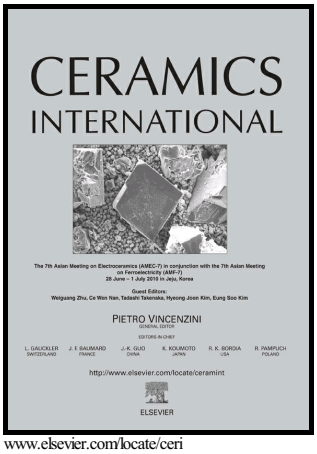

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Synthesis of coral-shaped yttrium-aluminium-iron garnets by solution-combustion method

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Abstract

Aluminium substituted yttrium-iron garnet ($Y_3Al_xFe_{5-x}O_{12}$, x = 0, 1, 2, 3, 4 and 5) powders were synthesized by the solution combustion route followed by calcination at 1000 °C for 6 h. According to the X-ray diffraction (XRD) results, the as-prepared samples were amorphous. Calcination of the samples at 1000 °C for 6 h results in the formation of phase pure (***Ia*$\bar{3}$*d***) garnet structure. The morphology of the samples (for all compositions) were found to be coral-network-like. The Rietveld refinement of the XRD patterns and the Mössbauer spectroscopy confirmed that Y^{3+} ions occupy the dodecahedral site, whereas Al^{3+} and Fe^{3+} ions are distributed in the tetrahedral and octahedral sites of the ***bcc*** (***Ia*$\bar{3}$*d***) structure of the garnet phase. The Al^{3+} ions have a preference to occupy the octahedral site. The lattice parameter decreases with increase in Al^{3+} content due to the small size of the Al^{3+} cations. For the yttrium-iron-garnet (YIG) sample (x = 0), a saturation magnetization (M_S) value of ~ 29 emu/g was obtained, which decreases to ~ 7 emu/g for the sample with x = 2. Further addition of Al makes the garnets paramagnetic. The coral network shape of our garnet samples renders them useful for various applications in catalysis.