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STRUCTURAL PROPERTIES SYNTHESIZED MAGNESIUM ALUMINATE SPINEL DOPED WITH CERIUM AND ERBIUM

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In this study, we investigated the structural properties of magnesium aluminate spinel (MAS) doped with some rare earth elements such as cerium and erbium synthesized by radiation method [1]. The crystal structure, crystallinity, and phase of the obtained synthesized MAS were investigated by X-ray diffraction (XRD-7000S diffractometer, Shimadzu, Japan) equipped with CuKα (λ = 0,15406 nm) radiation. Result have shown that, the synthesized MAS have cubic structure and are in crystalline spinel $MgAl_2O_4$ and periclase MgO phase (fig. 1.). The clear diffraction peaks demonstrate the good crystallinity of the synthesized MAS. The weak peaks of phase MgO and no peaks related to aluminum oxides indicate the rather high purity of the obtained MAS.

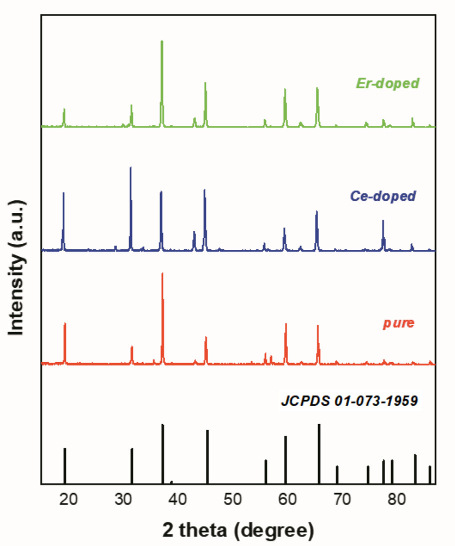

Fig.1. Experimental diffraction pattern (XRD) of obtained samples.

Calculation of parameters characterizing the crystal structure of the samples has been performed. The lattice constant of samples MAS pure, with Ce-doped and with Er-doped is 8.042 Å, 8.078 Å and 8.063 Å respectively. This result is also equivalent to standard card JCDPS 01-073-1959 (a = b = c = 8,05 Å). The change in crystal size in different samples is due to the substitution of ions Al^{3+} by ions Ce^{3+} and Er^{3+} at the octahedral position in the spinel. The larger the radius of ion, the larger the lattice constant. The radius of ion Ce^{3+} (1.14 Å) is larger than that of ion Er^{3+} (1.03 Å) and ion Al^{3+} (0.53 Å), so the lattice constant of the Ce-doped sample is the largest and the pure sample is the smallest. The average crystallites size of samples MAS pure, with Ce-doped and with Er-doped is 32.06, 32.89 and 34.78 respectively. The average crystal sizes of the spinel samples synthesized by radiation method are also similar to those synthesized by the published common methods. The replacement of ions Al^{3+} with rare earth ions not only changes the lattice constant, but also creates lattice defects, thereby reducing the crystallinity of the synthesized sample [2]. This explains the crystallinity calculation results of the synthesized MAS samples, the crystallinity of samples MAS pure, with Ce-doped and with Er-doped is 87.7%, 70.2% and 77.3%, respectively.

From the results of calculating the structural properties of synthesized MAS by X-ray diffraction method, it is shown that the synthesis of samples MAS pure as well as some doped rare earth elements such as Ce and Er by radiation method was performed successfully. This is the premise for the synthesis of samples MAS doped with transition metal elements and other rare earth elements by radiation method to create samples with suitable thermal and optical properties for different applications.

REFERENCES

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