrated that the mobility of graphene on substrates are reduced drastically with the values of $7000 \text{ cm}^2\text{V}^{-1} \text{ s}^{-1}$ [7], $10000 \text{ cm}^2\text{V}^{-1} \text{ s}^{-1}$ [1,8], etc. On the other hand, the practical use of graphene mostly depends on the optimum choice of electrophysical, physicochemical, and electromechanical properties of their substrates, gates, and interfaces which are the most challenging. Currently, the choice of the substrates in a given two-dimensional material with additional functionality is vital [9,10]. In this regard, different ferroelectric substrates with graphene are being considered. The transport properties of graphene placed on ferroelectric substrates or thin films are modulated due to the domain structure and spontaneous polarization of ferroelectric material [9,10]. Moreover, the direction of polarization in ferroelectric substrate can be inverted by the applied voltage to the gate of the graphene field-effect transistor (G-FET), where graphene acts as a channel. Hence, graphene on-ferroelectric structures can be used as electrical transducers, advanced field-effect transistors, and modulators. It has been conveyed that the band structure of graphene changes by the elastic strain that results in modification in the bandgap of graphene [9,10]. There are reports of change in conductivity of graphene owing to the existence of the piezoelectric effect after the voltage is applied to the ferroelectric gate of G-FET [9,10]. Hong et al. have reported about the large carrier mobility ($\sim 7 \times 10^4 \text{ cm}^2\text{V}^{-1}\text{S}^{-1}$) of G-FET on lead zirconium titanate (PZT) ferroelectric material [11]. However, the element Lead (Pb) present in PZT is

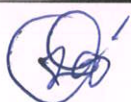
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ଓଡ଼ିଆ ଉପନ୍ୟାସରେ ଆଇନର ଦିଗ ଦିଗନ୍ତ

ସାହିତ୍ୟ ମାନବ ଜୀବନର ରୂପକାର । ସମାଜର ଦିଗ ଦର୍ଶକ । ଏହା ଯେପରି ସମାଜରେ ବିପ୍ଳବ ସଂଘଟିତ କରି ତାକୁ ଏକ ନୂତନ ରୂପ ପ୍ରଦାନ କରିଥାଏ । ଠିକ୍ ସେହିପରି ଅନାତି ଏବଂ ଅନ୍ୟାୟର ବାଣୀ ପ୍ରଦାନ କରି ସମାଜକୁ ପଲ୍ଲୁ କରି ଦେଇଥାଏ । ସମୟରେ ସୁସ୍ଥ ବାତାବରଣ ସୃଷ୍ଟି କ୍ଷେତ୍ରରେ ଏହାର ଯେପରି ଗୁରୁତ୍ୱପୂର୍ଣ୍ଣ ଭୂମିକା ରହିଛି, ଅସୁସ୍ଥତାର ପରିବେଶ ସୃଷ୍ଟି କ୍ଷେତ୍ରରେ ଏହାର ସେହିପରି ନିନ୍ଦନୀୟ ଭୂମିକା ମଧ୍ୟ ରହିଛି । ମାତ୍ର ସମାଜର ହିତାକାଂକ୍ଷା ଦୃଷ୍ଟିରୁ ସମାଜରେ ସୁନୀତି, ସୁରୁଚିତ୍ତ ନ୍ୟାୟର ପ୍ରଚାର ପ୍ରସାର କରିବା ସାହିତ୍ୟର ପ୍ରଥମ ଓ ଶ୍ରେଷ୍ଠ ଲକ୍ଷ୍ୟ । ଯାହା ସମାଜର ହିତ ସାଧନ କରିପାରେ ତାହା ହିଁ ସାହିତ୍ୟ । ସାହିତ୍ୟ ସର୍ବଦା, ସୁନୀତି, ବିଚାର, ଆଇନର ଉପାସକ ହେବା ବିଧେୟ ବୋଲି ବହୁ ଆଲୋଚକ ମତବ୍ୟକ୍ତ କରି ଅଛନ୍ତି ।

ସମାଜର ଆବଶ୍ୟକତାକୁ ଆଖି ଆଗରେ ରଖି ସାହିତ୍ୟର ସୃଷ୍ଟି ହୋଇପାରିଛି । ବେଦ ରଚନା ସମୟରେ ଆମର ପ୍ରାଞ୍ଜ ରକ୍ଷିମାନଙ୍କ ସମ୍ମୁଖରେ ଜୀବନ ଓ ଜଗତ ହିଁ ଥିଲା ସବୁଠାରୁ ବଡ଼ । ମଣିଷ ଜୀବନକୁ ମଧୁର ଏବଂ ନୀତିନିଷ୍ଠ କରିବାକୁ ତଥା ସମାଜକୁ ସୁନ୍ଦର ଓ ଆଚାରନିଷ୍ଠ କରିବା ପାଇଁ ଓ ସେମାନେ ବେଦରେ ବହୁ ନୀତିପୁର୍ଣ୍ଣ ବାଣୀର ଅବତାରଣା କରିଛନ୍ତି । ପୁରାଣ ଯୁଗରେ ମଣିଷ ଚରିତ୍ରକୁ ସଂଗଠିତ ତଥା ନୀତିପୁର୍ଣ୍ଣ କରିବା ପାଇଁ ପୁରାଣ ସାହିତ୍ୟରେ ଗୁରୁତ୍ୱ ଆରୋପ କରାଯାଇଥିଲା । ତେଣୁ ଆଇନ-କାନୁନ, ଧର୍ମ, ଅଧର୍ମ, ପାପ-ପୁଣ୍ୟ, ନୀତି-ଅନୀତି ଆଦି ସମ୍ବନ୍ଧରେ ଏଥିରେ କଥା ଛଳରେ ବହୁ ଉପଦେଶ ପ୍ରଦାନ କରାଯାଇଛି । “ସତ୍ୟର ଜୟ ଓ ପାପର କ୍ଷୟ” ଏହା ହିଁ ପୁରାଣ ସାହିତ୍ୟର ବାଣୀ ।

ପ୍ରତ୍ୟେକ ସ୍ଥାନରେ ଧର୍ମର ଜୟ ଉଦ୍‌ଘୋଷିତ । ରାମାୟଣରେ ରବଣ ଅନ୍ୟାୟ ପଥରେ ଗତି କରୁଥିବାରୁ ସ୍ୱର୍ଣ୍ଣପୁରୀ ଲଙ୍କା ସମ୍ପୂର୍ଣ୍ଣ ଧ୍ୱଂସ ପାଇଯାଇଛି । ପରାକ୍ରମଶାଳୀ ରବଣ ଶେଷରେ ମୃତ୍ୟୁବରଣ କରିଛି । ମାତ୍ର ଜାତିର ଅପମାନ କରିଥିବାରୁ ସେ ଧ୍ୱଂସର

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ସୃଜନ ସ୍ଵପ୍ନ

ମୁଖ୍ୟ ସଂପାଦକ
ଦେଶବନ୍ଧୁ ସ୍ଵାଇଁ

ସଂପାଦିକା
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ସଂପାଦକୀୟ

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୧. ଗୁହରେ ବି ଲେଖା
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୧. ଶୁଣିଥିବା ଏକ ସୁରଣୀୟ କଥା :
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୩. ବାପା
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୨. ସଦ୍‌ସାରଣୀ
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୧. ଡାକରାଣୀ ଝିଅ
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୧. ଚିତ୍ରି ସୁଚିତ୍ର କୁମାର ମିଶ୍ରଙ୍କ
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ରବିନାରାୟଣ ଷଡ଼ଙ୍ଗୀ

• ଭାବଗତ, ଭାଷାଗତ ଓ ଆତ୍ମଗତ ଚେତନାର ସ୍ଵାକ୍ଷର : ସମୀକ୍ଷା ସମ୍ପାଦକ ତ୍ରୟମାସିକ-ସୂଚନୀ ସମ୍ପାଦନା

Principal
Govt. (Auto) College
Rourkela

କାଳଜୟୀ ପ୍ରଷ୍ଠା କବିତ୍ରୟ କାଳୀଚରଣ

ଡ. ସୁଚିତ୍ରା ମହାନ୍ତି

ଓଡ଼ିଆ ନାଟ୍ୟ ସାହିତ୍ୟରେ କାଳୀଚରଣ ଏବଂ ସ୍ଵାଧୀନତାର ମହାମାସ ଉତ୍ସାହୀ ପାଇଁ ସର୍ବପ୍ରଥମେ ଅଗ୍ରସର ହୋଇଥିଲେ ନାଟ୍ୟକାର କବିତ୍ରୟ କାଳୀଚରଣ ପଟ୍ଟନାୟକ । ତାଙ୍କ ନାଟ୍ୟପ୍ରାଣତା, ତୀକ୍ଷ୍ଣ ଓ ଉତ୍ସର୍ଗାକୃତ ମନୋଭାବ ତଥା ନାଟ୍ୟ ଜଗତ ସହ ସମ୍ପୃକ୍ତି ଏକ ନୂତନ ଦିଗର ସନ୍ଧାନ ସୃଷ୍ଟି କରିପାରିଥିଲା । ଦର୍ଶକମାନଙ୍କ ରୁଚି ଓ ରାହିତ୍ୟ ଅନୁସାରେ ବାସ୍ତବ୍ୟତା, ନୂତନ ନାଟ୍ୟଶୈଳୀ, ଯୌତୁକତା, ଅଧିକ ତୁଲ୍ୟତା ବିଷୟବସ୍ତୁ ଓ ସଂଳାପ, ନାଟ୍ୟମଞ୍ଚକଳା, ଦୃଶ୍ୟ ଓ ଚାରିତ୍ରିକ ବୈଶିଷ୍ଟ୍ୟ ସମ୍ପାଦନରେ କର୍ଣ୍ଣଧାର ହୋଇଥିଲେ ନାଟ୍ୟରତ୍ନ କବିତ୍ରୟ କାଳୀଚରଣ ପଟ୍ଟନାୟକ । (ସେ ଏକାଧାରରେ ଥିଲେ ପ୍ରତିଭାସଂପନ୍ନ ନାଟ୍ୟକାର, ନିର୍ଦ୍ଦେଶକ, ସଂଗୀତଜ୍ଞ, ଗୀତିକାର, ସଂପାଦକ ଓ ସଂଗଠକ । ତାଙ୍କର ନିରବଚ୍ଛିନ୍ନ ସାଧନା, ଦୃଢ଼ ସଂକଳ୍ପ, ଅଖଣ୍ଡ ଏକାଗ୍ରତା ଓ ଅଧିବସାଧ ଓଡ଼ିଆ ନାଟକରେ ଯେଉଁ ଆନ୍ଦୋଳନ ଓ ଆତ୍ମିକ ପରିବର୍ତ୍ତନ ଆଣିଥିଲା, ତାହା ଓଡ଼ିଆ ନାଟ୍ୟ ସାହିତ୍ୟ ଇତିହାସର ଏକ ଗୌରବାନ୍ୱିତ ବିଷୟ । ତାଙ୍କ ସୃଷ୍ଟିରେ ଉଚ୍ଚ ଦାର୍ଶନିକ ଚିନ୍ତା ସ୍ଥାନିତ ହୋଇ ନଥିଲେ ମଧ୍ୟ ସାଧାରଣ ମଣିଷର ହସ, କ୍ରୁଦ୍ଧ, ଯତ୍ନଶୀଳ ଓ ସମସ୍ୟା ହିଁ ରୂପ ପାଇଥିଲା ।)

ଓଡ଼ିଶାରେ ନାଟ୍ୟକଳା ଓ ରଙ୍ଗମଞ୍ଚ ସ୍ଥାପନ କରି କାଳୀଚରଣ ବୈପ୍ଳବିକ ଭାବଧାରା ସୃଷ୍ଟି କରିପାରିଥିଲେ । ଯଥାର୍ଥରେ ନାଟ୍ୟରୀତି ପରିଚଳନାରେ ହିଁ ତାଙ୍କୁ ଦର୍ଶକମାନଙ୍କ ଅତି ନିକଟତର କରିପାରିଥିଲା । ମଞ୍ଚ ସଫଳତା ଉପରେ ପରବର୍ତ୍ତୀ ସମୟରେ ଓଡ଼ିଶାରେ ପେଶାଦାର ରଙ୍ଗମଞ୍ଚ ସବୁ ପ୍ରତିଷ୍ଠା ଭାଗ କରିଥିଲା । 'ଓଡ଼ିଶା ଥିଏଟର'ରେ କ୍ରମାଗତ ଭାବେ ନିଜ ନାଟକଗୁଡ଼ିକୁ ଅଭିନୀତ କରାଇ ଓଡ଼ିଶାରେ ନାଟ୍ୟପ୍ରିୟ ଦର୍ଶକମଣ୍ଡଳୀ ସୃଷ୍ଟି କରିବା ସଂଗେ ସଂଗେ ଅଭିନୟ ପ୍ରତି ଆକୃଷ୍ଟ ଥିବା ଏକ କଳାକାରଗୋଷ୍ଠୀ ମଧ୍ୟ ତିଆରି କରିପାରିଥିଲେ । ଅଭିନେତା ରଙ୍ଗମଞ୍ଚରେ ଏକ ବଳିଷ୍ଠ ମାଧ୍ୟମ, ଅଭିନୟ ମାଧ୍ୟମରେ ଦର୍ଶକ ମନକୁ ମଞ୍ଚରେ ବାନ୍ଧିରଖି ସୃଷ୍ଟିକର୍ତ୍ତାଙ୍କ ବାଣୀକୁ ସେମାନଙ୍କ ପାଖକୁ ପ୍ରେରଣ କରିଥାଏ । ସେହି ଅଭିନେତା ଗୋଷ୍ଠୀକୁ ନିଜ ହାତରେ କାଳୀଚରଣ ଗଢ଼ିତୋଳିବାର ପ୍ରୟାସ କରିଥିଲେ ।

ଓଡ଼ିଶାର ବିଭିନ୍ନ ସୌଖୀନ ନାଟ୍ୟ ସଂସ୍ଥାମାନଙ୍କରେ ଅଭିନୟ କରି ଶହଶହ ଦର୍ଶକମାନଙ୍କର ମନୋରଂଜନ କରୁଥିବା କଳାକାରମାନଙ୍କ ମଧ୍ୟରୁ ଅଧିକାଂଶ ନାଟ୍ୟକାର କବିତ୍ରୟଙ୍କ କୁଖଣ୍ଡା ହାତରୁ ଗଲା । ଏକଥା ଧୂବ ସତ୍ୟ । ଅନ୍ୟ ଭାଷାରେ କହିଲେ 'ଓଡ଼ିଶା ଥିଏଟର' ଥିଲା ଓଡ଼ିଶାର କଳାକାରଗୋଷ୍ଠୀଙ୍କର ପ୍ରଶିକ୍ଷଣ କ୍ଷେତ୍ର ।

କାଳୀଚରଣ ଥିଲେ କର୍ମବୀର । କର୍ମ ହିଁ ଥିଲା ତାଙ୍କ ଜୀବନର ମୂଳମସ୍ତକ । ବଳିଷ୍ଠ ବ୍ୟକ୍ତିତ୍ୱର ଅଧିକାରୀ । ଓଡ଼ିଶାର ଗୌରବମୟ ପରମ୍ପରା ଓ ଆଧୁନିକତା ମଧ୍ୟରେ ଏକ ସଫଳ ସମନ୍ୱୟବାଦୀ ପ୍ରଷ୍ଠା । ପଦୋକ୍ତା ପ୍ରଦେଶର କେତେକ ହାନିମାନ୍ୟ ବ୍ୟକ୍ତି ଯେତେବେଳେ ଓଡ଼ିଆ ଭାଷା ଓ ସଂସ୍କୃତିର ଉଚ୍ଚାକୃତ ଅପମାନ ସାହିତ୍ୟରେ, ନାଟକ ଓ ଚଳଚ୍ଚିତ୍ରରେ କରିବାକୁ ଲାଗିଲେ, ସେତେବେଳେ 'ଜୟଦେବ' ନାଟକ ରଚନା କରି, ସେ ସେମାନଙ୍କୁ ଉଚିତ୍ ଶିକ୍ଷା ଦେଇଥିଲେ । ଏକମୁଖୀ ମଞ୍ଚନାଟକ ପାଇଁ ଯେଉଁ ଧାରାଟି ଗ୍ରହଣ କରାଯାଇଥିଲା, ତାକୁ ସେ ଗ୍ରହଣ କରିଥିଲେ । ସେଥିରେ ପ୍ରୟୋଜନୀୟ ପରିବର୍ତ୍ତନ ମଧ୍ୟ କରିପାରିଥିଲେ । ତାଙ୍କ ନାଟକରେ ବିଦେଶୀ ନାଟ୍ୟଶୈଳୀର ପ୍ରଭାବ ଖୁବ୍ କମ୍ ଥିଲା । ଆହରଣରେ ସେ ଦଙ୍ଗଳା ଓ ହିନ୍ଦୀ ଭାଷାରୁ ବହୁ କିଛି ତଥ୍ୟ ଗ୍ରହଣ କରି ନିଜର ମୌଳିକତା

ପ୍ରଦର୍ଶନ କରିଥିଲେ । ଲୋକ ସଙ୍ଗୀତ ଓ ନୃତ୍ୟର ପ୍ରୟୋଗରେ ତାଙ୍କର ଦକ୍ଷତା ପ୍ରଦର୍ଶିତ ହୋଇଥିଲା ।



ନାଟ୍ୟକାର କାଳୀଚରଣ ଓଡ଼ିଆ ନାଟକକୁ ମଂଚାଭିମୁଖୀ, ମନୋରଞ୍ଜନଧର୍ମୀ ଏବଂ ସାମାଜିକ ଆଦର୍ଶ ପ୍ରତିଷ୍ଠା କରିବା ଥିଲା ତାଙ୍କର ପ୍ରମୁଖ ଉଦ୍ଦେଶ୍ୟ । ହେମନ୍ତ କୁମାର ଦାସ ଓଡ଼ିଆ ନାଟକର ବିକାଶଧାରାରେ ସ୍ୱୀକାର କରି କହିଛନ୍ତି- 'କବିତ୍ରୟଙ୍କର ବିସ୍ମୃତ ସୃଷ୍ଟିକୁ ମି ଆଡ଼େ ଦୃଷ୍ଟିପାତ କଲେ, ପ୍ରଥମେ ସନ୍ତ କରିବାକୁ ହେବ ଯେ, ଓଡ଼ିଆ ନାଟକକୁ କୃତ୍ରିମତାର, କଳ୍ପନାବିକାସିତାର ଏବଂ ଉଦ୍ଦେଶ୍ୟଧର୍ମୀତାର ବିଷ ମଧ୍ୟରୁ ମୁକ୍ତିଦେଇ ତାକୁ ଏକ ଲାଳିତ୍ୟମୟ ରୂପ ଦିବା ମଧ୍ୟରେ ପ୍ରତିଷ୍ଠା କରିଛନ୍ତି କାଳୀଚରଣ । ନାଟକ ତା'ର ସ୍ୱାଭାବିକ ଧର୍ମ 'ଅପୋୟ'ର ପୂର୍ଣ୍ଣତା ଇତିପୂର୍ବରୁ ଲାଭ କରିପାରିନଥିଲା । ସହଜତ ନାଟ୍ୟ ପ୍ରତିଭା, ତଥା ଅଭିଜ୍ଞତା ବଳରେ କବିତ୍ରୟ ମଞ୍ଚକ୍ଷେତ୍ରରୁ ଏହି ଅସୁବିଧାଟିକୁ ଦୂର କରିଦେଲେ ।'

୧୮୯୮ ମସିହା ସେପ୍ଟେମ୍ବର ୨୩ ତାରିଖରେ କାଳୀଚରଣ ଜନ୍ମ ଗ୍ରହଣ କରିଥିଲେ । ପିତା ଦୁର୍ଗାଚରଣ ଓ ମାତା ରାଧାମାଳାଙ୍କ ଯତ୍ନରେ ଲାଳିତ୍ୟାଳୟ ହୋଇ ଉତ୍ତରାଳୟ ସେ ତାଙ୍କର ଶିକ୍ଷାଲାଭ ଆରମ୍ଭ କରିଥିଲେ । ଚର୍ଚ୍ଚିତା ମାନ୍ଦବର ସ୍କୁଲରେ ପଢ଼ୁଥିବା ସମୟରେ ସେ କାଳିକାବେଦୀ ନାଟକରେ ଆଚ୍ଛନ୍ଦ୍ୟ କରିଥିଲେ । ସ୍କୁଲ ଜୀବନରେ ସେ 'ସାତାବିବାହ' ନାଟକରେ 'ସାତା' ଭୂମିକାରେ ଅଭିନୟ କରିଥିଲେ । ରେଭେନ୍ସା କଲେଜରେ ଆଇ.ଏ ଶ୍ରେଣୀରେ ପଢ଼ୁଥିବାବେଳେ ସେ ବିଭିନ୍ନ ନାଟ୍ୟସଂସ୍ଥା ସହିତ ଜଡ଼ିତ ହୋଇଥିଲେ । ୧୯୧୮ରେ 'ଧୂବ' ନାଟକଟି ସୃଷ୍ଟି ହୋଇପାରିଥିଲା । ରେଭେନ୍ସା କଲେଜରୁ ଆଇ.ଏ ପାଠ୍ କଲାପରେ ହିଁ ୧୯୧୯ରେ କାଳୀଚରଣଙ୍କ ପିତୃ ବିୟୋଗ ଘଟିଥିଲା । ସେହି ଦିନଠାରୁ ତାଙ୍କର ଶିକ୍ଷାରେ ପୂର୍ଣ୍ଣହେବ ପଡ଼ିଥିଲା । ୧୯୨୧ରେ ଖଣ୍ଡପଡ଼ାରେ ସେ ସ୍କୁଲ ଜନସଂପ୍ରେକ୍ଷର ଚାକିରି କରୁଥିବାବେଳେ 'ରାସଦେବ' ପ୍ରତି ଆକୃଷ୍ଟ ହୋଇପଡ଼ିଥିଲେ । ଫକସ୍ତରୂପ ରାସଦେବ ସଂଗଠିତ ହୋଇଥିଲା ।

ପୁରୀ ରାଜା ତାଙ୍କୁ 'କବିତ୍ରୟ' ଉପାଧିରେ ଭୂଷିତ କରିଥିଲେ । ଉତ୍କଳ ସାହିତ୍ୟ ସମାଜ ତାଙ୍କୁ 'ନାଟ୍ୟରତ୍ନ' ଉପାଧି ପ୍ରଦାନ କରିଥିଲେ । ସମ୍ବଲପୁର ବିଶ୍ୱବିଦ୍ୟାଳୟ ତରଫରୁ ସମ୍ମାନଜନକ ଡକ୍ଟରେଟ୍ ଡିଗ୍ରୀ ଲାଭ ମଧ୍ୟ କରିଥିଲେ । ଏତଦନ୍ତର୍ଗତ ଭାରତ ସରକାରଙ୍କ ଦ୍ୱାରା 'ପଦ୍ମଶ୍ରୀ' ଉପାଧିରେ ମଧ୍ୟ ଭୂଷିତ ହୋଇଥିଲେ ।

୧୯୩୯ରେ ନବଗଠିତ 'ଓଡ଼ିଶା ଥିଏଟର' ଓଡ଼ିଆ ନାଟକ ଏବଂ ରଙ୍ଗମଞ୍ଚ ଇତିହାସରେ ଏକ ନୂତନ ଯୁଗର ସଂଯୋଗ ସେତୁ ସ୍ଥାପନ ହୋଇପାରିଥିଲା । 'ରାସଦେବ' ଭାଙ୍ଗିଯିବା ପରେ କାଳୀଚରଣ 'ଓଡ଼ିଶା ଥିଏଟର'ରୁ ବାକୀ ବଙ୍ଗଳାରେ ଜୀବନ୍ୟାସ ଦେଇଥିଲେ । ଏହି ମଞ୍ଚରେ ସେ ନାରୀମାନଙ୍କୁ ଅଭିନୟ କରିବାର ପ୍ରୟୋଗ ଦେଇଥିଲେ । ପ୍ରଥମଥର ପାଇଁ ରଙ୍ଗମଞ୍ଚରେ ସେ କରନସିନ ପ୍ରଚଳନ କରାଇଥିଲେ । କାଳୀଚରଣ ନିଜେ ଜଣେ ଶ୍ରେଷ୍ଠ ଅଭିନେତା, ନିର୍ଦ୍ଦେଶକ, ନାଟ୍ୟକାର ଏବଂ ସଙ୍ଗୀତଜ୍ଞ ଥିବାରୁ ତାଙ୍କର ପ୍ରୟୋଗ ନାଟକ ଦର୍ଶକର ମନକୁ ବେଶ୍ ପ୍ରଭାବିତ କରିପାରିଥିଲା ।

• ଭାବଗତ, ଭାଷାଗତ ଓ ଆତ୍ମଗତ ରେଚନାର ସ୍ୱାକ୍ଷର : ସମାକ୍ଷା ସମୂହ ରୂପମାସିକ-ପୁଲକନ ସମ୍ପଦ •

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A MULTILINGUAL

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FROM THE HOUSE OF SWABHIMAN

YEAR 38 NO. 02 JANUARY 2024



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This Journal started in 1986 (in line with erstwhile Madras Journal of Science and Literature) along with other objectives is mainly meant to encourage the sprouting talents in the fields of Science and Literature irrespective of Society, Culture, Nationality, Education, Economy, Polity, Caste, Creed, Language, Religion, Region, Sex, Boarder, Ideology and any such other restriction/affiliation. Though it has published earlier many writings of persons of international eminence like future Nobel Laureates, Vice-Chancellors, Directors and Professors of repute no one established has ever been approached nor will be contacted in person in future or presented a free copy. Editor.

Editors Pick of the Issue: *ସୁରଥ କୁମାର ସାହୁ*

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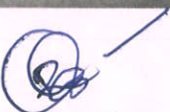
Tireless Effort of Practising Human Unity without fetters.

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EDITOR: *Kanhucharan Padhy*



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ସମାଜବାଦୀ ବାସ୍ତବତାଧର୍ମୀ ଓଡ଼ିଆ କବିତାର ଶବ୍ଦବୈଚିତ୍ର୍ୟ

36 ସୁରଥ କୁମାର ସାହୁ

ଦିଶ୍ଵାମନ ଅବବୋଧ ଓ ଓଡ଼ିଆ କବିତା

46 ଡ. ସୁଚିତ୍ରା ମହାନ୍ତି

ଓଡ଼ିଆ ସାହିତ୍ୟରେ ବାମାବାଦୀ ଚେତନା

55 ଡ. ଜାୟଦେବୀ ସାହୁ

ମଧ୍ୟଯୁଗୀୟ ସାହିତ୍ୟ ପ୍ରଣୟ

70 ଉତ୍କଳିକା ଭାରତୀ କାହାଳୀ

ମୃତ୍ୟୁ ଏକ ମାତୃତ୍ଵର: ଏକ ଅତର୍କିତ୍ୟାତ୍ମକ ଅଧ୍ୟୟନ



ଓଡ଼ିଆ ସାହିତ୍ୟରେ ବାମାବାଦୀ ଚେତନା



ସାହିତ୍ୟରେ 'ବାଦ' ବା ଇତିମ୍ବ ସ୍ୱଳ୍ପନାତ୍ମକ କଳା କୃତି ପରିବର୍ତ୍ତେ ଦର୍ଶନ ଓ ସମାଲୋଚନା ସହ ହିଁ ଅଧିକ ସଂଶ୍ଳିଷ୍ଟ । ପାଞ୍ଚାତ୍ୟ ପରମ୍ପରାରେ ସମସାମୟିକ ସାମାଜିକ, ସାଂସ୍କୃତିକ, ଧର୍ମାତ୍ମ ତଥା ରାଜନୈତିକ ଜୀବନର ପ୍ରତିକ୍ରିୟା ସ୍ୱରୂପ ବିଭିନ୍ନ ବାଦ ବା ଇତିମ୍ବର ଉଦ୍ଭବ ଘଟିଛି । ବିଶେଷତଃ ଆଧୁନିକତା ପରିପ୍ରେକ୍ଷାରେ ଜାତୀୟତାବାଦ, ମାର୍କ୍ସବାଦ, ରୋମାଣ୍ଟିକ୍ ବାଦ, ବାସ୍ତବବାଦ, ଅସ୍ଥିତବାଦ, ବାମାବାଦ ଆଦି ପାଞ୍ଚାତ୍ୟ ଦର୍ଶନ ଓ ସମାଲୋଚନାର ଅବଦାନ । ପାଞ୍ଚାତ୍ୟ ପରମ୍ପରାରେ ବିବିଧ ଆନ୍ଦୋଳନ କ୍ରମରେ ଭିନ୍ନ ଭିନ୍ନ ବାଦର ଉଦ୍ଭବ ଘଟିଥିଲା । 'ବାଦ' ବା ଇତିମ୍ବର ଉଦ୍ଦେଶ୍ୟ 'ସଚେତନତା' ସହ 'ଯଥାର୍ଥ ବିଚାର' ସୃଷ୍ଟି କରିବା ।

ଅଷ୍ଟାଦଶ ଉନ୍ନତ-ଶତାବ୍ଦୀରେ ଶତାବ୍ଦୀରେ ଇଉରୋପ ଓ ଆମେରିକାରେ ଏକ କ୍ରାନ୍ତିକାରୀ ପରିବର୍ତ୍ତନ ସୃଷ୍ଟି ହୋଇଥିଲା । ତାହା ଥିଲା ନାରୀର ସାମାଜିକ, ଅର୍ଥନୈତିକ, ରାଜନୈତିକ ଜୀବନରେ ଏକ ନୂତନ ଦିଗନ୍ତ ଅର୍ଥାତ୍ ନାରୀମୁକ୍ତି ବା ବାମାବାଦ । ଏହା ନାରୀକୁ ଦେଲା ଏକ ନୂତନ ପରିଚୟ । ପୌରାଣିକ ରୀତିନୀତି, ଶୃଙ୍ଖଳା ପରମ୍ପରା ନୀତିରେ ନିର୍ଦ୍ଦିଷ୍ଟ ନିୟମରେ ନାରୀମାନଙ୍କୁ ବାନ୍ଧି ରଖାଯାଉଥିଲା । ସେଥିରୁ ସେ ନିଜକୁ ମୁକ୍ତ କରିବାକୁ ଚେଷ୍ଟାକଲା । ପୁରୁଷ ସହିତ ନିଜକୁ ସମକକ୍ଷ ହେବାପାଇଁ ମନେକଲା । ବିପ୍ଳବ, ନିର୍ଯ୍ୟାତନା, ଅତ୍ୟାଚାର, ଅଧିକାରରୁ ବଞ୍ଚିତ ହେଲା ପରେ ହିଁ ନାରୀବାଦ ବା ବାମାବାଦର ଜନ୍ମ ହୋଇଥିଲା ।

ବାମାବାଦ ଯାହା ଇଂରାଜୀରେ Feminism ଏହାର ଆଭିଧାନିକ ଅର୍ଥ ହେଲା, "The principle that women should have the same rights and chances as man". ସାମଗ୍ରିକ ଭାବରେ ବାମାବାଦ ବା ନାରୀବାଦ ଚେତନା କହିଲେ ନାରୀର ଅଧିକାରକୁ ଜାହିର କରେ । ପୁରାତନ ରୀତିନୀତି, ପରମ୍ପରା, ଅନ୍ଧବିଶ୍ୱାସ, କୁସଂସ୍କାର



Simple pyrolysis synthesis of multi-walled carbon nanotubes as a highly stable electrode material for supercapacitor applications

Manoranjan Mandal^a  , Injamul Alam^c, Manas Ranjan Sahoo^a, Santosini Patra^b, Apurba Mahapatra^d, Alok Kumar Nayak^b, Subhasri Subudhi^b, Pitamber Mahanandia^b


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Highlights


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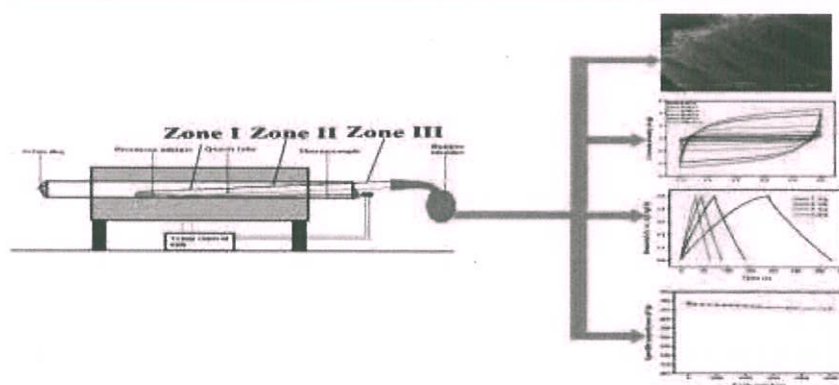


- Simple and cost-effective method for the synthesis of multiwalled carbon nanotubes.
- Better specific surface area and porosity was noticed in the prepared material.
- Fast charge transfer and low series resistance in multiwalled carbon nanotubes.
- Outstanding specific capacitance was achieved in the fabricated electrode.
- An excellent cyclic stability was observed in the electrode over 10,000 cycles.

Abstract

We report the preparation of multi-walled carbon nanotubes (MWCNTs) by using a simple and cost-effective method for supercapacitor applications. The fabricated MWCNTs electrode shows a maximum specific capacitance of 278 F g^{-1} at 1 A g^{-1} and 257 F g^{-1} at 5 mV/s . Also, excellent retention has been achieved in the fabricated MWCNT electrode and 97% capacitance is retained even after 10,000 cycles. The findings highlight the potential of pyrolysis-synthesized MWCNTs as a viable electrode material for supercapacitors, offering a pathway towards the development of efficient and durable energy storage devices for various applications.

Graphical abstract



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Volatility Spillover Effect in Commodity Derivatives Market: Empirical Evidence Through Generalized Impulse Response Function

Bhabani Sankar Rout¹
Nupur Moni Das²
K. Chandrasekhara Rao¹

Abstract

The present work is specifically directed to examine the volatility spillover mechanism in Indian commodity derivatives market. It has especially focused on comparing the agricultural and metal commodity segment by considering five agri-commodities and five metal commodities. The study period taken is 2010–2015 for understanding the mechanism between the spot and the futures commodity markets. Generalized impulse response function is mainly used to check the magnitude of volatility spill, pattern of volatility and lead–lag relationship. The result shows metal commodities are more prominent and investment worthy than agricultural commodities.

Key Words

Volatility Pattern, Lead–Lag Relationship, Influential Direction, Generalized Impulse Response Function, Volatility Spillover

Introduction

Commodity derivatives market has been receiving momentum as a separate asset class for investment over the globe. It has also been considered as diversification mechanism by various investors. However, Indian commodity derivatives market is still at a nascent stage although it came into existence as early in 1875. As per Kapil and Kapil (2010), India shares 7 per cent of the global commodity derivatives market and further stated that Indian commodity market is still under development as compared to Chicago Board of Trade and other developed global commodity market. Kumar and Sunil (2004) had too supported this argument by specifically mentioning the agricultural commodities' futures as immature and inefficient. Derivatives are specialized hedging instruments that allow the traders to hedge

against the unexpected price movements in cash prices (Gupta, Choudhary, & Agarwal, 2017). Futures are most used derivatives instruments in Commodities Derivatives segment. As defined by (Mahalik, 2014), a future contract is an agreement to deliver a specified quantity of commodity at a specified future date, at a price (the futures price) to be paid at the time of delivery. As the prices of future sale can be predetermined in advance, it operates as a price risk management tool for volatile prices of commodities in cash market. Malhotra (2015) established that co-movement of futures and cash market prices partially or wholly offset the adverse price movements in physical market by gains in the futures market. Another major utility of futures market is price discovery. Price discovery in futures market is defined as the use of futures prices to determine the


The study may be useful for investors for decision-making purpose. The summarized results are directed towards investment in metal commodities. Though agricultural commodities have mixed pattern of volatility in long-run, the fluctuations are amounts to be more in spot return due to its own shock. Therefore, the investments futures market in agricultural commodities are not up to the mark, while, metal commodities are somehow safer investment avenues.

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Multiferroic BaCoX_2O_7 ($X = \text{P}, \text{As}$) Compounds with Incommensurate Structural Waves but Collinear Spin Ingredients

Bastien Leclercq, Angel M. Arévalo-López, Houria Kabbour, Sylvie Daviero-Minaud, Alain Pautrat, Tathamay Basu, Claire V. Colin, Ranjana-Rani Das, Régnald David, and Olivier Mentré*

A new paradigm in multiferroics is observed in BaCoX_2O_7 ($X = \text{As}, \text{P}$) compounds. They consist of one dimensional (1D) antiferromagnetic chains undulated by incommensurate structural modulations with unusually large atomic displacive waves, giving a mixed 1D/2D “real” magnetic topology. The magnetic ground state is antiferromagnetic (AFM) with $k = [\frac{1}{2} 0 0]$, leading to a nonmodulated collinear spin lattice despite the aperiodic atomic framework, and allows developing spin-induced multiferroicity below T_N . Severe arguments against the identified mechanisms for type-II multiferroics, i.e., by inverse Dzyaloshinskii–Moriya, exchange striction and spin-dependent p – d hybridizations, suggest an original scenario in which the atomic waves, the collinear magnetic structure, and magnetic dipole–dipole interactions may interact as crucial ingredients of the spin-induced ferroelectric phase. Here, the specific role of the Co^{2+} spin–orbit coupling in the magnetoelectric (ME) phase diagram is demonstrated by comparison with the novel Heisenberg BaFeP_2O_7 isomorph, similarly structurally modulated. This compound shows a noncollinear modulated AFM ordering, while no ME coupling is detected in its case. Accordingly, both BaCoX_2O_7 and BaFeP_2O_7 also undergo metamagnetic transitions above 5–6 T promoted by the modulated distribution of spin exchanges, but the spin-*flop* progressive alignment of the spins in the noncollinear spin structure (Fe^{2+} case) turns into an abrupt *flip*-like transition in the uniaxial spin structure (Co^{2+} case).

1. Introduction

Low-dimensional magnetic materials may provide a platform for developing original multiferroic devices, due to the loss of symmetry elements compared to their three dimensional (3D) counterpart, often compatible with ferroelectricity.^[1,2] From the perspective of fundamental physics, type-II multiferroics, are very exciting because one of the orders (generally ferroelectricity) is a consequence of the other (generally antiferromagnetism). Besides their realization in van der Waals layers or nanodevices, 1D or 2D subunits in bulk materials soften interblock cohesion and spin interactions, which may reinforce spin-induced polarity in type-II multiferroics (MF), by exchange striction or competing mechanisms. A plethora of arguments for enhanced MF properties in such low-D systems are found in the literature such as i) their predominant insulating behavior necessary for dielectrics,^[3,4] ii) the persistence of spin ordering in low-D units at relatively high temperature counterpart,^[5] iii) their good compatibility with the main mechanisms for ferroelectricity of spin origin,^[6,7]

iv) the frustration in low-D topologies playing for spin driven polar atomic shifts,^[8] and v) the possibility of metamagnetic transitions aligning isolated magnetic units with enhanced magnetoelectric (ME) exchanges at magnetization steps, see CoV_2O_6 .^[9,10] In addition, the effects of magnetic fields on low-D structures open the route to other fascinating phenomena, such as Bose–Einstein condensation or novel field-induced magnetic states such as skyrmions.^[11] Here highly anisotropic Co^{2+} spin chains may generate field-induced particularities, such as incommensurate spin density waves (SDWs) in the screw AFM chain of $\text{BaCo}_2\text{V}_2\text{O}_8$,^[12] metamagnetic spin flip versus spin flop in Co^{2+} chain systems,^[13] spin dynamics and low-field spin alignments in canted-1D inorganic systems, i.e., $\text{BaCo}_2(\text{As}_3\text{O}_6)_2 \cdot (\text{H}_2\text{O})_2$ ^[14] analog to hybrid single-chain magnets (SCMs).^[15,16] Although ignored up to day, the access to noncollinear magnetic structures and magnetization steps suggest attractive ME properties.


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Giant exchange bias effect in Ruddlesden-Popper oxides $\text{SrLaFe}_{0.25+x}\text{Mn}_{0.25}\text{Co}_{0.5-x}\text{O}_4$ ($x=0,0.25$): Role of the cluster glass magnetic phase in a quasi-two-dimensional perovskite

Anusree V. K, Ranjana R Das, P Neenu Lekshmi, Ramchandra Dhal, Claire Colin, P N Santhosh

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Giant exchange bias effect in Ruddlesden-Popper oxides $\text{SrLaFe}_{0.25+x}\text{Mn}_{0.25}\text{Co}_{0.5-x}\text{O}_4$ ($x = 0, 0.25$): Role of the cluster glass magnetic phase in a quasi-two-dimensional perovskite

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Structural and magnetic studies on $\text{SrLa}(\text{Fe}_{0.25}\text{Mn}_{0.25})\text{Co}_{0.5}\text{O}_4$ (FMC1) and $\text{SrLaFe}_{0.5}(\text{Mn}_{0.25}\text{Co}_{0.25})\text{O}_4$ (FMC2) reveal unusually large exchange bias behavior in these atomically disordered quasi-two-dimensional layered perovskites. Powder x-ray as well as neutron diffraction confirm tetragonal crystal structure with $I4/mmm$ space group for both the compounds. Magnetization measurements on FMC1 as well as FMC2 reveal short-range antiferromagnetic ordering around room temperature and frozen magnetic clusters at lower temperatures ($T < 23$ K for FMC1 and $T < 43$ K for FMC2). The random occupancy of mixed-valent magnetic ions ($\text{Fe}^{3+}/\text{Fe}^{2+}$, $\text{Mn}^{3+}/\text{Mn}^{2+}$, $\text{Co}^{2+}/\text{Co}^{3+}$) at the perovskite octahedral sites give rise to locally varying competing antiferromagnetic and ferromagnetic exchange interactions, resulting in low temperature frozen spin states. Giant exchange bias values of ~ 6 and ~ 9.5 kOe were observed for FMC1 and FMC2, respectively, at 2 K under an applied field of 50 kOe. In comparison, the Co-rich FMC1 exhibits higher magnetization and coercivity, whereas Fe-rich FMC2 possesses a higher exchange bias effect. Our experimental results reveal compositional tuning induced exotic magnetic behavior in quasi-two-dimensional layered oxides.

DOI: 10.1103/PhysRevB.102.134405

I. INTRODUCTION

Perovskites, well-known versatile oxides, have been explored rigorously with different combinations of magnetic rare earth and transition metal ions. In the list of multifunctional materials, perovskites lead because of their diverse physical properties such as magnetoresistance, multiferroic properties, magnetocaloric effect, exchange bias (EB), etc. [1–4]. However, in recent years, quasi-two-dimensional (2D) layered perovskite systems are investigated in connection with their strongly correlated d electrons, and the mixed-valence states of the transition-metal ions owing to the promising experimental results in comparison to its 3D perovskite [5]. One such category of quasi-2D layered perovskite is the Ruddlesden-Popper (RP) series $[(A'/AO)(ABO_3)_n]$ where A' = alkaline earth ion, A = rare earth ion, B = transition metal ion, O = Oxygen ion, and n (1,2,3, ...) represents the number of perovskite layers intercalated between two $A'O$ layers in a unit cell [6]. The quasi-dimensionality originates due to the separation of perovskite blocks along the long crystallographic axis (c axis) by nonmagnetic $A'A'O$ layers. Crystal structure of n layered RP series can be visualized as BO_6 octahedral blocks sandwiched between $A'A'O$ layers, with n number of BO_6 sheets in each octahedral block. So, for single-layered RP compounds

($n = 1$) in Fig. 1(a), there will be one connected BO_6 sheet in the ab plane, which is sandwiched between adjacent $A'A'O$ layers as shown in Fig. 1(b).

Inhomogeneous magnetic phases in atomically disordered perovskites lead to coexistence of ferromagnetic (FM) and antiferromagnetic (AFM) interactions resulting in magnetic frustrations [7]. These competing magnetic exchange interactions give rise to an interesting magnetic phenomenon known as EB. The EB effect is usually associated with a horizontal and/or vertical shift in hysteresis loops as a result of unidirectional anisotropy at the FM/AFM interfaces [8,9]. In addition, EB has been investigated in many perovskites consisting of interfaces of frozen magnetic phases such as FM/spin glass, AFM/spin glass and ferrimagnetic/spin glass [10–12]. The EB effect is technologically important and has been implemented in nonvolatile memory, giant magnetoresistance sensors, and magnetic read heads [13–16]. Similar to perovskites, the properties of RP oxides are also strongly influenced by structural distortions and atomic disorder. However, in comparison with perovskites, quasilayered perovskite systems are not much explored for EB effects.

Recently, our group reported a giant EB field of ~ 5.5 kOe in the single-layered RP system $\text{SrLaCo}_{0.5}\text{Mn}_{0.5}\text{O}_4$ (SLCMO), for which a low temperature glassy magnetic transition ($T_{C2} \sim 50$ K) along with a ferromagnetic phase transition (at $T_{C1} \sim 150$ K) were observed [17]. The perovskite analog of SLCMO is $\text{La}_2\text{CoMnO}_6$, which is a FM double perovskite. The observation of giant EB in SLCMO was explained in terms of competing FM and AFM interactions at nanoscale domains along the perovskite layers. In the present work, we have considered a RP oxide $\text{SrLaFe}_{0.5}\text{Co}_{0.5}\text{O}_4$, where the perovskite analog is

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Competing short-range magnetic correlations, metamagnetic behavior and spin-phonon coupling in $\text{Nd}_2\text{CoMnO}_6$ double perovskite

Ranjana R. Das, P. Neenu Lekshmi, S.C. Das¹, P.N. Santhosh  

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Highlights

- $\text{Nd}_2\text{CoMnO}_6$ (NCMO) double perovskite ceramic was prepared by the solid state method with $P2_1/n$ space group.
- Mixed valence cations of Mn and Co induce magnetic super-exchange interactions leading to double magnetic transitions.
- Domain wall pinning and magnetocrystalline anisotropy induced metamagnetic phenomena.
- Observation of Griffith phase due to competing magnetic interactions.
- Evidence of spin-phonon coupling.


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Abstract

We report the presence of ferromagnetic short-range interactions, metamagnetic transitions and spin-phonon coupling on monoclinic polycrystalline $\text{Nd}_2\text{CoMnO}_6$ double perovskite. DC thermomagnetic characterization shows a paramagnetic to ferromagnetic transition at $T_{C1} \sim 168\text{K}$ and further to a cluster glass like magnetic transition at $T_{C2} \sim 135\text{K}$. Griffiths phase like features are also observed, attributed to the presence of competing magnetic interactions. Step like nature observed in the virgin curves of magnetic isotherms implies the presence of metamagnetic features. Additionally, temperature evolution of Raman spectra signatures spin-phonon coupling extending up to Griffiths like phase region indicating the possibility of magnetoelectric coupling in $\text{Nd}_2\text{CoMnO}_6$.

Introduction

Ferromagnetic oxides gain much attention in scientific and technological aspects not only due to their possible applications in memory devices and spintronics, but also they provide a significant contribution towards the understanding of fundamental physics. Among them rare-earth double perovskites ($A_2BB'O_6$) (A- Rare earth, B and B' - transition metals) have attracted considerable attention due to their multiple functionalities such as magneto-capacitance, magnetoresistance, magnetodielectric, magnetic field induced metamagnetic effects, relaxor ferroelectricity, etc. [[1], [2], [3]] Different factors affecting the properties of double perovskites are (i) cations at A/B/B' sites [4], (ii) cation ordering [5] (iii) oxidation states of B and B' ions [6], (iv) antiphase boundaries, (v) exchange interactions [7] and (vi) chemical pressure induces lattice distortions [8]. Among them the chemical pressure induced octahedral tilting has greater importance since it will provide deviation on B-O-B' angle, consequently affecting the interactions along B-O-B'-O-B paths leading to provide different functional properties [[9], [10], [11], [12], [13]].

Recently there has been plethora of the double perovskite explored in the search for new multiferroic materials. $\text{La}_2\text{CoMnO}_6$ (LCMO), with $P2_1/n$ symmetry, are ferromagnetic (FM) due to the positive super-exchange interaction between Co^{2+} -O- Mn^{4+} [7,14]. The cation ordering of the LCMO system has a strong dependence on the synthesis conditions, and consequently they exhibit one or more magnetic transitions [7,15,16]. An ordered sublattice with high spin Co^{2+} ($S = \frac{3}{2}, t_{2g}^5 e_g^2$) and Mn^{4+} ($S = \frac{3}{2}, t_{2g}^3 e_g^0$) pair gives rise to a FM transition at 220K, while a disordered sublattice of Co/Mn with a low spin (LS) Co^{3+} ($S = 0, t_{2g}^6 e_g^0$) and high spin (HS) Mn^{3+} ($S = 2, t_{2g}^3 e_g^1$) pair favor a FM transition below 150K [7]. In $A_2\text{CoMnO}_6$, on varying the rare earth ionic radii from La to Y ground state magnetic structure can be tuned from ferromagnetic to complex


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SOME STUDIES ON CENTRAL DERIVATION OF NILPOTENT LIE SUPERALGEBRA

RUDRA NARAYAN PADHAN AND K.C PATI

1. ABSTRACT

Many theorems and formulas of Lie superalgebras run quite parallel to Lie algebras, sometimes giving interesting results. So it is quite natural to extend the new concepts of Lie algebra immediately to Lie superalgebra case as the later type of algebras have wide applications in physics and related theories. Using the concept of isoclinism, F. Saeedi and S. Sheikh-Mohseni[1,2,3] recently studied the central derivation of nilpotent Lie algebra with nilindex 2. The purpose of the present paper is to continue and extend the investigation to obtain some similar results for Lie superalgebras, as isoclinism in Lie superalgebra is being recently introduced.

2. INTRODUCTION AND PRELIMINARIES

In this section we review some terminology on Lie superalgebra and recall notations used in the paper. Throughout this paper we always mean $\alpha, \beta, \gamma \in \mathbb{Z}_2$ and all the Lie superalgebras are over a fixed field \mathbb{F} . A *superalgebra*[4] is a \mathbb{Z}_2 -graded algebra $A = A_{\bar{0}} \oplus A_{\bar{1}}$ (that is, if $a \in A_\alpha, b \in A_\beta, \alpha, \beta \in \mathbb{Z}_2$, then $ab \in A_{\alpha+\beta}$). A *Lie superalgebra* is a superalgebra $G = G_{\bar{0}} \oplus G_{\bar{1}}$ with the operation [...] satisfying the following axiom:

- (1) $[a, b] = -(-1)^{deg(a)deg(b)}[b, a]$, for $a \in G_\alpha$ and $b \in G_\beta$
- (2) $[a, [b, c]] = [[a, b], c] + (-1)^{deg(a)deg(b)}[b, [a, c]]$, for $a \in G_\alpha$ and $b \in G_\beta$.

Where $deg(a)$ is 0 if $a \in G_{\bar{0}}$ and $deg(a)$ is 1 if $a \in G_{\bar{1}}$. For a Lie superalgebra $G = G_{\bar{0}} \oplus G_{\bar{1}}$, the even part $G_{\bar{0}}$ is a Lie algebra and $G_{\bar{1}}$ is a $G_{\bar{0}}$ -module. A \mathbb{Z}_2 -graded vector subspace F of G is called a super subalgebra (respectively ideal) of G , if $[F, F] \subseteq F$ (respectively $[F, G] \subseteq F$). The ideal $Z(G) = \{x \in G \mid [g, x] = 0, \forall g \in G\}$ is called the center of the Lie superalgebra G . The Lie superalgebra G is abelian, if $[G, G] = 0$. Since $[G_{\bar{0}}, G_{\bar{0}}] \subseteq G_{\bar{0}}$ and $[G_{\bar{1}}, G_{\bar{1}}] \subseteq G_{\bar{0}}$, we can observe that a Lie superalgebra without even part, i.e., $G_{\bar{0}} = 0$, is an abelian Lie superalgebra.

By a *homomorphism* between super vector spaces $T : G \rightarrow H$ of degree $\beta \in \mathbb{Z}_2$, we mean a linear map satisfying $T(G_\alpha) \subseteq G_{\alpha+\beta}, \forall \alpha \in \mathbb{Z}_2$. In particular, if the degree of T is zero, then the homomorphism T is called homogeneous linear map of even degree. A Lie superalgebra homomorphism $T : G \rightarrow H$ is a homogeneous linear map of even degree such that $T[g_1, g_2] = [T(g_1), T(g_2)], \forall g_1, g_2 \in G$. The notation of *epimorphisms, isomorphisms, automorphisms* have the obvious meaning. For superdimension of Lie superalgebra G , we simply write $dim(G) = (m|n)$, where $dim(G_{\bar{0}}) = m$ and $dim(G_{\bar{1}}) = n$. For Lie superalgebra $G, End(G)$ consists of set of all linear transformations from G to G , which has a \mathbb{Z}_2 -grading by defining;

$$End_\alpha(G) = \{T \in End(G) \mid T(G_\beta) \subseteq G_{\alpha+\beta}\} \forall \alpha, \beta \in \mathbb{Z}_2.$$

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Key words and phrases. Lie Superalgebra; Isoclinism; Derivation; nilindex .

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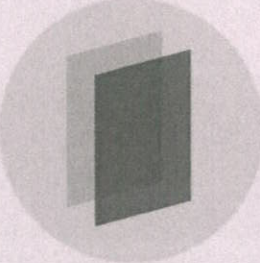
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Splints of root systems of basic Lie superalgebras

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Abstract. Splints [9] of root systems of simple Lie algebras appear naturally on the studies of embedding of reductive subalgebras. A splint can be used to construct branching rules, as implementation of this idea simplifies calculation of branching coefficients. We extend the concept of splints to basic Lie superalgebras case as these algebras have wide applications in physics. In this context we have determined the splints of root system of all basic Lie superalgebras and hope to contribute towards a small step in the direction of representation of these algebras.

1. Introduction

In this section we review some terminology on Lie superalgebra and recall notations used in the paper. A superalgebra [1,2,10] is a \mathbb{Z}_2 -graded algebra $A = A_{\bar{0}} \oplus A_{\bar{1}}$ (that is, if $a \in A_{\alpha}$, $b \in A_{\beta}$, $\alpha, \beta \in \mathbb{Z}_2$, then $ab \in A_{\alpha+\beta}$). A Lie superalgebra is a superalgebra $G = G_{\bar{0}} \oplus G_{\bar{1}}$ with the operation $[\dots]$ satisfying the following axiom:

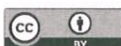
- (i) $[a, b] = -(-1)^{\deg(a)\deg(b)}[b, a]$ for $a \in G_{\alpha}$ and $b \in G_{\beta}$
- (ii) $[a, [b, c]] = [[a, b], c] + (-1)^{\deg(a)\deg(b)}[b, [a, c]]$ for $a \in G_{\alpha}$ and $b \in G_{\beta}$

Where $\deg(a)$ is 0 if $a \in G_{\bar{0}}$ and $\deg(a)$ is 1 if $a \in G_{\bar{1}}$. For a Lie superalgebra $G = G_{\bar{0}} \oplus G_{\bar{1}}$, the even part $G_{\bar{0}}$ is a Lie algebra and $G_{\bar{1}}$ is a $G_{\bar{0}}$ -module. Let H be a Cartan subalgebra of $G_{\bar{0}}$. The dimension of the Cartan subalgebra H is the rank of the Lie superalgebra. Let us denote Δ_0 (respectively Δ_1) be the set of all even (respectively odd) root of G . If Δ is the set of all roots of the Lie superalgebra G , then $\Delta = \Delta_0 \cup \Delta_1$. A root α is called degenerate if $(\alpha, \alpha) = 0$ and a degenerate root is necessarily an odd root. For each basic Lie superalgebra, there exists a simple root system for which the number of odd simple roots is smallest one. Such a simple root system is called the distinguished simple root system. We denote $\Delta(G)$ to be the set of all positive roots of the basic Lie superalgebra G .

Let Δ and Δ' be positive root systems of two different basic Lie superalgebras with $\Delta = \Delta_0 + \Delta_1$ and $\Delta' = \Delta'_0 + \Delta'_1$, where Δ_0 (Δ'_0) and Δ_1 (Δ'_1) are even and odd roots of Δ (Δ') respectively. The map $\iota: \Delta \hookrightarrow \Delta'$ is an embedding if

- (i) ι is an injective map and $\iota(\gamma) = \iota(\alpha) + \iota(\beta)$ for all $\alpha, \beta, \gamma \in \Delta$ such that $\gamma = \alpha + \beta$
- (ii) $\iota(\Delta_0) \subseteq \Delta'_0$ and $\iota(\Delta_1) \subseteq \Delta'_1$.

A root system Δ splinters as (Δ_1, Δ_2) if there are two embeddings $\iota_1: \Delta_1 \hookrightarrow \Delta$ and $\iota_2: \Delta_2 \hookrightarrow \Delta$ where, Δ is the disjoint union of the images of ι_1 and ι_2 and neither the rank of Δ_1 nor the rank of Δ_2 exceeds the rank of Δ .



Some properties of isoclinism in Lie superalgebras

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ABSTRACT

Isoclinism of Lie superalgebras has been defined and studied currently. In this article, it is shown that for finite dimensional Lie superalgebras of same dimension, the notation of isoclinism and isomorphism are equivalent. Furthermore, we show that covers of finite dimensional Lie superalgebras are isomorphic using isoclinism concept.

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1. Introduction

In 1940, P. Hall introduced an equivalence relation on the class of all groups called isoclinism, which is weaker than isomorphism and plays an important role in classification of finite p -groups [7]. In 1994, K. Moneyhun [8, 9] gave a Lie algebra analog of the concept of isoclinism. Furthermore, Saeedi and Veisi [13] have defined the same notation for n -Lie algebras. Similarly, isoclinism has been defined and studied for Lie superalgebras recently [12].


Definition 1.1. Let L and K be two Lie superalgebras, $\varphi: \frac{L}{Z(L)} \rightarrow \frac{K}{Z(K)}$ and $\theta: L' \rightarrow K'$ be Lie superalgebra homomorphisms such that the following diagram is commutative,

$$\begin{array}{ccc} L/Z(L) \times L/Z(L) & \xrightarrow{\mu} & L' \\ \downarrow \varphi^2 & & \downarrow \theta \\ K/Z(K) \times K/Z(K) & \xrightarrow{\rho} & K' \end{array}$$

where $\mu((\bar{l}, \bar{m})) := [l, m]$ for $l, m \in L$ and similarly for $\rho((\bar{r}, \bar{s})) := [r, s]$ for $r, s \in K$. Or, equivalently φ and θ are defined in such a way that they are compatible, i.e., $\theta([l, m]) = [k, r]$, where

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Risk Analysis for Recommendation of an Effective Fire Hazard Management System: A Study in Kolkata Municipal Corporation (KMC) Area, West Bengal, India

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Abstract - Urban fire is one of the most common and dangerous man made- hazards often causing massive damages to life and properties; however, can be manageable by taking preventive measures. It occurs frequently, particularly if the urban layouts are unplanned and congested. The study area is historically old, overcrowded and has emerged as an unplanned city due to haphazard growth since its establishment in the colonial era. The urban fire managers responsible for planning and implementation of urban fire prevention strategies usually work upon integration of fire protection systems along with various other aspects such as nature conservation, riparian zone management, preservation of aesthetics and urban heritage sites, etc. In Kolkata, the different land uses form a complex mosaic in the landscape and subsequently create varying degrees of fire hazards in the KMC area, particularly in the high density localities. Fire prone zones of the KMC area have increased dramatically, and data for the last ten years show that a substantial increase of fires which have caused huge loss of properties and a number of lives as well. So, development of a proper fire management system is very essential for the fire hazards of this cityscape. Geomatics, the new technological support of these days, may be immensely beneficial for management of the fire hazards, to a great extent. This paper is an attempt to explore the possibilities of application of Geomatics in fire hazard management in the KMC area.

Keywords - Urban fire, man-made, hazards, land uses, high-density, fire management system, Geomatics,

I. INTRODUCTION

Fire management certainly demands experts with quick and effective communication skills to handle modern fire extinguishing equipments. Besides, for proper fire management it is very important to have knowledge about the fire history of the very areas. It is basically a record of the fire regime within an area since a useful time period (Delcourt and Delcourt, 1991). The main components of a fire regime include fire frequency, size, duration and intensity. Fire frequency can be defined as the average annual probability of a site being burnt or it is the number of fires that occur within a given time period of the interval between fires. The impacts of fire can range from destroying the local flora, fauna as well as human lives and monetary loss, to instances where fire can pass through an area without having much of an effect, depending on environmental conditions, fuel loading, and fire tolerance of

the flora and mobility of the fauna (Larsen, 1997).

Although fire hazard is not geographically limited to an area, yet it occurs more frequently in urban areas, where the man-land ratio is usually very high, and the nature of land use land cover (LULC) (Anderson et al. 1976, Jensen 2007, Tang, 2012) permits fire to spread quickly, especially in the unplanned towns and cities (Ghosh, 2018).

Fire management is concerned with 3P system. These are: (a) pointing at the exact location where fire event has occurred, (b) protection against fire and (c) prevention of fire. Pointing of the exact fire location indicates the identification of the fire victim place, and its demands the classification the character of the building, i.e. industry, hospital, school or residential area. Then the next important step is the selection of the shortest route with nearby water sources. Fire protection highlights the identification of the character of the concerned fire. The fire is classified as A,