Size controlled synthesis of Mn3O4 nanoparticles: characterization and defect chemistry

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Abstract:

Identification of defect chemistry and variation of particle size are key factors for understanding many intrinsic properties of materials. Herein, size selective synthesis of Mn3O4 nanoparticles was performed by precipitation of Mn(OH)2 via NaOH or ammonia followed by air oxidation in ethanol/water solution. The amount of ethanol in water affects the average particle size that drops from ~25 nm in pure water to ~10 nm in 95% EtOH/H2O. TEM studies showed that the Mn3O4 samples have a sphere-cube like morphologies. Calculation of SOF and unit cell parameters via Rietveld analysis and the excess mass of Mn3O4 samples depending on size by TGA and IR revealed that the cationic deficiency observed in the structure of the smallest size sample is compensated mainly by anionic vacancies. Ideal spinel structure was found for largest size sample. The degree of tetragonal distortion (c/√2 a) of Mn3O4 unit cell increases with particle size.

Keywords:

Hausmannite; solvent polarity; ethanol-water mixture; amount of dissolved oxygen; defect chemistry and tetragonal distortion

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