

Insights into catalytic oxidation of Fe-doped ZrO₂ nanoparticles with modified electronic structure: pH dependence

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Catalytic activities of Fe-doped ZrO₂ nanoparticles (NPs), which are modified by pH, are characterized for various oxidation reactions such as electrochemical reaction, photocatalytic dye-degradation in aqueous conditions, and gas-phase photooxidation of thiol function group and thermal CO oxidation by using various surface analysis techniques such as transmission electron microscopy (TEM), scanning transmission X-ray microscopy (STXM), and high-resolution photoemission spectroscopy (HRPES). We evaluated the catalytic effects of these doped particles on the oxidation of 4-ATP in aqueous solution by taking electrochemistry (EC) measurements and on the photocatalytic oxidation of 4-ATP by using HRPES under UV illumination. Here, we found that the Fe-ZrO₂ NPs fabricating under base condition (pH=13.5) exhibit enhanced catalytic activities, which according to the various surface analyses were due to the enhanced defect structure and surface area.