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A structural study and magnetic properties of electrospun carbon/manganese ferrite (C/MnFe₂O₄) composite nanofibers

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Carbon/manganese ferrite (C/MnFe₂O₄) composite nanofibers were fabricated using electrospinning technique followed by carbonization process under mixed of air and argon atmosphere at 400, 600 and 800 °C, respectively. The prepared composite nanofibers were characterized by X-ray diffraction (XRD), scanning electron microscopy (SEM), transmission electron microscopy (TEM), vibrating sample magnetometry (VSM) and X-ray absorption spectroscopy (XAS) including X-ray absorption near edge structure (XANES) and extended X-ray absorption fine structure (EXAFS). After calcination at 800 °C, the composite nanofibers of C/MnFe₂O₄ were obtained with a mean diameter of nanofibers of approximately 700 - 800 nm. The structure of MnFe₂O₄ was successfully studied using XAS technique and was found to be cubic spinel with a coupling of Mn²⁺/Mn³⁺ and Fe³⁺ oxidation states. All composite nanofibers exhibited ferromagnetic behavior especially after being calcined at 800 °C. This ferromagnetic properties were related to the distribution of cations over tetrahedral and octahedral sites as revealed by EXAFS results.

Keywords

Ferrite; Carbon nanofibers; Nanocomposites; X-ray absorption spectroscopy (XAS); Electrospinning

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