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Criterion 3

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Research Publications in Journals

Displacement and Narrative: The Desert as a Diasporic Space of Existence in the *Goat Days* by Benyamin

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Abstract

Emerson in his essay 'Experience' brings forth the idea of the cosmological relation between the universe and the human being. What we perceive as truth is not the reality because it exists in space and it is not an absolute entity. But Life – from minute particles, sub atoms, plants, animals, humans – creates the environment and the universe. Universe is the complete spatio-temporal logic of the individual self. Thus from the mist to man-made things we try to understand and give meaning to ourselves and to the world around us.

Introduction

The place of exile is often regarded as a desert- an unfriendly, hostile, dry, dangerous, empty, naked, rough and endless landscape. The desert as a metaphor is often described as a landmark that can never be mapped and where nothing grows. It is a space of unparallel lives and meaningless values. Benyamin's *Goat days* analyses the desert as a space of asserting faith, brotherhood and love for humanity at large. Najeeb, narrator and protagonist of the novel calls his life in the desert: "a cocooned existence" (135), a lonely being with no sense of time. The

Survivor Literature: Not a Victim but a Victor- Reading Nadia Murad's *The Last Girl* and Halima Bashir's *Tears of the Desert*.

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Popular fiction has created many new genres and sub genres as the tag bestseller suggests, so are the new wave autobiographies with the theme of survival whether it be disease, war or human and animal attack or being abandoned in the island or an adventure to some forbidden land. Survival Literature interests their readers to think about people and situations that are considered unimaginable and unresisting. Usually survival themes exist in children's literature like *Robinson Crusoe* by Daniel Defoe or *Hatchet* by Gary Paulsen. In this era of popular reading, popular non-fiction also has become bestsellers. The current paper looks into the themes of representation of women in war, loss of femininity as a war tool, the emergence of terrorism in Asia, Africa and Middle east and how the women's will help her escape. Both the authors and victims of the war produce an authentic personal account of their trials and tribulations as war victims. The paper also intends to look into the impact of popular non-fiction in the reading public.

Keywords: Survival Literature, Popular fiction and non-fiction, terrorism, war.

This above all, to refuse to be a victim. (Margaret Atwood, *Surfacing*, 197)

Survival Literature in Popular fiction

To survive is the basic instinct of every living thing. Charles Darwin's Theory of Natural Selection also states the dictum of survival of the fittest as the crucial process of establishment of the human race. As Darwin suggests any species that are better adapted to the environment survive and endure. The comforts and luxuries that the modern livelihood gives has put our animal instinct system down or minimal. If at all we are lost in forest or in the mid of the ocean or in midst of predators will we ever know how much persistence and tenacity we have in order to overcome the situation. Being a survivor one can only urge for the basic necessities of life like food, water and shelter and all the abstract facilities that an enlightened modern man's psyche has is unwanted and worthless.

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Radical and Rationalistic Ideologies in SNDP Yogam- A Historical Perspective

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to lower such horrendous crimes. It would be possible to an extent if lynching cases are dealt without politicising it if India wants to be a progressive country, it need policy

implementation that curtails mob lynching from its roots. An act that strictly punishes the culprit will only help to uphold the pluralist and secular ethos of the nation.

End Notes

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RADICAL AND RATIONALISTIC IDEOLOGIES IN SNDP YOGAM – A HISTORICAL PERSPECTIVE

Dr. O.C Promod

The 19th century Travancore witnessed many superstitious customs and rituals in society. Untouchability was a great problem in the entire Hindu community and the Brahmins were the only community skipped from it in India during those days. The system was introduced for the sake of minority group of Brahmins in society and crores of majority class lower community suffered much in this system. It is a funny thing that, most of the lower class was not ready to occupy powers from Brahmins. It is the victory of Brahmin community to mould a lower-class society for the betterment of upper class community in the erstwhile Travancore region. The educated Brahmins also orally taught to the uneducated lower class that, it is sin to behave in manner-less to the upper class Brahmin community, because they are associated with supreme god. By the system, each and every Hindu class have to maintain a specified distance from other communities. A king (if he is non-brahmin) shall maintain two feet from Brahmins, while Nairs 3 feet from them, Ezhavas maintain 12 feet and Pulayas keep a distance of 54 feet and Parayas 64 from the Brahmins.¹ Another funny thing is that, most of them were happy, because most of them were superior among their lower classes. A dress code was also prescribed depending on the status of community. Education was restricted on the

lower class and they had no right to enter their temples. Lower classes were taxed heavily on various accounts.

On this context, the Sree Narayana Dharma Paripalana yagam (SNDP) was organized in 1904 on the grace of Sree Narayana Guru and his disciples. He had made verbal struggles against the prominent upper class sections in society during those days. To criticise the Hindu texts, were not only sin, but also a punishable crime in Travancore area during those days. Therefore nobody was ready to questioning the existing rules in society. Narayana Guru was the first person questioned the existing caste rules in the erstwhile Travancore. He strongly opposed the Chaturvarna system in Hindu society? That is why Narayana Guru is considered as the father of social reform movements in Kerala. He raised his voice against the pre-eminence of the Brahmins in all spheres of life and he worked for the establishment of a classless and casteless society? He was born in an Ezhava family at Chempazhanthi in the erstwhile Travancore state. Ezhava community was a leading Hindu lower class community at Travancore region. After the formation of SNDP, Narayana Guru gave shelter to the all other lower class communities, who were even the lower status in social strata than Ezhavas. But SNDP was

CHRISTIANITY AND INHERITANCE RIGHTS PRIOR TO THE EARLY 16th CENTURY

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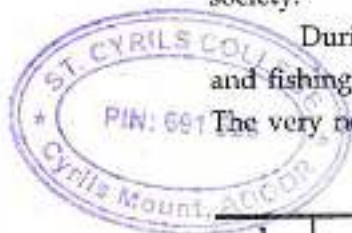
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Abstract

Medieval Christianity portrayed the picture of a well settled Christian Community in Malabar, who were called as the St. Thomas Christians or the Syrian Christians. The faith, though alien to the Malabar region, and to India, began its hasty development to the area even before the advent of the Portuguese. In the socio-economic and political arena of Malabar, the Christians exerted and exercised immense power. The rulers of Malabar from time to time bestowed them with certain rights and privileges. Thus they emerged at the top of the economic ladder with the high caste Hindus of the land and they acquired large tracts of landed property. The Syrian Christian society had been following the patriarchal system of inheritance. The paper focus on the two main milestones of medieval age Malabar-the grant of Syrian Christian copperplates and the Synod of Diamper. **Keywords:** Syrian Christians, Synod of Diamper, Oath of the Coonan cross, Inheritance rights, Syrian Christian Copperplates

The concept of private property and property rights are as old as the evolution of society. Engles in his 'Origin of family, Private Property and State' converse on the emergence of Private property and argued that the triumph of the male dominated society was the result of the production of the 'surplus'. The male folk took over the control over the production process which finally gave them to a relatively superior power in society than their female counterparts. Thus the control of the resources enabled them to be more predominant and they considered women as property. Engels' argument was that the abolition of sexual division of Labour and the communal management of Property and women's entry into the public service will abolish all sorts of subordination of women. The very concept of Private property in India dates back to the days of the India's greatest law giver Manu in his 'Manusmriti'. His theory on property is that of 'first come - first serve'. He cited with example that the carcass of a deer belongs to the person who drove the first arrow to the animal. Similar is the case with the land too. The land belonged to the person who dug in it the first plough. Manu had looked upon 'woman', who is to be controlled by a man all throughout her life. To quote 'Manusmriti', A woman is always dependent on her father during her child hood, to her husband after marriage and during her old age, she is protected by her son and as such she's denied of property or her share in property was meagre when compared to her male counterparts. It is to be noted that the concept has been changing from time to time in the economic evolution and changes in the structure of society.

During the period of the old stone age when man led a primitive life, where hunting and fishing were his only occupations, the ownership of property and use went together. The very next stage of human civilization was the period of the Neolithic age when man



TRUTH BEHIND THE PERIYAR LEASE DEEDS- A CRITICAL APPROACH

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The Principal Periyar lease deed was signed between the governments of Madras and Travancore in the year 1886. Common people have no idea regarding the Periyar Lease deeds and provisions added to it. The aim of the deed was to irrigate the barren lands at Madurai, Theni, Dindignl, Ramnad and Sivagangai, which were under the erstwhile Madras state. The Travancore government bargained well with the Madras government as the compensation to give Periyar water of Travancore to the Madras region. Before the deed became signed, an annual amount was fixed for lending the land of 8000 acres to Madras authorities for the period of 999 years. Even though the amount was a huge one on that days, but there was no provision for the revision of annual land-rent for the long 999 years. In many books and documents, it is wrongly mentioned that, the deed was signed during the period of Vishakam Thirunal Rama Varma (1880-1885), but the truth is that, Vishakam Thirunal engaged in many discussion with British authorities, but he had passed away in 1885 and during the time of Sree Moolam Thirunal Rama Varma (1885-1924) the Periyar lease deed was signed in 1886.

Almost 8000 acres of land had been handed over to the Madras state on the basis of Principal Periyar deed signed in 1886 and thus the authority over the wood and under woods were handed over to Lessee for the construction of the Periyar project or its allied works. The right of fishing was also given to the lessee on the basis of Periyar Lease deed of 1886. On the basis of the deed, the lessee should hand over Rs. 5 for one acre (Acreage Rent) and thus almost Rs. 40,000 (Rs.5 x 8000 Acre) to the Lesser, but the amount should be deducted from the tribute from time to time payable by the Lesser to Government of Madras, because Travancore was already signed a subsidiary alliance treaty with British authorities and the rulers of Travancore should remit an annual amount to them.

The main limitation of the Principal Periyar deed is that, there is no provision to rebuild a new dam after a stipulated period of years and no revision of Acreage Rent during the period of long 999 years. But there is a provision added that, If any dispute arose between the lessee and lesser can approach to arbitrators or umpire for the disclose of matter, but the arbitrator should be acceptable to both parties.

Meanwhile, the Madras government generated electricity by using Periyar water without the consent of Travancore government. It was against the norms of Periyar Lease deed and the Principal Periyar deed specified that the water is used only for irrigated the barren lands of Madras region. The Travancore government approached to the arbitrator and the umpire made a judgement that, the Madras government is unlawfully utilizing the



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MYTHOLOGICAL ASPECTS ON MULLA PERIYAR AND IDUKKI DAMS OF KERALA- A CRITICAL APPROACH

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KEY WORDS:

Rationalism, Mythology, Dam, Surki compound, Jaggery

ABSTRACT

Mythology is the part parcel of everyday life in society seen in developed as well as the under developed nations. We cannot easily segregate fact and myth, because both are mixed together and cannot be separated. Superstitious beliefs are also associated with mythological beliefs. It is a fact that almost all are claiming that, they are totally against all types of superstition. The thing is that the superstition of another community may be the normal belief to one's own religion. Whenever the rationalistic ideas come to forefront, then the mythology may disappear from society. Here the researcher tries to trace out the mythological ideas associated with two dams- Mulla Periyar and Idukki. In the case of Mulla Periyar, people make cautious about the safety of the dam, because it is built by Surki compound and jaggery, while Idukki dam is considered by laymen as a wonder in engineering.

Introduction:

Even though mythology and rationalism are two aspects of ideology and entirely different in nature, but can be seen in every society irrespective of developed or underdeveloped nations. Even a rationalist ideologist may sometimes a superstitious person, while a mythologist may sometimes more rationalist than his counterpart. The ideology of rationalism can be seen in every person. Generally saying, a person who upholds the modern scientific ideology is called as rationalist while a person who gives more importance to the old beliefs and customs as mythologist.

Almost all huge buildings in India have one or more mythological stories associated with its construction. The rational ideas can't effectively prevent to spread the story

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MYTHOLOGICAL ASPECTS ON MULLA PERIYAR AND IDUKKI DAMS OF KERALA- A CRITICAL APPROACH

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KEY WORDS:

Rationalism, My-
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Experimental and DFT/TD-DFT approach on photo-physical and NLO properties of 2, 6-bis (4-Chlorobenzylidene) cyclohexanone

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ABSTRACT

The crystalline nature and lattice parameters of synthesized compound 2, 6-bis (4-Chlorobenzylidene) cyclohexanone (B2CBC) were confirmed by powder X-ray diffraction technique. The splitting of the carbonyl mode is attributed to the intramolecular association on the basis of C=O...H type hydrogen bonding in the molecule. The doublet of the C=O mode band originates from Fermi resonance. The solvatochromic behaviour of B2CBC in acetone solvent was investigated by UV-Vis, fluorescence spectroscopy and supported by TD-DFT calculations. Fluorescence lifetime measurement of the title compound exhibits a lifetime of the order of 2-3 ns and blue emission observed from CIE chromatic diagram. Decay curve also shows that excited state life time of B2CBC is longer, indicating that the chlorine substituent atom has a significant impact on the excited state relaxation process. Our result shows that NLO response and photo-physical parameters of cyclohexanone derivatives are tunable via peripheral substituent chlorine atom.

1. Introduction

The photophysical and chemical properties of organic luminescence materials have attracted attention in OLED and NLO devices fabrications [1,2]. The nonlinear optical responses of organic materials were studied in order to find suitable systems for optoelectronic/photonics applications [3-5]. Studies show that the high molecular nonlinearities can be achieved if a molecule contains donor and acceptor groups connected through the π -electron delocalized bridge [6-8]. By increasing the donor-acceptor capability of the substitutions attached to the π -conjugated system, nonlinearity can be increased. The position of the substitutions is of vital importance in terms of NLO activity [9]. D- π -A (Donor- π -Acceptor) systems are made up of electron-donating (D) and electron-accepting (A) cores that are connected by a π -conjugated bridge. In such D- π -A framework on photoexcitation an extensive charge transfer is realized wherein electrons located in the electron-rich D unit experience an intramolecular or twisted intramolecular charge/electron transfer to the electron-deficient A core, and such a charge/electron transfer phenomena inference a non-centro-symmetric charge

distribution leading to large nonlinear optical (NLO) characteristics [10]. Compounds exhibit intense fluorescence after substitution of various electron donor-acceptor functional groups at different positions of the ring structure [11,12]. Especially, the electron accepting group substituted at the 4-position of the ring structure exhibit strong fluorescence [13,14]. This substitution induces more delocalization of electrons and the electron donating or withdrawing force of the substituent has a strong influence on the optical properties [15]. Vibrational spectroscopic studies of cyclohexanone derivatives by DFT studies have been reported [16-19]. The optical activity features in spectral bands of cyclohexanone derivatives have been studied [20]. Vibrational spectral investigations of 2, 6-(4-N, N-dimethyl benzylidene) cyclohexanone [22], 2,6-bis (p-methoxy benzylidene) cyclohexanone [23] and 2,6-bis (p-methyl benzylidene) cyclohexanone [24] 2, 6-bis (Benzylidene) cyclohexanone (BBC) [25], 2, 6-bis (2-Chlorobenzylidene) cyclohexanone (B2CBC) [26] using density functional theory studies have been reported.

The present work deals with comprehensive theoretical as well as experimental studies of optimized geometry, absorption spectra,

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Growth, Z-scan and density functional theoretical study for investigating the nonlinear optical properties of guanidinium L-glutamate for optical limiting applications

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ABSTRACT

A novel semi-organic single crystal exhibiting third order optical nonlinearity was grown by the method of slow evaporation. Single crystal X-ray diffraction technique (XRD) was employed to confirm the crystal structure and powder XRD was used to determine the cell parameters. The sample was characterized using FT-IR, FT-Raman and UV-visible absorption and analysed with density functional theory (DFT) calculation. The detailed interpretation of the vibrational spectra has been carried out using normal coordinate analysis (NCA) through the scaled quantum mechanical force field methodology. The red shifting of NH stretching wavenumbers, both the observed and calculated, affirm that N-H...O type bonds are present in GuLG. The Natural Bond Orbital (NBO) analysis also points to a strong intermolecular N-H...O hydrogen bond. Thermal stability of the crystal was studied making use of the TG/DTA technique. The third order nonlinearity studies, along with the optical limiting behaviour were investigated by Z-scan technique using diode-pumped Nd:YAG laser with 50 mW power at 532 nm. © 2020 Elsevier B.V. All rights reserved.

1. Introduction

Nonlinear optical (NLO) materials are very much essential in areas like laser frequency conversion, optical communication and optical data storage [1–4]; but their properties are not up to the mark to be efficient for these applications. In order for them to be useful, NLO materials having properties such as high optical susceptibility (χ) and laser damage resistance, appropriate transparency cut off wavelengths, good thermal stability and mechanical performance are required. A possible way to counteract this shortcoming is to explore and design novel NLO materials. A lot of inorganic and organic materials with useful physical and chemical characteristics have thus been studied [5–9]. Studies reveal that normal inorganic NLO materials are suitable for growing large size crystals due to their good mechanical properties and ther-

mal stability. Organic crystals, on the other hand, are not suitable for growing large size crystals [13] due to their poor mechanical strength and thermal stability although they possess fast response times, high optical susceptibilities and high laser damage threshold [10–12]. Semi organic crystals are of interest due to their high damage threshold, wide transparency range, less deliquescence, excellent non-linear optical coefficient, low angular sensitivity and exceptional mechanical properties [14,15]. Guanidinium based organic compounds with π -bonds show good nonlinearity which aids molecular engineering for optoelectronic applications. Recently, many guanidinium based compounds showing nonlinear optical behaviour, including guanidinium 4-hydroxybenzoate [16], guanidinium tetrafluoroborate [17], bis(guanidinium) hydrogen phosphate monohydrate [18], guanidinium 3-nitrobenzoate [19], guanidinium chlorochromate [20], guanidinium carbonate [21], guanidinium L-glutamate [22], zinc guanidinium sulphate [23] guanidinium perchlorate [24], guanidinium cinnamate [25] and guanidinium propionate [26], have been reported. This paper reports the growth and characterization of guanidinium L-glutamate (GuLG).

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Synthesis, physicochemical properties and third-order optical nonlinearities of cadmium (II) dibromide L - Proline monohydrate for optical limiting application

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ABSTRACT

Metal-semi organic NLO single crystal of Cadmium (II) dibromide L - Proline monohydrate (CBLPM) has been synthesized and the crystal was grown from solution by room temperature slow evaporation method. The crystal structure and cell parameters were refined by Rietveld refinement technique and confirmed that the microcrystalline samples are in the orthorhombic system with space group $P2_12_12_1$. The crystal structure of CBLPM is stabilized by intermolecular N-H...O, N-H...Br, O-H...O and O-H...Br hydrogen bonds. The water molecules serve as donors for the weak O-H...O and O-H...Br hydrogen bonds which link adjacent chains forming a three-dimensional structure. A Hirschfeld surface analysis suggests that the most significant contribution to the crystal packing is by H...Br contacts (26.2%). The complete vibrational features and electronic absorption spectra of the title compound were analyzed by FT-IR, FT-Raman and UV-visible spectra combined with density functional theory and time-dependent density functional computations. The second-order hyperpolarizability value of the molecule was also calculated at density functional theory method. The third-order nonlinear optical properties of the crystal were studied by Z-scan techniques using CW laser with wavelength 532 nm. The open aperture result exhibits the saturable absorption, which indicates that this material has potential candidate for optical limiting applications.

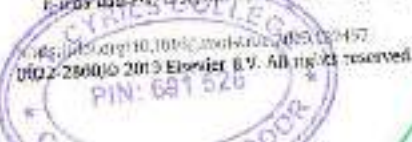
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1. Introduction

Organometallic compounds with second-order, third-order nonlinear optical properties and luminescence are of growing interest as new molecular multifunctional materials, since they offer additional flexibility compared to organic chromophores by introducing active electronic charge transfer transitions between the metal and the ligand, which are tunable by virtue of the nature, oxidation state and coordination sphere of the metal center [1,2]. As part of the design of novel NLO materials, much effort is being devoted to understand the origin of non-linearity in large systems

and to correlate NLO responses with molecular structure and geometry [3]. Metal-organic hybrids also offer interesting advantages when respect to both pure organics and pure inorganic materials in that they may be reliably designed by integrating highly predictable structural features, such as hydrogen bonds and coordination bonds, in each of these cases which are used jointly to achieve spatial and dimensional control in organic-inorganic hybrid [4]. Compounds containing α -amino acids and inorganic salts became an alternative to popular inorganic crystals. Complexes of L - Proline with alkali metals [5,6], alkaline earth metal [7] and transition metals [8-10] have been reported. Growth and its characterization of L - proline cadmium chloride monohydrate [11], dibromo bis (L - proline) Cd (II) [12], L - proline lithium bromide monohydrate [13] have been reported. Crystal structure of metal coordination

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Giant Dielectric Constant, Dielectric Relaxations, and Tunable Properties of $\text{Sm}_{2/3}\text{Cu}_3\text{Ti}_4\text{O}_{12}$ Ceramics

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Abstract

The polycrystalline $\text{Sm}_{2/3}\text{Cu}_3\text{Ti}_4\text{O}_{12}$ ceramics have been prepared by the solid-state reaction. The crystallinity of the compound has been investigated by Rietveld refinement which has revealed a cubic structure with space group $Im\bar{3}$. It is observed that at low frequencies, $\text{Sm}_{2/3}\text{Cu}_3\text{Ti}_4\text{O}_{12}$ ceramic exhibits tremendously high values of dielectric permittivity ϵ' , larger than 22,000, at room temperature. Two distinct, thermally triggered, dielectric relaxations have been noted. This mechanism has been confirmed through impedance analysis of the ceramics. The complex impedance plane shows three semicircles, which confirm the existence of two dielectric relaxations in $\text{Sm}_{2/3}\text{Cu}_3\text{Ti}_4\text{O}_{12}$ ceramics. In general, the electrical as well as dielectric behaviour of $\text{Sm}_{2/3}\text{Cu}_3\text{Ti}_4\text{O}_{12}$ ceramics are seen to be reasonably analogous to those of $\text{CaCu}_3\text{Ti}_4\text{O}_{12}$ ceramics. The emergence of the enormous dielectric constant in $\text{Sm}_{2/3}\text{Cu}_3\text{Ti}_4\text{O}_{12}$ ceramic is accredited to the combined effect of polarization both at the sample-electrode interface as well as at the insulating grain boundary interface. The $\text{Sm}_{2/3}\text{Cu}_3\text{Ti}_4\text{O}_{12}$ ceramics are identical to the CCTO ceramics in their structure and composition and hence, as the above results indicate, the IBLC effect mechanism, originally put forward for CCTO ceramics, is furthermore plausible to account for the mammoth values of dielectric constant in $\text{Sm}_{2/3}\text{Cu}_3\text{Ti}_4\text{O}_{12}$ ceramics.

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Origin of colossal dielectric behavior in hydrothermally prepared non-stoichiometric α - MnO_2 nanorods

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ABSTRACT

Precise incorporation of defects into transition metal oxides is gaining scientific interest among researchers as a pertinent variable for tuning their functional properties. Herein we report an unusual behavior in the dielectric properties of a MnO_2 nanorods prepared by hydrothermal method. Recently, we have reported the origin of ferroelectricity in α - MnO_2 nanorods prepared by co-precipitation method which has been ascribed to the cooperative Jahn-Teller (JT) distortion prevailing in the sample due to defect induced non-stoichiometry. However, ferroelectricity is found to be absent in the hydrothermally prepared sample. Instead the new non-stoichiometry has resulted in the origin of peculiar features like temperature independent dielectric response, very high dielectric constant and low dielectric loss which are the characteristics of colossal dielectric materials. This opens up the prospect of usage of α - MnO_2 as a possible candidate for capacitive applications. A thorough investigation into the inter-link between the structural and dielectric properties has disclosed that the novel exotic properties are a result of the non-stoichiometry-triggered interplay between space charges and dipoles within the interior of the nanorods.

1. Introduction

The pragmatism of defect engineering on transition metal oxides (TMOs) is gaining immense interest among the scientific community. When imperfections are introduced to the crystal lattice, unexpected and unprecedented changes occur in their physical and chemical properties, which bear great potential for technological applications. Among the metal oxides, manganese dioxide (MnO_2) exhibit two distinguishing features namely, rich polymorphism and structural flexibility. The ability of the metal cation, Mn to exist in different valence states [1] can be hypothesized as a key factor for enabling tailor-tuned properties in MnO_2 . Among the different polymorphic variations, hollandite type cryptomelane MnO_2 (α - MnO_2) consists of a basic MnO_6 octahedra sharing corners and edges to form a 2×2 tunnel framework as depicted in Fig. 1. The inclusion of K^+ ions into the 2×2 tunnel space, so as to

maintain charge neutrality, leads to the associated presence of Mn^{3+} and Mn^{4+} cations [2]. Along with its characteristic feature like low toxicity, environmental compatibility and natural abundance [3], the α phase also possess easily interchangeable stable oxidation state and tunnel framework which makes them beneficial in fields of energy storage [4], batteries [5], biosensors, molecular sieves [6] and catalysts [7]. The versatility of α - MnO_2 to cope with the lattice modifications, thereby enhancing its features for robust applications, makes the material a suitable candidate for defect assisted tuning of properties.

For the past few decades, intrusion of foreign dopants in a material has been the major strategy involved in inducing defects and non-stoichiometry in material. Besides these extrinsic defects, it is understood that intrinsic defects like vacancies and interstitials are also capable of changing the properties of an oxide material. Apart from the contribution of Mn^{3+} cations maintaining charge neutrality within the

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Morphological and thermal studies of mesoporous $\text{TiO}_2\text{-ZrO}_2$ and $\text{TiO}_2\text{-ZrO}_2$ -polymer composites as potential self cleaning surface

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ABSTRACT

Inorganic organic composites have significant importance in various fields including self cleaning displays, photocatalysis, solar energy conversion etc. The synthesis of polymer capped inorganic frameworks consisting oxides of Ti and Zr had been accomplished in a straightforward cost effective method. In this work, $\text{TiO}_2\text{-ZrO}_2$ -Pluronic F127 composites were synthesized using sol-gel process in the presence of chelating ligand diethanediamine, which acts as a reaction inhibitor for hydrolysis and condensation of Ti and Zr alkoxide. For comparative studies, $\text{TiO}_2\text{-ZrO}_2$ composite sample under the same atmospheric conditions were also prepared. The structural and thermal properties were investigated using scanning electron microscopy (SEM), transmission electron microscopy (TEM), Fourier transform infrared spectroscopy (FTIR), water contact angle measurement (WCA) and thermogravimetric analysis (TGA-DTA). The textural parameters such as surface area, pore volume and pore diameter were analyzed using nitrogen sorption analysis. The water contact angle measurements have shown that the synthesized polymer-based composite material was superhydrophilic.

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1. Introduction

Sol-gel synthesis route has received an overwhelming attraction in the recent past as it helps to synthesize composite materials with cheap and non-hazardous precursors [1]. This method provides a versatile approach to fabricate homogeneous organic-inorganic composites with improved chemical composition and better purity [2]. Under mild conditions the organics can survive in such composites. Polymer based nanocomposite materials exhibit novel properties other than those shown by inorganic composites such as increased strength of both organic polymers (functionalization, simple way of processing, toughness and dielectric) and inorganic materials (chemical and thermal stability, high refractive index, transparency and rigidity) [3]. The main advantage of fabrication of nanocomposites by growing nanoparticles from corresponding precursors in presence of polymer chains is

that it can prevent any unwanted irreversible particle aggregation which may occur due to isolation and handling process [4]. Incorporation of binary metal oxide particles into polymer to prepare hybrid materials is a promising technology since it leads to manufacturing of composite materials with high hydrophilicity, antifouling and anti-compaction properties [5]. Inorganic frameworks capped with polymer have promising applications in the field of solid catalysts, thermal insulators, chromatographic support materials, battery materials and photonic crystals [6].

Photocatalytic surfaces especially containing TiO_2 have the additional advantages of absorbing air pollutants such as NO_x , SO_2 , and particulate matter where it undergoes decomposition and forms by-product such as limestone or mineral stones which can be easily washed out by rain [7]. The incorporation of a secondary phase also gives additional functionality, of enhanced surface chemistry particularly surface acidity, to the hierarchically porous composites [8]. By varying the composition of TiO_2 and incorporation of some carriers can make TiO_2 in the anatase phase for obtaining larger pore size and specific surface area $\text{TiO}_2\text{-ZrO}_2$

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