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Spin freezing behavior in polycrystalline $La_{0.7}Ca_{0.3}(Mn_{1-x}V_x)O_3$ ($x \leq 0.2$)

K. H. Han, S. Y. Park, K. K. Yu, J. S. Park, and Y. P. Lee
Quantum Photonic Science Research Center and Department of Physics, Hanyang University, Seoul, 133-791 Korea

The spin-freezing behavior of the vanadium (V)-doped polycrystalline for $La_{0.7}Ca_{0.3}Mn_{1-x}V_xO_3$ ($x \leq 0.2$) was investigated. Temperature dependences of the magnetization and the coercivity of samples were measured by vibrating-sample magnetometer. The spin-glass-like phenomenon has been observed for the V-doped samples. For x = 0.2, the zero-field-cooled and field-cooled curve exhibit the λ-shape-like behavior, suggesting the possibility of a spin-glass nature. The high-temperature (160 < T < 300 K) magnetization data were fitted according to the Curie-Weiss law. The values of Mn^{3+}/Mn^{4+} ratio and average spin ↑S⇑ are determined to be (0.7/0.3, 1.86), (0.45/0.55, 1.73) and (0.17/0.83, 1.61) for samples x = 0, 0.1 and 0.2, respectively. The obtained average ↑S⇑ and Mn^{3+}/Mn^{4+} ratio for sample x = 0 show good agreement with that of $La_{0.65}(PbCa)_{0.35}MnO_3$ [1] and the numbers of Mn^{3+} and Mn^{4+} ions per the formula unit of $La_{0.7}Ca_{0.3}MnO_3$, respectively. The temperature dependence of magnetization behaves to match with that of the coercivity below the Curie temperature. It is suggested that the temperature dependence of coercivity for $La_{0.7}Ca_{0.3}Mn_{0.9}V_{0.1}O_3$ is related to coexistence of the ferromagnetic and the antiferromagnetic orders, which is induced by the V doping at the Mn sites.

[Reference]

1. J. Z. Liu, I. C. Chang, S. Irons, P. Klavins, R. N. Shelton, K. Song and S. R. Wasserman, Appl. Phys. Lett. 66 (1995) 3218.