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Influence of gamma irradiation on structural and optical properties Sm^{3+}-$Gd^{3+}$of nanocrystalline Manganese Zinc ferrites

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Abstract

$Mn_{0.4}Zn_{0.4}Sm_xGd_yFe_{2-(x+y)}O_4$ (x = 0.01, 0.02, 0.03, 0.04 and 0.05) nanocrystalline powders were synthesized through novel combustion route and calcined at 600 °C. The X-ray diffraction (XRD) patterns were measured for the prepared samples to confirm the existence of monophasic spinel phase structure. The crystallite size was estimated and found to be within the range of 50 – 60 nm. To study the radiation effect on the structural and optical properties, a representative group of the investigated samples were irradiated by ^{60}Co source with a dose of 50 kGy. The XRD spectra were recorded on the irradiated samples and compared with that of the un-irradiated samples to estimate changes in the structure. The obtained results showed that the crystallite size increased by a factor of 10 – 16% after gamma irradiation and the same has been observed in FESEM micrographs. The lattice parameter was also increased due to the conversion of Fe^{3+} (0.64 Å) to Fe^{2+} (0.76 Å) and because of co-doping of Sm^{3+} – Gd^{3+}. The room temperature Raman scattering spectroscopy and spectroscopic elipsometry (SE) were measured on before and after gamma irradiation. According to group theory, five Raman active modes are observed and fitted using Lorentzian equation. The optical constants (*n* and *k*) and their behaviour will be discussed in detail.

Keywords: Ferrites, Manganese Zinc ferrites, gamma irradiation, Solution combustion route, Raman scattering spectroscopy.

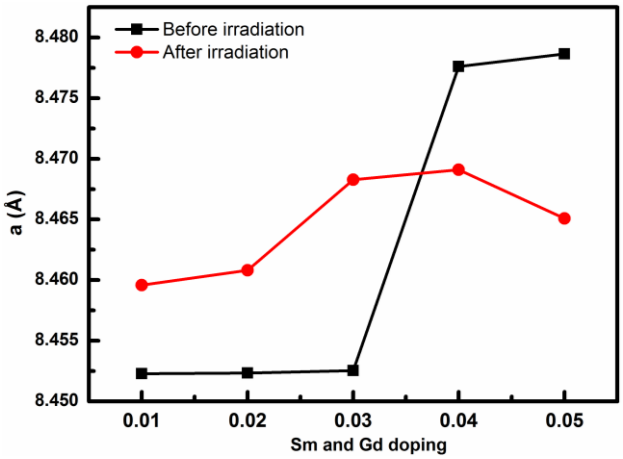

Fig. Change of lattice constant before and after irradiation.