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Review:
Cerium Oxide nanoparticles in Engineering, biology and medicine.

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Abstract- Cerium Oxide nano particles (CONP) play major role in recent advancement in science. Their properties with unique size make these materials superior in developing field of nano technology. This review highlights the current research into cerium oxide nanoparticles and its application in to various field of applied nanomaterials, biology, medicine, chemical engineering and their future scope.

Keywords- Cerium oxide nanoparticles, applications ,unique size, medicine**,** biology;

1. Introduction

Nanomaterials are at the leading edge of the rapidly developing field of nanotechnology. Their unique size-dependent properties make these materials superior and indispensable in many areas of human activity [1]. Cerium (Ce) is a rare earth element which is a member of the lanthanide series, and is one of the most abundant of the rare earth elements, in earth's crust it is present at about 66 parts per million as a free metal or oxide form [2]. Ce containing materials have attracted wide interest around the globe in fields of ceramics, metallurgy, smart glass materials and also in optics [3-6].

Cerium oxide nanoparticles (CNPs) have been used efficiently in various advanced technologies, such as catalytic materials, solid-oxide fuel cells, high-temperature oxidation protection materials, as an oxygen sensor and solar cells [7–11]. In the last several years, much attention has been paid towards Ce-based compounds because of their popular applications of CeO2 nanoparticles (NPs) in various industrial applications.

The aim of this review is to give a detailed prospective of ceium oxide nanomaterial and its application to various field and to overview the recent developments. cerium oxide has unique properties such as a high refractive index, a high dc dielectric constant and a lattice constant similar to Si, making it suitable as an insulating material in Si device technology[7].

2.1. Properties

2.1.1. Chemical Properties

Chemical Details	
Chemical symbol	CeO_2
CAS No.	1306-38-3
Group	Cerium 3 Oxygen 16
Electronic configuration	Cerium [Xe] $4f^2$ $6s^2$ Oxygen [He] $2s^2$ $2p^4$
Composition	
Element	**Content**
Cerium	81.39
Oxygen	18.60

2.1.2. Physical Properties

Properties	**Metric**	**Imperial**
Density	7.65 g/cm^3	0.275lb/in^3
Molar Mass	172.12 g/mol	-

2.1.3. Thermal Properties

Properties	**Metric**	**Imperial**
Melting point	2400 °C	2400 °C
Boiling point	3500° C	3500° C

3. Applications

The applications Cerium Oxide nanomaterials to engineering,biology and medicine is given below.

- Cancer Treatment-[12-13]
- Catalysts and catalyst support –[14]
- Coatings-[16]
- Electrolyte and/or electrode materials-[17]
- Fuel cell-[18]
- microelectronics and optics-[19]
- Heat resistant alloy Coatings-[20]

4. Cancer Treatment.

In recent years, nanomedicine has gained a lot of interest. It deals with the therapeutical application/use of particles o100nm and represents a promising tool in anti cancer [15].therapy In recent research conducted by Claudia von Montfort show that non-crytotoxic effect of cerium oxide nanoparticles on stromal cells, supporting a prospective therapeutical approach of such particles in context of protection of stromal cells against the oxidative damage playing an important role in pathological disorder such as cancer[12]. The cerium oxide by HT was CeO2 (4+_ and by HL Ce2O3 (3+).The cytotoxicity profile of HT CNPs is a promising result which makes cerium oxide as an anticancer vehicle for prostate cancer cells. Due to its 3+ and 4+ oxidation states it can involve in redox reactions which makes the cerium oxide to act specifically towards cancer and normal cells. Current treatment methods using chemo drugs damage normal cells also, so the specific action of cerium oxide towards normal and cancer cells can be an additional support to the prostate cancer therapy[13]. it This details give provides a firm basis and evidence of a bright future for the pharmaceutical application of Cerium Oxide nano particles (CONP) in cancer.

5. Catalysts and catalyst support

Catalytic based work is very much needed at the worlds gasoline production, it is the most important source of aromatics for the petrochemical industry. In addition, reforming of hydrocarbon on the dual-function catalysts has been found to form fundamentally different products in hydrogen diluents. The presence of La2O3 in the Pt/Al2O3 catalyst promotes aromatization of n-hexane and n-heptane, also the dehydrocyclization of n-hexane is more difficult than that of n-heptanes. Thus, modification of the Pt/Al2O3 catalyst by La, resulted in a more active and selective reforming catalyst [14].

6. Fuel Cell

In the research field of fuel cell, proton exchange membrane fuel cells, the design of electro- catalytic activities on Pt-oxide promoter in the anode side attracted more attention for the improvement of CO tolerance of Pt in anode side and a lowering of large over-potential loss of the oxygen reduction reaction on the cathode in the fuel cells. The recent works for improvement of the CO tolerance of Pt in the Pt–CeOx /C anodes and enhancement of the oxygen reduction reaction activity on Pt in the Pt–CeOx/C cathodes for fuel cell application [16].**7.**

7. Conclusion

Thus the number of potential applications for cerium oxide nano particles (CONP) increase in the market of nanotechnology.

- While current research into the applications of CONPs leaves some questions unanswered, but it provides a firm basis and evidence of a bright future for the application of CONPs in cancer, diabetes, and other ROS-linked disorders that have been a great challenges to the human community.
- As the production of CeO2 increases, so does the usage in the industry and consumer markets.

8.References:

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