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Highly Active Cobalt Doped Meso-ceria for Visible Light Assisted base Free Oxidation of Mercaptanes to Disulfides

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Abstract—*Oxidation of thiols to disulfides is immensly important because this not only remove thiols from petroleum products but also extracted thiols can be used in synthetic industries. Many catalytic systems like conventional oxidants such as manganese dioxide, dichromates, chlorochromates, etc., other catalytic systems like cobalt, manganese, copper, vanadium, cerium, and nickel based catalysts have been reported for the aerobic oxidation of thiols into disulfides. Visible light initiated organic transformation has attracted scientific community for the development of green and sustainable catalytic system. Semiconductor like TiO_2, CeO_2 etc. can may be applied for this purpose because of their electron transfering ability. Meso CeO_2 is good in the sense of its good visible light absorption pattern. But high electron hole pairs recombination make this unsuitable for practical application. Doping with metals like Ag, Au, Cu, Co etc slowdown electron hole pair recombination rate. Most of doping methods use wet surface imprgnation methods that show leaching of metals from the surface of semiconductors catalyst. In this work we have developed a new method of cobalt, nitrogen and carbon doping on the surface of CeO_2. The synthesized catalyst was charecterized with various techniques like SEM, TEM, FTIR, UV, XPS, ICP-AES, CHNS, BET, DT-TGA etc that confirm the well synthesis of catalyst. The developed catalyst was used for visible light driven thiols oxidation to disulfides. Various thiols from C_2 to C_{12} were checked for the photooxidation. All thiols was oxidized to disulfides within 5 hours. Further we have checked phocatalytic activity of catalyst for the oxidation of thiols in kerosene having premixed docecane thiols as model substrate for simulating conditions of sulfur containg thiols. It was found that catalyst was well functioning in this medium too. For confirming that developed catalyst was robust enough we have carried out recycling experiment and after four recycling there were no significant loss in activity of catalyst was found.*

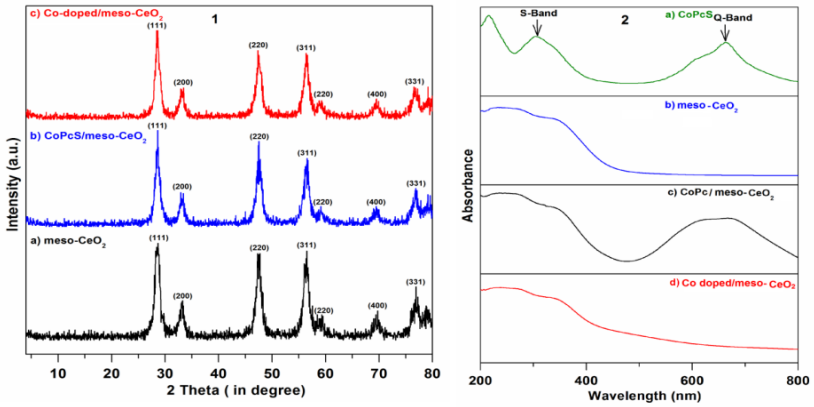

Fig: 1: a) XRD diffraction pattern of a) meso-CeO_2 b) CoPcS/meso-CeO_2 and c) Co-doped/meso CeO_2 and 2. a) UV-Vis spectra of CoPcS b) meso-CeO_2 c) CoPcS/meso-CeO_2 d) Co-doped/meso CeO_2

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