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CRYSTAL STRUCTURE, PHASE SEPARATION, AND MAGNETIC PROPERTIES OF MANGANATE-BASED MULTIFERROIC CERAMICS

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The study of multiferroic, i.e., simultaneously ferromagnetic and ferroelectric materials, is becoming increasingly important for various microelectronic applications. In this work, crystal structure, phase separation, and magnetic properties were studied in multiferroic composite ceramics of the composition (x)$La_{0.625}Sr_{0.375}MnO_3$ - (1-x)$LuMnO_3$. The XRD results confirm that there is a solid solution of monoclinic phase of space group P1121/a in this system, i.e. $(La_{0.625}Sr_{0.375})$ x $Lu_{1-x}MnO_3$ forms at x=0.98-1.0. The lattice parameters were determined as a = 5.4782(1)-5.4835(1) Å, b = 7.7623(2)-7.7776(1) Å, c = 5.4973(1)-5.5166(1) Å, and β = 90.4713-90.7132°. With decreasing x, monoclinic La-rich and hexagonal Lu-rich phases become distinctly separated (x=0-0.975). The maximum magnetization at T=293 K is found to be proportional to x, thus confirming the intrinsic separation and immiscibility of the two phases. Magnetic properties and conductivity are then studied as a function of the composition and temperature. The nature of the coupling between electrical and magnetic properties in this system is discussed.

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INTER-RELATED MAGNETIC AND FERROELECTRIC DOMAIN STRUCTURES IN $BaTiO_3$ - $(Ni_{0.5}Zn_{0.5})Fe_2O_4$ MULTIFERROIC CERAMICS

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Multiferroic ceramics (1-x)$BaTiO_3$-x$(Ni_{0.5}Zn_{0.5})Fe_2O_4$ with various compositions x are investigated in the present work. The processing parameters were adapted in order to obtain pure diphasic ceramics without reactions at the interfaces. The macroscopic ferroelectric behaviour was proved by the existence of the ferroelectric-paraelectric dielectric and calorimetric anomaly of $BaTiO_3$ around 125-130°C. The magnetic activity with a concentration influence (“dilution” effect) due to the presence of the non-magnetic phase was found by measuring the M(H) loops at various temperatures. The existence of both magnetic and ferroelectric domain structure and their interdependence was proved by local MFM/AFM-piezoresponse experiments.