

$Ce^{IV}O_2/Ce_2^{III}O_3$ -silica composite materials and their catalytic activity for liquid phase organic transformations

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We have synthesized two sets of highly ordered mesoporous $Ce^{IV}O_2$ -doped MCM-41 and MCM-48 silica materials with Ce/Si ratio up to 0.50 in a facile surfactant-assisted hydrothermal method using CTAB as a structure-directing surfactant under ammonia basic conditions. These samples were successfully reduced to $Ce_2^{III}O_3$ -silica species under H_2 gas flow. Bifunctional catalytic activity of these ceria incorporated silica samples have been investigated for oxidation as well as acid catalyzed esterification reactions under mild conditions. Both the oxidation states of ceria have been proved highly efficient catalysts for liquid phase oxidation of numerous hydrocarbons like cyclohexene, styrene, benzyl alcohol, xylene etc. at room temperature under solvent-less condition whereas Lewis acidic role of cerium oxide has been explored by carrying out esterification reaction of various alcohols like benzyl alcohol, octanol, decanol etc. using acetic acid under mild condition. The surface acidic sites present in both $Ce^{IV}O_2$ -silica and $Ce_2^{III}O_3$ -silica composites have been measured and compared by ammonia-TPD techniques.