Nanocomposites and nanomaterials

Structural, magnetic, ^{55}Mn NMR and magnetotransport properties of $(La_{0.6}Sr_{0.3}Mn_{1.1}O_3)_{1-x}(LaCu_2O_4)_x$ composite ceramics

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One of the most topical directions of condensed matter physics development is studying closely correlated systems with competing types of interactions both in terms of research and application. Such systems include metal oxide rare earth (RE) cuprates and manganites with controversial nature of high-temperature superconductors and a colossal magnetoresistance effect (MRE). Creation and investigation of composite ceramics with coexisting MRE and superconductivity explain topicality of the investigation conducted.

Single phase $(La_{0.6}Sr_{0.3}Mn_{1.1}O_3)_{1-x}(LaCu_2O_4)_x$ composite ceramics (x = 0, 0.1, 0.2, 0.3 and 0.5) sintered at 1240 °C (24 h) has been investigated by X-ray diffraction, thermogravimetric, resistive, magnetic, ^{55}Mn NMR and magnetoresistive methods.

It has been found out that Mn ions in B-positions of the $R\bar{3}c$ perovskite structure are substituted for copper. Molar formulae of its real structure, which contain anionic and cationic vacancies as well as nanostructured planar clusters have been determined experimentally. Hyperfine fields are calculated by ^{55}Mn NMR method. It been concluded that there are 3 nonequivalent Mn states caused by heterogeneous Mn environment of other ions and defects. An experimental phase diagram (Fig.) that determines a correlation between composition, structure defects and properties of the composite ceramics has been constructed.