Up-scalable synthesis of size-controlled copper ferrite nanocrystals by thermal treatment method

ABSTRACT

Close-packed cubic copper ferrites (CuFe2O4) nanoparticles were synthesized using an effective thermal-treatment method directly from an aqueous solution containing copper and iron nitrates as metal precursors and poly(vinyl pyrrolidone) as a capping agent. The FTIR spectra of the calcined samples revealed the vibration bands of Feï O and Cuï O at 315 and 535 nm respectively. The structural, morphological, optical and magnetic properties of the nanocrystal powder samples were analyzed using various characterization techniques. The powder X-ray diffraction unveiled the formation of spinel phase of CuFe2O4 with the average particle size determined from TEM images increased from 24 to 34 nm at the calcination temperatures between 773 and 1173 K. The band gap calculated using Kubelkaï Munk function from the UVï visible diffuse reflectance spectra decreased from 2.64 to 2.45 eV with increasing calcination temperature. The electron spin resonance (ESR) spectroscopy confirmed the presence of unpaired electrons in the calcined samples. The g-factor increased from 2.10497 to 2.57056 and the resonance magnetic field decreased from 3.11599×10ī 7 to 2.55161×10ī 7 A/m with increasing calcination temperature.

Keyword: Copper ferrites; Nanocrystals; Thermal treatment; Optical and magnetic properties