

Absorption characteristics of the electromagnetic wave and magnetic properties of the $\text{La}_{0.8}\text{Ba}_{0.2}\text{Fe}_x\text{Mn}_{1/2}(1-x)\text{Ti}_{1/2}(1-x)\text{O}_3$ ($x = 0.1-0.8$) perovskite system

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Abstrak

This paper reports on the magnetic properties and electromagnetic characterization of $\text{La}_{0.8}\text{Ba}_{0.2}\text{Fe}_x\text{Mn}_{1/2}(1-x)\text{Ti}_{1/2}(1-x)\text{O}_3$ ($x = 0.1-0.8$). The $\text{La}_{0.8}\text{Ba}_{0.2}\text{Fe}_x\text{Mn}_{1/2}(1-x)\text{Ti}_{1/2}(1-x)\text{O}_3$ ($x = 0.1-0.8$) 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 LaMnO_3 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 $\text{BaFe}_{12}\text{O}_{19}$ phase in all $\text{La}_{0.8}\text{Ba}_{0.2}\text{Fe}_x\text{Mn}_{1/2}(1-x)\text{Ti}_{1/2}(1-x)\text{O}_3$ ($x = 0.1-0.8$) 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 $\text{La}_{0.8}\text{Ba}_{0.2}\text{Fe}_x\text{Mn}_{1/2}(1-x)\text{Ti}_{1/2}(1-x)\text{O}_3$ ($x = 0.1-0.8$) for the electromagnetic waves absorber material application.