K Sabri et al., Int J Mater Sci Res. 2018
http://dx.doi.org/10.18689/2638-1559.a2.002

Elaboration and Characterization Structural of Chromium Substituted Magnesium Spinal Ferrite

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The standard double sintering ceramic technique at 1100 °C for 12h was used to prepare samples of $MgCr_xFe_{2-x}O_4$ at compositions of x = 0, 0.2, 0.5, 0.7 and 1 The ingredient materials were analytical high purity grade MgO, Fe_2O_3 and Cr_2O_3(BDH). The details of samples preparation are described elsewhere. The single-phase spinel structure was confirmed by the XRD spectra of these samples obtained with a PANalytical X'Pert Pro diffractometer using CuKα radiation (λ¼1.5406 Å) The scans' ranges were kept the same for all samples 2θ=20–100° using a step size of 0.01° with sample time of 10 s. For recording IR spectra, samples were prepared by mixing with KBr then hydraulically pressing at 10tons/cm2 in a cylindrical disc. The IR measurements of the prepared samples were recorded at room temperature in the range from 400 cm1 up to 1000 cm1 using a Nicolet iS10 FT-IR spectrophotometer. The Raman spectra were recorded using a commercial LABRAM-HR spectrometer equipped with a CCD detector and liquid nitrogen cooled. It has 800 mm focal length and is equipped with a grid of 600 t/mm enabling spectral resolution of 1 cm1 /pixel. The Raman measurements were carried out using a laser source of 632.8 nm and the optical intensity at the sample surface was kept at 0.1 mW to avoid damaging. The microstructure and sample morphology were examined with an analytical scanning electron microscope (ASEM) JEOL; JSM6360. The ASEM is coupled with an energy dispersive system (EDS) for elementary composition analysis of samples.

Conclusion: The characterization of $MgCr_xFe_{2-x}O_4$ ferrites system prepared by the conventional solid state reaction with double sintering at 1100 °C shows that:

1. Rietveld refinement of XRD patterns validate the cubic spinel structure in space group Fd3m over the whole composition range from x=0 to x=1.
2. The Rietveld refined cell parameters decrease with increasing chromium content and the lattice constant appears to obey Vegard's law.
3. The FT-IR spectra indicate two main absorption bands, a high band (580–610 cm^{-1}) for tetrahedral (A) sites and a lower band (400–410 cm^{-1}) for octahedral [B] sites, thus confirming the single phase spinal structure.
4. For all compositions, Raman spectra show the five active modes $A_{1g}+E_{1g}+3T_{2g}$ of the motion of O^2 ions and both the A-site and B-site ions.
5. The frequencies trend with chromium content of both FT-IR and Raman spectra presents a shift toward higher values for all modes.