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Synthesis and characterization of (100) surface exposed CeO2 nanocubes as breakthrough catalyst for the oxidation of alkylarene and aryl alcohol in water

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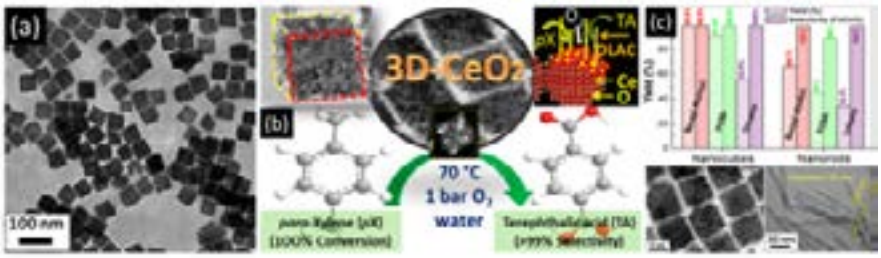
In the recent time CeO_2 nanoparticles (NPs) has attracted intense interest because of its environmental, biological, and energy related applications. Moreover, CeO_2 NPs having well defined morphology and exposed active facets are coveted in a variety of applications, mainly as catalyst in various industrially important oxidation reactions. Here we demonstrated a simple one pot surfactant-assisted colloidal strategy for the morphology controlled synthesis of CeO_2 nanoparticles with various interesting shapes viz., nanopolyhedra, nanorods and only (100) surface exposed size controlled CeO_2 nanocubes by using different cerium precursors. By using XRD, FT-IR, Raman spectroscopy, HRTEM, HAADF-TEM, STEM and SEM technique the phase purity and morphology of the products were confirmed (Figure 1a). Further we applied all these CeO_2 NPs of various morphologies as heterogeneous catalyst for exclusively selective oxidation of industrially important para-xylene to terephthalic acid in environmentally friendly condition for the first time, where water was used as solvent (Figure 1b). Moreover, we have observed the effect of various shapes of CeO_2 NPs in some other organic transformation like in aryl alcohol and toluene oxidation also (Figure 1c). Among all other morphology, CeO_2 nanocube catalyst was found to be very effective in quantitative conversion of all substrates towards the desired oxidation product selectively due to its larger surface area and pore size and the presence of higher concentrations of oxygen vacancies.



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