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Synthesis and properties of magnetic ceramic nanoparticles[1]
MONICA SORESCU, Duquesne University — Magnetic ceramic nanoparticles of the type xIn2O3-(1-x)alpha-Fe2O3, xV2O5-(1-x)alpha-Fe2O3 and xZnO-(1-x)alpha-Fe2O3 (x=0.1-0.7) were synthesized from the mixed oxides using mechanochemical activation for 0-12 hours. X-ray diffraction was used to derive the phase content, lattice constants and particle size information as function of ball milling time. Mossbauer spectroscopy results correlated with In3+, V5+ and Zn2+ substitution of Fe3+ in the hematite lattice. SEM/EDS measurements revealed that the mechanochemical activation by ball milling produced systems with a wide range of particle size distribution, from nanometer particles to micrometer agglomerates, but with a uniform distribution of the elements. Simultaneous DSC-TGA investigations up to 800 degrees C provided information on the heat flow, weight loss and the enthalpy of transformation in the systems under investigation. This study demonstrates the formation of a nanostructured solid solution for the indium oxide, an iron vanadate (FeVO4) for the vanadium oxide, and of the zinc ferrite (ZnFe2O4) for the zinc oxide. The transformation pathway for each case can be related to the oxidation state of the metallic specie of the oxide used in connection with hematite.

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