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Synthesis and Investigation of $Ln_{1-x}Er_xFe_{0.5}Mn_{0.5}O_3$ (Ln = La, Sm; x = 0.2 and 0.4)

C. Trajkovska, S. Popovska, M. Bukleski, S. Dimitrovska-Lazova and S. Aleksovska*

Institute of Chemistry, Faculty of Natural Sciences and Mathematics, Ss. Cyril and Methodius University, Skopje, N. Macedonia

*bote.aleksovska@gmail.com

In recent years, perovskites that contain two different lanthanides in the A-position have garnered significant attention due to the ability of these elements to introduce exceptional properties and functionalities to the versatile perovskite framework. Lanthanides, which exhibit unique and distinctive electronic configurations and magnetic moments, offer opportunities for precise tuning of optical, electric, magnetic, and catalytic properties of perovskite materials. In this work the synthesis and characterization of complex perovskites with general formulas $Ln_{1-x}Er_xFe_{0.5}Mn_{0.5}O_3$ (Ln = La, Sm; x = 0.2 and 0.4) is presented.

The proposed perovskites were synthesized using the sol-gel combustion method with citric acid as a fuel/chelating agent. In this procedure, the pH value of the initial mixture was controlled using NH_4OH. After the combustion, the obtained perovskite precursors were annealed for 8 hours at 900 °C.

For the identification of the obtained powders, PXRD was used. The XRD patterns confirmed their purity and crystallinity and showed that the sol-gel combustion method is an appropriate method for the synthesis of this type of compounds. The comparison of the recorded XRD patterns to the ones of the pristine La/Sm/Er-perovskites indicated that the partial substitution was successfully done. The structural analysis implied that the synthesized $Sm_{1-x}Er_xFe_{0.5}Mn_{0.5}O_3$ perovskites are orthorhombic, but $La_{1-x}Er_xFe_{0.5}Mn_{0.5}O_3$ are cubic. The two samarium perovskites are isostructural to each other, as well as, the two lanthanum perovskites.

The influence of the lanthanide substitution on metal-oxygen bonds in the investigated perovskites was studied by Fourier Transform Infrared Spectroscopy (FTIR). The infrared spectra showed the presence of characteristic modes of stretching and banding metal-oxygen vibrations.

Keywords: complex perovskites, lanthanides, sol-gel combustion, citric acid, PXRD, FTIR spectroscopy