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Structural Characterization and Magnetic Properties of $LaMn_{0.5}Fe_{0.5}O_3$ Prepared by Different Methods

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Abstract – $LaMn_{0.5}Fe_{0.5}O_3$ perovskites were prepared by Pechini and Microwave-assisted combustion methods. The precursor powders were calcined at 700℃ and 900℃ for 4h. The characterization of materials took place by X-ray diffraction, scanning electron microscopy and magnetization measurements. The crystalline structures were determined by X-ray diffraction and Rietveld refinement. The results show the formation of single phase with orthorhombic structure. The micrographs reveal the presence of agglomerates. The magnetization measurements indicate a weak ferromagnetic behavior.

Perovskites are interesting metal oxides exhibiting various transport, magnetic, optical and dielectric properties [1-2]. Particularly, manganites are important materials due to potential applications as magnetic sensors, catalysts, pigment and electrode materials for solid oxide fuel cell. In the doped perovskites $AB_{1-x}B'_xO_3$ (B,B´ = transition metals), the substitution of B site generally induces an ionic size effect and/or an ionic valence effect, and thus it results in a dramatic change of magnetic and transport properties [3-4]. Differences between magnetic properties of $LaMn_{0.5}Fe_{0.5}O_3$ compound have been reported and it was attributed to difference of the synthesis and processing conditions [5]. This paper reports the preparation of $LaMn_{0.5}Fe_{0.5}O_3$ powders by Pechini and Microwave-assisted combustion methods in order to study the influence of synthesis method on the magnetic properties of materials. The powders were calcined at 700℃ and 900℃ for 4h in air and characterized by x-ray diffraction (XRD), scanning electronic microcopy (SEM) and magnetic measurements.

Rietveld refinement of the x-ray patterns shows that the powders are single phases and all diffraction peaks are well indexed on the orthorhombic symmetry with space group Pbmn. The crystallite sizes obtained were 38 nm and 40 nm for samples produced by Pechini and combustion methods, respectively. The micrographs reveal that materials present irregular morphology and presence of agglomerates. However, the combustion method produces a porous material. Hysteresis curve measurements indicate a weak ferromagnetic behavior for studied materials.

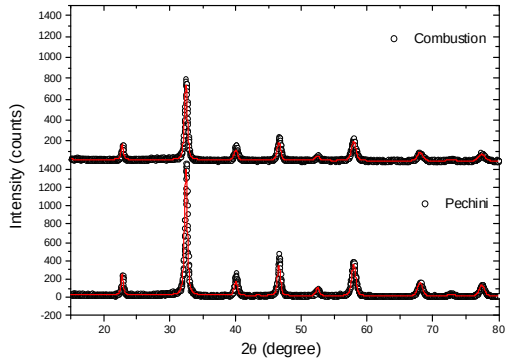

Figure 1: X-ray patterns of $LaMn_{0.5}Fe_{0.5}O_3$ powders calcined at 700℃ for 4h obtained by Pechini and Combustion Methods.

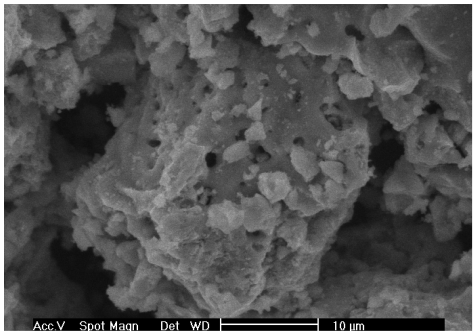

Figure 2: SEM image of $LaMn_{0.5}Fe_{0.5}O_3$ powder calcined at 700℃ for 4h obtained by Combustion Method.

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