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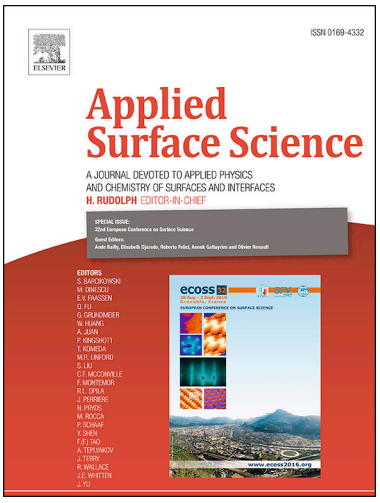

Full Length Article

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Nanocrystalline $CeO_{2-\delta}$ coated β-MnO_2 nanorods with enhanced oxygen transfer property

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Abstract: In this research, β-MnO_2 nanorods were synthesized by a hydrothermal method, followed by a facile precipitation method to obtain nanocrystalline $CeO_{2-\delta}$ coated β-MnO_2 nanorods. The as-prepared samples were characterized by XRD, HRTEM, FESEM, XPS and in-situ high-temperature XRD. The HRTEM results show that well dispersed $CeO_{2-\delta}$ nanocrystals sized about 5 nm were coated on the surface of β-MnO_2 nanorods. The oxygen storage and transfer property of as-synthesized materials were evaluated using TGA under various atmospheres (air, pure N_2, and 5%H_2/95%Ar). The TGA results indicate that $CeO_{2-\delta}$ modification could favour the reduction of Mn^{4+} to Mn^{3+} and/or Mn^{2+} at lower temperature as compared with pure β-MnO_2 nanorods and the physically mixed $CeO_{2-\delta}$-β-MnO_2 under low oxygen partial pressure conditions (i.e., pure N_2, 5%H_2/95%Ar). Specifically, $CeO_{2-\delta}$@β-MnO_2 sample can exhibit 7.5 wt% weight loss between 100 and 400 ^oC under flowing N_2 and 11.4 wt% weight loss between 100 and 350 ^oC under flowing 5%H_2/95%Ar. During the reduction process under pure N_2 or 5%H_2/95%Ar condition, the oxygen ions in β-MnO_2 nanorods are expected to be released to the surroundings in the form of O_2 or H_2O with the coated $CeO_{2-\delta}$ nanocrystals acting as mediator as inferred from the synergistic effect between the well-interacted $CeO_{2-\delta}$ nanocrystals and β-MnO_2 nanorods.

Keywords: $CeO_{2-\delta}$; β-MnO_2; oxygen transfer; synergetic effect