$0.675Pb(Mg_{1/3}Nb_{2/3})$-$0.325PbTiO_3$] /$CoFe_2O_4$ Nanocomposite Synthesized by Novel *in situ* Polymeric Precursor Route

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Recently, the optimization of the magnetoelectric coupling particulate composites is based on the implementation of new methods of synthesis and processing favoring proper homogeneity between the phases ferroelectric and magnetic, ensuring the chemical balance between constituent phases, and a suitable interface between the grains of each of the phases after firing. This research proposes to obtain nanocrystalline (1-x)[$0.675Pb(Mg_{1/3}Nb_{2/3})$-$0.325PbTiO_3$] / (x)$CoFe_2O_4$ (x=0.1-0.5) biphasic system by the polymeric precursor (Pechini) chemical route using the in situ methodology, which consists in simultaneous crystallization of two constituent phases in only one step. The morphology and structure of the nanocomposite were systematically analyzed by diffraction X-ray (XRD), Thermogravimetry (TG), Fourier transform infrared spectroscopy (FTIR), specific surface area (BET) and by scanning and transmission electron microscopy (SEM, TEM). The presence of spinel and perovskite phases without the presence of secondary phases was confirmed by the results of XRD and Rietveld analysis, whereas microscopic results showed biphasic nanostructures having a phase distribution and highly uniform particle size. The results of this study indicate that the in situ methodology implemented using the Pechini method is reliable and can be successfully used in the synthesis of pure biphasic systems comprising complex perovskites which have high Difficulty of obtaining such as $0.675Pb(Mg_{1/3}Nb_{2/3})$-$0.325PbTiO_3$]/$CoFe_2O_4$ in the nanometric scale, with a great potential for obtaining a bulk ceramic with a highly homogeneous distribution of phases important feature for magnetoelectric composite particles.