Effect of Fe substituted on the monovalent La0.85Ag0.15Mn1-xFexO3 doped manganites : Their electromagnetic and microwave properties

ABSTRACT

New microwave absorber material, La0.85Ag0.15Mn1-xFexO3 (x = 0, 0.05, 0.10, 0.15 and 0.20) monovalent-based manganites with epoxy resin as a binder were prepared to investigate the effect of Iron (Fe) substitution on microwave absorption properties. The La0.85Ag0.15Mn1-xFexO3 (x = 0, 0.05, 0.10, 0.15 and 0.20) manganites were prepared using solid state method. The phase identification investigated by using X-ray diffraction (XRD) pattern, showed that all samples were single phase rhombohedral crystal structure. Fe substitution caused increase in room temperature resistivity and decrease in ferromagnetic–paramagnetic transition temperature, TC, indicating changes in carrier concentration and weakening of double exchange mechanism. Microwave reflection loss, RL measurements in the frequency range of 8 GHz to 18 GHz showed the highest reflection loss for x = 0 sample where value of reflection loss of − 57.2 dB at 16.41 GHz with a bandwidth of 2.67 GHz corresponding to reflection loss below − 10 dB was observed. However, Fe substitution produced lower reflection loss values with lowering of matching frequency with an upturn at x = 0.20. Permeability measurements showed real part of magnetic permeability increased but magnetic loss tangent decreased above 13 GHz with increasing Fe. Further analysis showed contribution of eddy current loss for most samples at high frequency region. On the other hand, permittivity measurements showed both real part of permittivity and dielectric loss tangent increased with Fe content at high frequencies indicates Fe substitution enhancing the dielectric loss component thus may dominantly contributes to the microwave absorption in the Fe substituted samples.

Keyword: Manganites; Fe substitution; Reflection loss; Bandwidth; Microwave absorption