SYNTHESIS AND STRUCTURAL PROPERTIES OF NICKEL DOPED CERIUM OXIDE

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The real impact of nanoparticles and nanomaterial synthesis are increasing day by day due to their overwhelming properties and miniaturization and also high energy with low size. The present paper aims of the structural property changes on doping of nickel compounds with cerium oxide where nickel is a ferromagnetic material with higher magnetization property which tends to give O^- valency in the media. The study aimed is to discuss the structural changes and magnetic property between the compound. The various parameters like structural confirmation, doping levels of nickel, JCPDS verification., were observed in analysis.

Keywords: *Nickel, cerium oxide, Doping, JCPDS.*

I. INTRODUCTION:

Nanomaterials is the interdisciplinary crossing the boundary between nanoscience and nanotechnology to link the two areas together. It primarily deals with synthesis, characterization, exploration, and exploitation of nanostructured materials. These materials are characterized by at least one dimension in the nanometre range. A nanometre(nm) is one billionth of meter, or 10^{-9m}. one nanometre is approximately the length equivalent to 10 hydrogens or 5 silicon atoms aligned in a line.

The processing, structure and properties of materials with grain size in the tens to several hundreds of nanometer range are research areas of considerable interest over the past years. A revolution in material science and engineering is taking place as researchers find ways to pattern and characterize materials at the nanometre length scale. New materials with outstanding electrical, optical, magnetic and mechanical properties are rapidly being developed for use of information technology, bioengineering, and energy & in environmental applications.

Nano- sized materials currently are used in numerous industries, e.g.: carbon black particles makes rubber tires wear resistant; nanofibers are used for insulation and reinforcement of composites; iron oxide creates the magnetic material used in disk drives and in audio-video tapes; Nano-zinc oxides and Titania are used as sunblock's for uv rays; etc. Nanoscale particles and Nano thin layers of materials are being used, among other things, to make products lighter, stronger or more conductive. Some of the products on the market using nanotechnology are: magnetic recording tapes; computer hard drives; bumpers on cars; solid-state compasses; protective and glare- reducing coatings for eyes glasses and windows; automobile catalytic converters; metal cutting tools; dental bonding agents; longer-lasting tennis ball; burn and wound dressing; ink etc. promising applications of nanotechnology in medicine and biology have attracted a lot of attention and have become fast growing field. One of the attractive applications in medicine is the creation of nanoscale devices for improved therapy and diagnostics. Such nanoscale devices or nanorobots serves as vehicles for delivery of therapeutic agents, detectors or guardians against early disease and perhaps repair of metabolic or genetic defects. For applications in medicine, the major challenge is "miniaturisation": new instruments to analyse tissues literally down to the molecular level, sensors smaller than a cell allowing to look at ongoing functions, and small machines that literally circulate within a human body pursuing pathogens and neutralising chemical toxins.

Researchers expect to develop new *commercial applications for nanotechnology* for the next several years. They include: advanced drug- delivery systems, including implantable devices that automatically administer drugs and sense drug levels; medical diagnostic tools, such as cancer- tagger mechanisms and "lab on a chip" diagnostic for physicians; cooling chips or wafers to replace compression in cars, refrigerators, air conditioners and other devices, using no chemicals or moving parts; sensors for air borne chemicals and other devices; solar cells and portable power to provide inexpensive, clean energy etc.

II. OBJECTIVE OF THE STUDY:

[1] Synthesizing Nickel Doped Cerium Oxide.
[2] Confirming its structural changes.
[3] Finding the parameters validation with JCPDS data.

III. METHODOLOGY:

In this method of "Synthesisation" was done by Combustion technique where nickel nitrate, cerium oxide, succinic acid and urea introduced in to high hot furnace which doesn't disturbed due to external surroundings. Furtherly these particles are introduced in to annealing process too. By this nanoparticle are synthesized in a restricted and controlled conditions manner.

IV. EXPERIMENTAL SETUP:

This "Synthesisation" Process has been carried out using closed hot furnace where the 1:2 molar concentrations of nickel nitrate and cerium oxide has been deployed for 500° C for the surface volume ratio decreasing process for nanoparticle configuration and it has been annealed with 200° C for nine hours for the eradicating unwanted bonds to get crystalline nature of synthesized material (compound). These materials highly magnetic in nature due to its O^- mobility.

V. FIGURES:

Fig 1: The mixture boils foams and ignites to burn with flames to yield voluminous foamy Ni doped cerium Oxide.

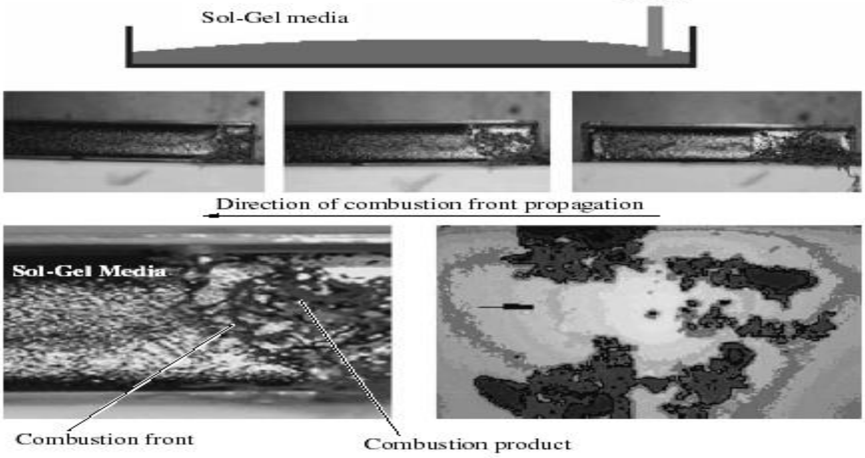

Fig 2 : Direction of Combustion technique

VI. RESULTS:

The XRD patterns could be indexed to the Fm$\bar{3}$m space group, face-centered cubic structure with cell parameter a = 5.4602 Å.

Table1:Unit Cell Parameters, Volume and Crystallite size

Sample	a(Å)	Crystallite size (nm)
$Ce_{(1-x)}Ni_xO_2$ (x = 0.1)	5.404	10
$Ce_{(1-x)}Ni_xO_2$ (x = 0.2)	5.452	21

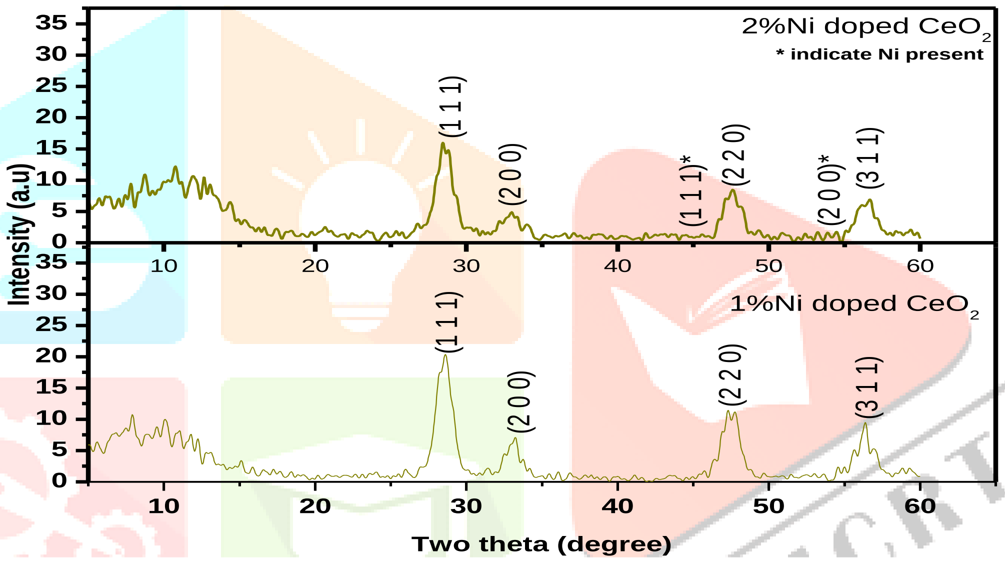

Fig. 3. Typical XRD patterns for different with Ni doping:
(a) Ce $_{(1-0.1)}$Ni$_{0.1}$O$_2$ (b) Ce $_{(1-0.2)}$Ni$_{0.2}$O$_2$,

VII. CONCLUSION:

[1] Nickel Doped cerium oxide are synthesized.
[2] These were analyzed using XRD for structural confirmation.
[3] Variation in concentrations tends to have higher size of the compound.
[4] JCPDS values tends to have coincidently perfect with synthesized material.

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