



METHOD FOR SYNTHESIS OF ORDERED MESOPOROUS CERIA-ZIRCONIA SOLID SOLUTION

IITM Technology Available for Licensing

Problem Statement

- Bulk ceria incorporated zirconia is widely used as catalyst component for various **oxygen storage applications** in oxygen partial pressure sensing applications, **driving the need for meso-structured counterparts** with high surface area and tunable pore structures.
- Existing methods for synthesizing homogeneous ceria-zirconia solid solutions, including precipitation, sol-gel, hydrothermal, microwave, and other conventional methods.
- These methods often involve cumbersome and tedious steps involving long experimental duration and huge amount of material waste when good textural properties are demanded.
- However, **the major challenge lies on to synthesis of ordered mesoporous materials without collapsing of ordered mesoporous framework** upon removal of the surfactant by calcination procedure.

Technology Category/ Market

Category - Chemicals, Catalysts

Application - Most promising automotive three-way catalyst **and has wide applications in fabricating sensors and various oxygen storage devices.**

Industry - Catalysis Industry, Automotive, Sensors & Electronics, Environmental Remediation, Energy

Market - In 2023, the global chemical catalyst market size was USD 6481.8 million and it is expected to reach USD 9509.1 million by the end of 2029, with a **CAGR of 5.6%** during 2023-2029.

TRL (Technology Readiness Level)

TRL - 4: Technology Validated in Laboratory

Research Laboratory

Prof. P. Selvam, NCCR & Dept. of Chemistry

Intellectual Property

- IITM IDF Ref. 1692
- IN 377506 - Patent Granted

Technology

- The present invention relates to a **method for synthesis and characterization of ordered mesoporous ceria-zirconia solid solutions** using solvent evaporation induced self-assembly (EISA), Pluronic F-127 and a nonionic tri-block copolymer surfactant.
- The invention proposes preparation of **mesoporous Ce_{1-x}Zr_xO₂ (x = 0.25, 0.5, and 5 0.75) by modified EISA method** in a non- aqueous medium by fine tuning of the evaporation process by applying small amount of vacuum.
- **Precursors: Cerium (III) nitrate hexahydrate and Zirconium (IV) oxychloride octahydrate** are used as precursors.
- **Vacuum Evaporation:** The sol is poured onto a petri dish and allowed to evaporate under vacuum, resulting in gel formation.
- **Calcination:** The obtained gel is subjected to **calcination at 385°C** to remove the organic components and obtain mesoporous ceria-zirconia solid solutions.

Key Features / Value Proposition

1

- **Enhanced Synthesis Method:** The invention introduces a modified EISA method that utilizes Pluronic F127 surfactant and vacuum evaporation.

2

- **Narrow Pore Size Distributions:** N₂ sorption isotherms indicate extremely narrow pore size distributions in the range of 3.1 - 3.8 nm.

3

- **Ordered Mesostructures:** This synthesis method resulted in production of **well-defined long range ordered mesostructures with unimodal meso-porosity.**

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