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Synthesis and Microstructural Characterization of Modified Nano-Cerium Silica Mesoporous by Surfactant-Assisted Hydrothermal Method

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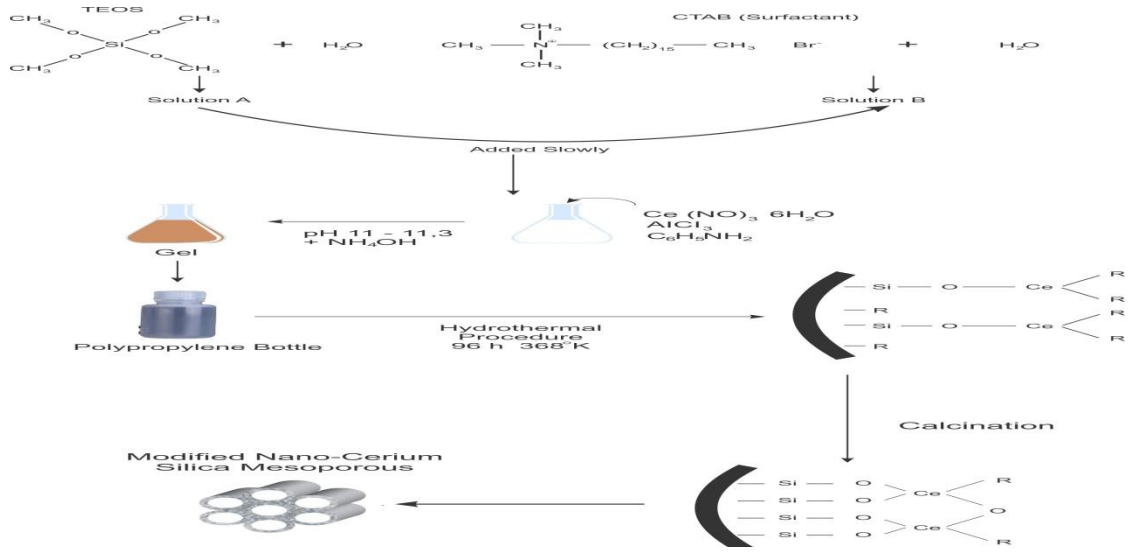
ABSTRACT

Mesoporous silica modified doped nano crystalline cerium oxide (Ceria) has been successfully synthesized by the surfactant-assisted hydrothermal method. The surfactant was used cetyltrimethylammonium bromide (CTAB), tetraethyl orthosilicate (TEOS) was used as a source of silica, cerium nitrate hexa hydrate was used as a cerium source. The comparison of Si/Ce mole is 10 with hydrothermal condition 368^{o}K. Mesoporous silica that is already formed modified with acid Lewis and base Bronsted was Iron (III) chloride and Aniline to increase catalyst activity. The effect of the hydrothermal method showed the at the material produced had a high surface area (~500-700 m^2g^{-1}), narrow pore diameter (~ 2,76-11,74 nm), large of pore volume (~ 0,27 - 1,58 cc g^{-1}) and uniform of pore indicated by N_2 adsorption desorption, transmission electron microscopy (TEM) and scanning electron microscopy (SEM) data. The result of wide angle X-ray diffraction (XRD) showed a specific peak of 2θ mesoporous silica between 20-25 ^{o}. The success of the cerium doping process into the mesoporous silica (MS) and modified mesoporous silica (MMS) pore framework can be seen from the Fourier transform infrared (FTIR) results with the appearance of a new peak and a peak absorption shift. The number of cerium has been doped on MS and MMS as much as 33,131% (MS) and 35,169% (MMS) which can be seen from X-Ray Fluorescence (XRF) analysis. The optical photocatalytic properties tested were analysed by diffuse reflectance UV-visible spectroscopy (DRUV-vis) showed the MMS-Ce light absorption wider than MS-Ce and Ceria so that light capture was more efficiently used as a photocatalyst. Of all the tests that have been done can be concluded that the doping cerium with MMS photocatalysis properties better than doping cerium to MS.

Graphical Abstract



High Lights

- Modified nano –cerium silica mesoporous were synthesized by surfactant-assisted hydrothermal Method.
- Encapsulation Cerium in framework modified mesoporous silica was capable of increasing material reactivity.

Cetyltrimethylammonium Bromide (CTAB) (Surfactant) is used to decrease surface pressure, interface tension, increasing dispersed particle stability, and controlling emulsion formation characteristic.

Keywords: Mesoporous, Nanocrystalline, Cerium Oxide, hydrothermal.