SYNTHESIS OF DOPED FERRITES (MFE_2O_4, M= NI, ZN) FOR THERMOCHEMICAL WATER-SPLITTING

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ABSTRACT

We present the preparation and characterization of doped ferrites synthesized using two methods. In a combustion synthesis method, precursors such as metal (Zn, Fe, Ni) nitrates were dissolved in de-ionized water and combined with fuel, for instance, sugar, urea, or ethylenediaminetetraacetic acid (EDTA). The homogenous solution thus obtained was heat treated in a convective furnace to minimize the water content and subsequently heated to 650 °C in air at 20 °C/min for combustion to occur. Powder X-ray diffraction (XRD) analysis revealed that the ferrite synthesized with sugar was crystalline and phase pure, however, the use of urea and EDTA resulted in ferrites with multiple crystalline phases. The specific surface area of the Zn-doped ferrite prepared by the combustion approach was 17.4-19.5 m^2/g and was found to be dependent on the fuel to precursor ratio used during synthesis. Scanning electron microscopic (SEM) images of doped ferrites exhibited the presence of agglomerated nanocrystals. In another method, ferrite foam-like material was synthesized using a sol-gel method involving the addition of polymer microspheres containing hydrocarbon gases followed by microwave heating. Specifically, the Ni and Fe precursors were added in ethanol containing surfactant/polymer microspheres, and the solution was sonicated. After the addition of propylene oxide, the gel formation was observed after 5 min. The gel was rapidly heated in a microwave furnace to 1000 oC and quenched. The SEM image indicated foam like morphology with high aspect ratio nanosize tubular structure, which was consistent throughout the sample matrix.