

SA01

### Magnetic and Electronic Properties of $\text{La}_{0.7}\text{Ca}_{0.3}\text{Mn}_{1-x}\text{V}_x\text{O}_3$

S. J. Jun<sup>1</sup>, J. S. Park<sup>1</sup>, Y. P. Lee<sup>1\*</sup>, J. Y. Rhee<sup>2</sup>, J.-H. Kang<sup>3</sup> and Y. S. Lee<sup>4</sup>

<sup>1</sup>Quantum Photonic Science Research Center and BK21 Division of Advanced Research and Education in Physics, Hanyang University, Seoul, Korea

<sup>2</sup>BK21 Physics Research Division and Institute of Basic Science, Sungkyunkwan University, Suwon, Korea

<sup>3</sup>Department of Nano and Electronic Physics, Kookmin University, Seoul, Korea

<sup>4</sup>Division of Information Communication and Computer Engineering, Hanbat National University, Daejeon, Korea

\*Corresponding author: yplee@hanyang.ac.kr. Phone: +82 2 2281 5572, Fax: +82 2 2281 5573

The magnetic and the electronic properties of colossal magnetoresistance (CMR) materials, particularly,  $\text{La}_{0.7}\text{Ca}_{0.3}\text{Mn}_{1-x}\text{TM}_x\text{O}_3$  (TM = transition metal : V) have been investigated. The CMR phenomena have been understood on basis of double-exchange interaction due to the hopping of  $e_g$  electrons between Mn sites, promoting the ferromagnetic order, and the strong electron phonon coupling arising from the Jahn-Teller splitting of Mn  $3d$  levels. In common, the CMR properties can be significantly influenced by transition-metal ions into the Mn sites. The doping at the Mn site in perovskite manganites causes change in the electronic structure of Mn ion and a magnetic coupling between dopant and Mn. Heavy doping with V, that is,  $0.1 < x < 0.2$ , induces two distinct magnetic transitions. This indicates the reentrant character, and results in the growth of ferromagnetic insulating phase, due to the localization of charge carriers and the ferromagnetic metallic clusters. The magnetic relaxation also occurs in both the reentrant spin-glass and the high-temperature ferromagnetic regions.

SA02

### Effect of Structure Peculiarities on Magneto-transport Properties of the Ba-doped Nanomanganites

S.V. Trukhanov<sup>1\*</sup>, A.V. Trukhanov<sup>2</sup> and H. Szymczak<sup>3</sup>

<sup>1</sup>Joint Institute of Solids and Semiconductor Physics, P. Brovka str. 19, 220072 Minsk, Belarus

<sup>2</sup>Chemistry Department, Vitebsk State University, Moscow av. 33, 210036 Vitebsk, Belarus

<sup>3</sup>Institute of Physics, PAS, Lotnikow str. 32/46, 02-668 Warsaw, Poland

\*Corresponding author: trukhanov@iftpp.bas-net.by

The effect of the morphology and A-site ionic ordering on magneto-transport properties of the  $\text{Nd}_{1-x}\text{Ba}_x\text{MnO}_{3+\delta}$  system has been investigated. The high-quality stoichiometric  $\text{Nd}_{1-x}\text{Ba}_x\text{MnO}_3$  solid solution has been obtained in air at 1400°C. The A-site disordered  $\text{Nd}_{1-x}\text{Ba}_x\text{MnO}_3$  sample is orthorhombic ferromagnet below  $T_C \sim 15\text{K}$ . It is established that the annealing in vacuum  $\text{P}(\text{O}_2) \sim 10^{-4}\text{Pa}$  at  $T = 800^\circ\text{C}$  temperature leads to the decomposition of the solid solution into  $\text{Nd}_2\text{O}_3$ ,  $\text{MnO}$  as well as  $\text{NdBaMn}_2\text{O}_7$  phases and the formation of nanometric  $\sim 100\text{nm}$  grains (see fig.). The anion-deficient A-site ordered  $\text{NdBaMn}_2\text{O}_7$  phase is tetragonal ferrimagnet with  $T_N \sim 130\text{K}$  [1].

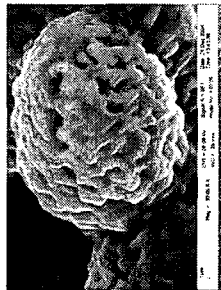
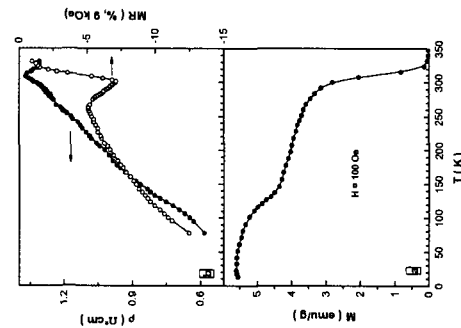


Fig. The microstructure, magnetization and resistivity with magnetoresistance for the nanosized  $\text{Nd}_{1-x}\text{Ba}_x\text{MnO}_3$  sample.



The structure of the anion-deficient phase consists of pyramidal  $\text{Mn}^{2+}/\text{Mn}^{3+}$  layers, sandwiched between alternating  $\text{Nd}^{3+}$  oxygen-free and  $\text{Ba}^{2+}$  oxygen-filled layers. The following annealing of the reduced multiphase sample in air at  $T = 800^\circ\text{C}$  does not change the size of the nanograins of composite product which consists from two phases : (i) A-site ordered  $\text{NdBaMn}_2\text{O}_7$ , one which has tetragonal symmetry of the unit cell and Curie point  $\sim 317\text{K}$  and (ii) superstoichiometric  $\text{NdMnO}_{3+\delta}$  one which has orthorhombic symmetry of the unit cell and Curie point  $\sim 140\text{K}$ . For the A-site ordered phase the  $\text{Nd}^{3+}$  and  $\text{Ba}^{2+}$  ions are equally arranged in alternating (001) planes of the perovskite structure. The magnetoresistance of the nanosized  $\text{Nd}_{1-x}\text{Ba}_x\text{MnO}_3$  sample at the  $T = 293\text{K}$  is about 7% in field of 9kOe. Nanosized effect produces the reduction of the unit cell and as consequence the increase of intensity of exchange interactions between  $\text{Mn}^{2+}$  and  $\text{Mn}^{3+}$  ions. A decrease in the grain size to the nanodimensional level is accompanied by a certain decrease in the unit cell volume, which is explained by an increase in the forces of surface tension relative to the bulk elastic forces. Such considerable changes of the magnetic properties are interpreted in frame of the A-site ordering [2] and the formation of nanometric grains [3], which are exchange coupled with each other.

#### REFERENCES

- [1] S.V.Trukhanov, I.O. Trovanchuk, M. Hervieu et al, Phys. Rev. B, **66**, 184424 (2002).
- [2] S.V. JETP, **101**, 513 (2005).
- [3] S.V. Trukhanov, A.V. Trukhanov, H. Szymczak et al., J. Phys. Chem. Solids, **67**, 675 (2006).