ABSORPTION CHARACTERISTICS OF THE ELECTROMAGNETIC WAVE AND MAGNETIC PROPERTIES OF THE $La_{0.8}Ba_{0.2}Fe_xMn_{½(1-x)}Ti_{½(1-x)}O_3$ (x = 0.1–0.8) PEROVSKITE SYSTEM

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ABSTRACT

This paper reports on the magnetic properties and electromagnetic characterization of $La_{0.8}Ba_{0.2}Fe_xMn_{½(1-x)}Ti_{½(1-x)}O_3$ (x = 0.1–0.8). The $La_{0.8}Ba_{0.2}Fe_xMn_{½(1-x)}Ti_{½(1-x)}O_3$ (x = 0.1–0.8) materials were prepared using a mechanical alloying method. All the materials were made of analytical grade precursors of $BaCO_3$, Fe_2O_3, $MnCO_3$, TiO_2, and La_2O_3, which were blended and mechanically milled in a planetary ball mill for 10h. The milled powders were compacted and subsequently sintered at 1000°C for 5h. All the sintered samples showed a fully crystalline structure, as confirmed using an X-ray diffractometer. It is shown that all samples consisted of LaMnO3 based as the major phase with the highest mass fraction up to 99% found in samples with x < 0.3. The mass fraction of main phase in doped samples decreased in samples with x > 0.3. The hysteresis loop derived from magnetic properties measurement confirmed the present of hard magnetic $BaFe_{12}O_{19}$ phase in all $La_{0.8}Ba_{0.2}Fe_xMn_{½(1-x)}Ti_{½(1-x)}O_3$ (x = 0.1–0.8) samples. The results of the electromagnetic wave absorption indicated that there were three absorption peaks of ~9 dB, ~8 dB, and ~23.5 dB, respectively, at respective frequencies of 9.9 GHz, 12.0 GHz, and 14.1 GHz. After calculations of reflection loss formula, the electromagnetic wave absorption was found to reach 95% at the highest peak frequency of 14.1 GHz with a sample thickness of around 1.5 mm. Thus, this study successfully synthesized a single phase of $La_{0.8}Ba_{0.2}Fe_xMn_{½(1-x)}Ti_{½(1-x)}O_3$ (x = 0.1–0.8) for the electromagnetic waves absorber material application.

Keywords: Absorber; Electromagnetic wave; Lanthanum manganite; Magnetic; Perovskite; Substitution; Structural