

## INTERPLAY BETWEEN SURFACE STRUCTURAL DISORDER AND MAGNETIC PROPERTIES OF NANOSIZED $\text{La}_{0.9}\text{Ca}_{0.1}\text{MnO}_3$ MANGANITE

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The rare earth mixed-valence manganites  $\text{R}_{1-x}\text{A}_x\text{MnO}_3$  demonstrate extremely rich phase diagrams, including a plethora of coexisting magnetic/electronic phases. The question on the extend, to which the unavoidable structural imperfections are crucial for such coexistence and complexity of the phase diagrams arises now. To address this question, we studied magnetic properties of nanometer-sized  $\text{La}_{0.9}\text{Ca}_{0.1}\text{MnO}_3$  samples, directly connected with its surface structural disorder.

The powder of  $\text{La}_{0.9}\text{Ca}_{0.1}\text{MnO}_3$  with the average size of  $24 \pm 4$  nm was prepared by sonication-assisted coprecipitation [1]. In the temperature ( $T$ ) interval 150-240 K its dc magnetization ( $M$ ) versus magnetic field ( $H$ ) curves are characteristic for superparamagnetic magnetic state. The ac susceptibility, measured at zero dc  $H$ , exhibits a broad maximum in the vicinity of 90 K with a long tail extending up to 240 K. I.e., superparamagnetic state appears at  $T < 240$  K and it coexist with the ferromagnetic one below 90 K. This model is strongly supported by direct high resolution TEM observations, showing that amorphous-like layers with thickness about 2-3 nm exist on the surface of nanometer grains. It seems that the Mn ions' spins within such surface layers are magnetically disordered and are responsible for appearance of superparamagnetic phase, while ferromagnetic ordering of crystalline cores is observed at  $T < 90$  K. The results obtained are discussed in terms of the different randomness of indirect ferromagnetic exchange interactions mediated by the bound holes in structurally disordered surface layers and ordered core of  $\text{La}_{0.9}\text{Ca}_{0.1}\text{MnO}_3$  powder.

[1] G. Pang et al., Mater. Res. Bull. 38, 11 (2003).