

ST. CYRIL'S COLLEGE  
ADOOR  
ESTD. 1981



**ST. CYRIL'S COLLEGE, ADOOR**

**Criterion 3**

**3.3.2**

**Research Publications in Journals**



## Development and characterization of organoclay filled polyetherimide nanocomposites for anticorrosive coatings

Ajith James Jose<sup>a</sup>, Francis Chacko<sup>b</sup>, Runcy Wilson<sup>c</sup>, Muthukaruppan Alagar<sup>d</sup>

Show more ▾

Outline | Share | Cite

<https://doi.org/10.1016/j.matpr.2020.05.232>

Get rights and content >

### Abstract

Polyetherimide (PEI)/organically modified Fluorohectorite (OFH) nanocomposite were prepared by dispersing OFH in PEI matrix. The structural as well as morphological characteristics of the nanocomposites were investigated using X-ray diffraction (XRD), Scanning Electron Microscopy (SEM), Atomic Force Microscopy (AFM) and Transmission Electron Microscopy (TEM). The thermal and mechanical properties of the PEI nanocomposites were found to be significantly improved by the incorporation of organically modified fluorohectorite nano clay into the PEI matrix. The water uptake of the nanocomposites was investigated in detail as a function of clay content and it was minimum for composites with 3 wt% of filler. The anticorrosion properties of clay polymer nanocomposite (CPN) coatings were evaluated by means of various electrochemical methods which include Electrochemical Impedance Spectroscopy (EIS) and Open Circuit Potential Measurements (OCP). The results obtained from various analyses showed that the PEI/OFH nanocomposites coatings possess better anticorrosion properties.

< Previous

Next >

### Keywords

Nanocomposite; Anticorrosion; Dispersion; Agglomeration; Impedance

Susan Alexander

## Appealing through Visual and Sonic Elements: Hard Rain Project - Affect and Effect

### Abstract

Hard Rain Project, the UNESCO Education Prize winning poster exhibition combining photographs depicting environmental, social and political issues captured by Mark Edwards coupled with the song "A hard rain's gonna" fall by Bob Dylan garnered attention of the whole world in its attempt to realign human systems and natural systems. The affect of aesthetics on the brain is a less explored area demanding more research and calls for deeper studies in the field of aesthetics and neurology and how they interact. This gives rise to studies that can be termed neuroaesthetics and when the element of environment comes in, it further shifts to econeuroaesthetics. This paper is an attempt to look into the changes in perspectives that can be brought about in people who happen to watch the Hard Rain poster exhibition with its amalgamation of pictures and music aimed at realigning thoughts of man about the environment and thus a study in econeuroaesthetics. The ultimate aim is salvaging the planet and the study is on how arts and science can work together in realizing this target and why such interdisciplinary studies become the need of the hour.

Keywords: Aesthetics, Econeuroaesthetics, Fluidifying, Hard rain, Neuroaesthetics

Aesthetics is defined as the ability to receive stimulation from the five senses. Primary emotions experienced by man namely love, desire, and beauty are stimulated by sensory inputs. These inputs triggered feelings, primarily due to exposure to art and beauty can cause changes in the brain and personality and the affect that these create in human beings can be studied under the broad branch of neuroaesthetics. Neuro-aesthetics can be referred to as the study of aesthetics and related brain changes which stem from observation or any of the related activities which takes into its ambit the five senses or any one of them. Semir Zeki, a neurobiologist of the University of London is credited with the coining of the term neuroaesthetics which links



## Anomalous Dielectric Behavior in Co-Doped TiO<sub>2</sub> Nanotubes: Effect of Oxygen Vacancy Mediated Defect Dipole Pairs

Pournami Vijayan P,<sup>1</sup> Poornima Vijayan P,<sup>2,\*</sup> Anoop Chandran,<sup>3</sup> and K. C. George<sup>1</sup>

<sup>1</sup>Department of Physics, S B College, Changanacherry, Kerala 686101, India

<sup>2</sup>Department of Chemistry, Sree Narayana College for Women (Affiliated to, University of Kerala), Kollam 691001, Kerala, India

<sup>3</sup>Department of Physics, St. Cyril's College (Affiliated to University of Kerala), Adoor, Pathanamthitta, Kerala, India

Titanium dioxide (TiO<sub>2</sub>) nanotubes are considered to be unique in terms of their physical properties and high dielectric constant. The oxygen vacancies in TiO<sub>2</sub> play a crucial role in the dielectric behavior, which can be tuned by doping with proper materials. Herein, the changes in the dielectric behavior, as well as defect concentration of TiO<sub>2</sub> nanotubes by Cobalt (Co) doping, have been evaluated. For this purpose, Co-doped TiO<sub>2</sub> nanotubes have been synthesized by using combined sol-gel and hydrothermal methods. By analyzing photoluminescence spectra, the intensities and positions of five emission peaks are clearly assigned. The PL peaks could be sensibly explained by various mechanisms, such as direct allowed transition, oxygen vacancies, and self-trapped excitons. The dielectric behavior of Co-doped TiO<sub>2</sub> nanotubes with controlled oxygen vacancies is explained. The dielectric constant is particularly at its highest in higher Co-doped TiO<sub>2</sub> nanotubes. The current investigation provides new insight into the mechanisms underlying the anomalous dielectric properties shown by Co-doped TiO<sub>2</sub> nanotubes, as evident from the movement of oxygen vacancies. It demonstrates the influence of defect dipoles, 2Co<sub>Ti</sub>-Vo<sup>••</sup>, in the anomalous dielectric behavior observed for Co-doped TiO<sub>2</sub> nanotubes.

© 2021 The Electrochemical Society ("ECS"). Published on behalf of ECS by IOP Publishing Limited. [DOI: 10.1149/2162-8777/ac344a]

Manuscript received October 24, 2021. Published November 22, 2021.

Titanium dioxide (TiO<sub>2</sub>) has prodigious importance in applications such as microwave electronics and capacitors, which is ascribed to its extremely good dielectric constant.<sup>1-5</sup> Most of these applications are circumscribed to TiO<sub>2</sub> thin films as well as nanoparticles. A large surface-to-volume ratio, favorable transport pathways, and intertube boundary regions engender nanotube structures to be more prominent compared to other morphologies.<sup>6</sup> The peculiarities of a nanotubular structure combined with the specialties of TiO<sub>2</sub> material can lead to an astounding effect on the electrical properties, which can improve the efficiency of capacitors and resistance switching memory devices.

The electrical and optical properties of TiO<sub>2</sub> are closely related to its size, morphology, and defect concentration.<sup>7</sup> Oxygen vacancies are a very important type of defect in TiO<sub>2</sub>, which can lead to drastic modification of optical and electrical properties.<sup>8</sup> Nonstoichiometry<sup>9</sup> and the related Ti/O ratio, have been described in terms of the formula TiO<sub>2-x</sub>, where x is the extent of the oxygen deficiency. Therefore, the properties of TiO<sub>2</sub> may be changed in a wide range of nonstoichiometries. There is immense interest in the synthesis of TiO<sub>2</sub> with controllable oxygen vacancies and exploitation of the resulting distinct properties. The concentration of oxygen vacancies can be altered by doping with proper 3d transition metal ions, in which the dopant acts either as an acceptor or donor.<sup>10-12</sup> Various unique physical properties of 3d transition metal ions make them attractive for altering the optical as well as electrical properties of host semiconductors.<sup>13</sup> Cobalt, a transition metal ion, has been proved as a competent dopant that leads to striking changes in the optical and magnetic properties of TiO<sub>2</sub>.<sup>14-18</sup> Co-doped TiO<sub>2</sub> thin films have drawn attention because of their significant applications in spintronics.<sup>19</sup> The Co-TiO<sub>2</sub> system with the combination of nanotechnology makes this a promising material. A remarkable improvement in material properties can be expected if TiO<sub>2</sub> nanotubes are doped with cobalt.

The present study examined the role of cobalt ions in controlling the oxygen vacancies in TiO<sub>2</sub> nanotubes. The controlled properties can be achieved by using an appropriate combination of defects. An oxygen vacancy is formed by the transfer of an oxygen atom on a normal site to the gaseous state. The two trapped electrons (e<sup>-</sup>) associated with the vacancy may be excited and freed from the vacancy depending on the temperature. In this case, the vacancy acts

as a donor and becomes singly (Vo<sup>•</sup>) or doubly charged (Vo<sup>••</sup>).<sup>20</sup> This charge will increase the majority carrier electron concentration, which shapes the electrical behavior in TiO<sub>2</sub> nanotubes. In addition, changes in the oxygen vacancy concentration can lead to a phase transition from anatase to rutile.<sup>7</sup>

Previous studies considering the effect of oxygen vacancies in Co-doped TiO<sub>2</sub> have been confined to the magnetic and optical properties of thin films,<sup>15,18,21</sup> nanoparticles<sup>14,17</sup> and bulk TiO<sub>2</sub>.<sup>19</sup> For example, Santara et al. reported the vital role played by oxygen vacancies in the ferromagnetism observed in cobalt-doped TiO<sub>2</sub> nanoparticles.<sup>17</sup> Very few studies have reported on the electrical properties of cobalt-doped TiO<sub>2</sub>, which are constricted only to the bulk particles as well as to below room temperature.<sup>16,20</sup> Okutan et al.<sup>20</sup> have shown an improvement in the dielectric constant of Co-doped TiO<sub>2</sub> particles with temperature for temperatures ranging from 100 K–275 K, which is attributed mainly to the polarization related to the thermal motion of the electrons. Photoelectrocatalytic activities of Co-doped TiO<sub>2</sub> nanotubes synthesized were well reported. It was found that cobalt doping could improve the photocatalytic performance of the titanium dioxide nanotube under ultraviolet light.<sup>21</sup> Lim et al.<sup>22</sup> employed cobalt-doped black TiO<sub>2</sub> nanotube array grown via electrochemical anodization for the purpose of peroxymonosulfate (PMS) activation for the removal of organic pollutants. Recently, Wtulich et al. studied the photoelectrocatalytic activity of cobalt doped titanium dioxide nanotube prepared via hydrothermal method.<sup>23</sup> Studies on the dielectric behavior in TiO<sub>2</sub> nanotubes doped with Co via the hydrothermal method still remains lacking. A detailed study of the dielectric behavior for TiO<sub>2</sub> nanotubes doped with Co above room temperature should be essential to explore the advantages of nanotubes with doping for high-temperature applications.

In the present article, TiO<sub>2</sub> nanotubes doped with varying concentrations of cobalt are successfully synthesized by the sol-gel method combined with hydrothermal processing. Sol-gel processing along with the hydrothermal method is the simplest and cheapest way to achieve effective doping in TiO<sub>2</sub>, and this method has been reported to be used for the doping of TiO<sub>2</sub> with Fe.<sup>24</sup> The success of sol-gel synthesis lies in the possibility of working at low temperatures and attaining good homogeneity in the solution phase. The optical and AC conductivity studies of the prepared Co-doped TiO<sub>2</sub> nanotubes have been previously reported.<sup>25</sup> The current investigation details its dielectric properties. The dielectric constant and dielectric loss in the frequency range 1 KHz–1 MHz and temperature

# Development of Highly Stable Carbon Nanotube Incorporated Polyvinyl Alcohol Composite Films for EMI Shielding Applications

O. Lekshmi<sup>1</sup>, Anoop Chandran<sup>2,b)</sup>, Runcy Wilson<sup>3</sup>, Reenu Elizabeth John<sup>4</sup> and Issac Paul<sup>1,a)</sup>

<sup>1</sup>Department of Physics, St. Berchmans College, Changanassery, Kerala 686101, India.

<sup>2</sup>Department of Physics, St. Cyril's College Adoor, Kerala 689694, India.

<sup>3</sup>Department of Chemistry, St. Cyril's College Adoor, Kerala 689694, India.

<sup>4</sup>Department of Physics, Saintgits College of Engineering, Kottayam, 686532, India.

\*corresponding author: issacpaul@gmail.com

\*corresponding author: anoopc23@gmail.com

**Abstract.** Rapid advancement in the usage of electronic devices in recent years underlines the necessity for the fabrication of highly efficient electromagnetic interference (EMI) shielding materials. The present work reports development of an EMI shielding material prepared by combining into a single whole, an environmental friendly polymer-polyvinyl alcohol (PVA) and highly conducting filler-multiwalled carbon nanotubes (MWCNT). These flexible PVA/MWCNT composite films are fabricated via solution casting method. The surfactant, sodium dodecyl sulfate has ensured the uniform dispersion of filler which is confirmed by FE-SEM analysis. Interestingly, the surfactant all by itself is found to reduce the OH content and is verified through FTIR. The electrical conductivity of the sample is optimized by varying parameters. Thus, we have achieved a highly conducting composite film with a good EMI shielding effectiveness of ~ 20 dB without using cross linking agents and yet reducing the OH content thereby making the material a stable one.

## I. INTRODUCTION

The quick progress in the field of electronic devices and communication yields extensive radiation problems and it causes imperfections in the functioning of devices and severely affect human lives [1,2]. In order to reduce these problems some electromagnetic shielding materials like metals, metal based composites and carbon based composites are employed. Metal based shielding materials have many drawbacks such as corrosion tendency, heavy weight, lack of flexibility and so on [3]. Nowadays, carbon based polymer composites which possess remarkable properties such as low density, easy processing, flexibility and tunable conductivity, can substitute over metal shielding [4]. Among various conductive fillers, carbon nanotubes and graphene create good conductive networks in matrix which are important in enhancing conductivity properties [5]. High aspect ratio of fillers provide better mechanical and electric transport properties [3]. Electrical and thermal properties of composites can be improved by developing conductive networks by maintaining uniform dispersion of fillers in matrix. However, the quest for an efficient EMI shielding material which is inexpensive as well as environmental friendly is still on.


This work includes a description of polyvinyl alcohol (PVA) based composites with carbon nanotube (CNT) fillers. Although there are many reports on PVA/CNT composites with even higher shielding efficiency, the synthesis methods adopted are complex and expensive. More importantly in this work, the hygroscopic nature of PVA, which has been one of the prime demerits of PVA based composites in various applications, is substantially reduced without using a crosslinking agent. This is a monumental achievement and hence the study of such a composite is of extreme significance.



*Handwritten signature and notes:*  
By [Signature]  
Date: 2 hours

## ARTICLE

# Robust polymer incorporated TiO<sub>2</sub>-ZrO<sub>2</sub> microsphere coatings by electrospraying technique with excellent and durable self cleaning, antibacterial and photocatalytic functionalities

Sanu Mathew Simon<sup>1</sup> | Gejo George<sup>1</sup> | Anoop Chandran<sup>2</sup> |  
Prakashan Valparambil<sup>1</sup> | Sajna M. Shamsudeen<sup>1,3</sup> | A. C. Saritha<sup>1</sup> |  
P. R. Biju<sup>1</sup> | Sabu Thomas<sup>4,5</sup> | Cyriac Joseph<sup>1</sup> |  
Unnikrishnan N. Vishwambharan<sup>1</sup> 

<sup>1</sup>School of Pure and Applied Physics, Mahatma Gandhi University, Kottayam, India

<sup>2</sup>Department of Physics, St. Cyril's College, Adoor, India

<sup>3</sup>Department of Optoelectronics, University of Kerala, Trivandrum, India

<sup>4</sup>School of Chemical Sciences, Mahatma Gandhi University, Kottayam, India

<sup>5</sup>International and Inter University Centre for Nanoscience and Nanotechnology (IUCNN), Mahatma Gandhi University, Kottayam, India

## Correspondence

Unnikrishnan N. Vishwambharan, School of Pure and Applied Physics, Mahatma Gandhi University, Kottayam 686 560, India.

Email: nvu100@yahoo.com

## Funding information

DST, INDIA, Grant/Award Number: DST-PURSE PII (SR. 417 & SR. 416 dated 27-2-2017); University Grants Commission, Grant/Award Number: Dr. D.S Kothari Post-Doctoral Fellowship (F.4-2/2006 (BSR)/PII/18-19/0037)

## Abstract

The applications of self-cleaning coatings on large scale are limited due to their poor durability, remnants of hazardous by-products and lack of biocompatibility. We propose to solve this problem by developing TiO<sub>2</sub>-ZrO<sub>2</sub> composite-based self cleaning coatings. In order to achieve this task another important aspect was to select biocompatible polymers poly (methyl methacrylate) and pluronic F-127 (PF-127) as they can enhance the self-cleaning capability of TiO<sub>2</sub>-ZrO<sub>2</sub> which itself is biocompatible and endowed with anti-bacterial capability. The selection of a preparation technique that could produce coatings mimicking the nature has also been important and hence Electrospraying technique was selected as the processing method. The samples were then characterized using various techniques like field emission scanning electron microscopy, X-ray diffraction, high resolution transmission electron microscopy, Brunauer-Emmett-Teller analysis, and so forth to fathom the interlink between observed properties and morphology. High quality superhydrophobic and superhydrophilic films have been generated and the surfaces were modulated by the addition of tri-block co-polymer which was found to provide swapping of superhydrophobic nature to superhydrophilic nature. The integration of superhydrophobic, superhydrophilic, photocatalytic and antibacterial properties in the prepared microsphere coatings is a unique achievement and may interest those in the quest for self-cleaning materials for antibacterial coatings in mitigating surgical site infections, medical implants, coronary stent surfaces, and so forth.

## KEYWORDS

antibacterial activity, electrospraying, microspheres, photodegradation, self-cleaning materials, sol-gel materials



## 22. SURVIVOR LITERATURE: NOT A VICTIM BUT A VICTOR- READING NADIA MURAD'S *THE LAST GIRL* AND HALIMA BASHIR'S *TEARS OF THE DESERT*

**Ms. Mariam John**

Assistant Professor, St Cyril's College, Adoor

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.

Survival stories are one of the genres of Popular fiction. It belong to two different sub genres- Fiction and Nonfiction. Survival Fiction are fictional accounts of surviving an incident, whereas survival non-fiction belong to personal accounts of victims on how they have endured and are liberated at last.

The Holocaust and the Jewish genocide were the first reminders of Survival Literature. Survival stories express the representation and recovery of the people who are left behind alive. Literature on Holocaust experiences explores the impact of the Nazi genocide on Jews during