RESEARCH PROPOSAL

on

STRUCTURAL AND ELECTRICAL STUDIES ON PURE AND Mn DOPED LANTHANUM NICKEL OXIDE NANOPARTICLES

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ABSTRACT

Rare-earth compounds are of immense significance due to the presence of *f*-orbital electrons and the resultant magnetic, electronic, catalytic,chemical and optical qualities. This leads to their practical application in diverse fields, such as luminescent devices or phosphors (component in LEDs, household compact fluorescent lamps, high-resolution flat panel displays), medical diagnostics and imaging, biochemical probes, powerful magnets, sensors, and in the catalysis of some technically important chemical processes. However, much attention has recently been devoted to the synthesis of rare-earth-based compounds in nanometric dimensions that can perform multiple functions, such as fluorescence imaging, drug delivery, and so on. In this mini review, a short summary of the applications of rare-earth nanomaterials in the fluorescent labelling of cells, MRI contrast imaging, and dual imaging modalities have been discussed.

INTRODUCTION

Nanomaterials are cornerstones of nanoscience and nanotechnology. Nanostructure science and technology is a broad and interdisciplinary area of research and development activity that has been growing explosively worldwide in the past few years. It has the potential for revolutionizing the ways in which materials and products are created and the range and nature of functionalities that can be accessed. It is already having a significant commercial impact, which will assuredly increase in the future. The new advanced technologies need new materials with improved characteristics, like lower weight, higher resistance to environmental exposures, lower production costs, higher strength and durability. In order to fulfil these requirements, scientists strive to find solutions among more sophisticated materials, *i.e.* composites. Composites are systems "composed" of two or more physically distinguishable components that combine the individual properties of their constituents and yield new features and better performances. Although the concept of composite materials has been known for thousands of years, recent advances in this field are particularly appealing. The origin of the renascence of composites lies in the progress of the synthesis of nano particular materials as fillers, resulting in new properties.

Therefore, the today's composites offer a great variety of properties and find numerous applications in various industrial branches, including: aerospace, automotive, electronics, construction, energy, bio-medicine, just to name a few of them. Furthermore, composite materials have improved the properties of a plethora of everyday products.The high-energy-density capacitors are the promising power source and have attracted considerable attention in recent years. The increasing pollution due to electrical vehicles and explosive growth of portable electronic devices has pushed the development of highperformance supercapacitors as the urgent requirement.

Polymer-based composites with excellent dielectric performance are currently very popular topics in the field of materials science, and have received increasing attention in recent years .

Polymers are presently the materials for energy storage applications because of their features such as high electric breakdown field, low dielectric loss, easy processing, and low cost. However, the dielectric constant (k) of common polymers is low (i.e. $k < 3$). Thus, a key issue is to enhance dielectric constant of polymers while retaining other excellent performances. Such composites could be useful as high-energy-density capacitors .

LITERATURE REVIEW

- High-surface carbons, noble metal oxides, and conducting polymers are the main families of electrode materials studied for supercapacitor applications. Conductive polymers have been extensively studied in supercapacitors. The main conductive polymer materials that have been investigated for the supercapacitor electrode are polyaniline (PANI), polypyrrole (PPY), poly thiophene (PTH) and their derivatives, and so on. Among these polymers, PANI is considered the most promising material because of its high capacitive characteristics, low cost, and ease of synthesis. However, the relative poor cycling life restricts its practical applications. Recently, advancement of nanoscale binding technique provides an innovative route to prepare PANI-based composites with better performance as electrode material. It has been demonstrated that PANI composite with metal oxides exhibit improved supercapacitor performance.

- Graphene is a two-dimensional form of graphite, the high surface area, excellent mechanical properties and conductivity of this new material have attracted great interests. Graphene oxide, bearing oxygen functional groups on their basal planes and edges, is a single sheet of graphite oxide and exhibits good performance. It can be obtained by exfoliation of graphite oxide. The tunable oxygenous functional groups of graphene oxide facilitate the modification on the surface and make it a promising material for composites with other materials. Recent reports on ultracapacitors based on graphene have attracted great interest. Many graphene composites with conducting polymers have been developed.However, the effect of raw graphite material sizes and feeding ratios on the electrochemical properties of such composites have not been investigated intensively l5].
- Cheng Yang et al reported that the multiwall Carbon nanotube (MWCNTs) -polypyrrole (PPy) composites prepared by an inverse microemulsion polymerization. Transmission electron microscopy, X-ray photoelectron spectroscopy and Raman spectroscopy indicated that the MWCNTs were coated with PPy. The composites presented a stable high dielectric constant (~44), rather low loss «0.07), and large energy density (up to 4.95 J cm"). Such MWCNT composites can be used to store charge, high-energy-density capacitors and electrical energy and playa key

role in modern electronics and electric power systems .

- Qun Li et al reported that the chemically purified multiwalled carbon nanotubejpoly(vinylidene fluoride) (MWCNT jPVDF) composites were fabricated. Raman spectroscopy and transmission electron microscopy
  indicated that the catalysts metal particles amorphous
  The most important result is that the dielectric constant
- Ranulfo Allen et al suggested a method to align carbon nanotubes with in-situ polymerization of conductive polymer to form composite films and fibers. Use of the conducting polymer raised the conductivity of the films by 2 orders of magnitude. The carbon nanotub conductive polymer composite films and fibers had conductivities of 3300 and *170 Sjcm*, respectively. The relatively high conductivities were attributed to the polymerization process, which doped both the SWNTs and the polymer. In-polymerization can be a promising solution-processable method to enhance the conductivity of carbon nanotube films and fibers .
- Chuang Peng et al reported that composites of conducting polymers (CP) and carbon nanotubcs (CNT) show improved mechanical, electrical, and electrochemical properties compared with conducting polymers alone, leading to a wide variety of applications including sensors, catalysis, and energy storage. CP-CNT composites combined the large pseudocapacitance of the polymers and the mechanical and structural properties of the nanotubes and are thus highly promising in novel supercapacitors with ultra-

high capacitance and power density. Three methods have been developed to prepare CP-CNT composites.

OBJECTIVES

The proposed research work covers the structural and electrical studies on pure and Mn Doped Lanthanam Nickel Oxide of Nanoparticles and nanostructure based polymer composites to form the basis of new materials and processes of interest for future applications.

- The objectives of the proposed research problem will come in shape with following experimental steps:
- The physicochemical structural properties will be analyzed by in situ X-ray diffraction (XRD) and Raman spectra.
- The morphological properties will be studied using Scanning Electron Microscopy (SEM) and Transmission Electron Microscopy (TEM) Characterization.
- The electrical properties i.e. dielectric constant, impedance, resistivity, capacitance,tangent loss etc. will be studied using impedance analyzer.
- Finally a comparative study will be done to draw concrete conclusions.

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