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Structural And Magnetic Properties Of $La_{0.5}Ca_{0.5}Mn_{0.98}TM_{0.02}O_3$

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Polycrystalline $La_{0.5}Ca_{0.5}(Mn_{0.98}TM_{0.02})O_3$ (TM = Cr, Ti) samples were synthesized by the conventional solid-state reaction method. The stoichiometric proportions of high-purity (99.99% or better) La_2O_3, $CaCO_3$, $MnCO_3$, Cr_2O_3 and Ti_2O_3 powders were mixed and fired at 1000 °C for 12 h in air. Then they were grounded and heated at 1200 °C for 24 h in air. Finally, the samples were pressed into pellets and sintered at 1350 °C for 24 h and furnace cooled (200 ~ 300 °C/h) in air. The formation of single-phase compound was confirmedby x-ray powder diffraction. The magnetic properties were investigated with a Lakeshore vibrating-sample magnetometer. The field dependence of magnetization was measured at a maximum magnetic field of 10 kOe. To understand the magnetic state of these compounds in detail, the low-field magnetization measurements were also performed in both zero-field-cooled (ZFC) and field-cooled (FC) modes. In the ZFC magnetization measurements, the samples were cooled down from 300 to 20 K without field, and then the magnetization was monitored as the samples were warmed up in an applied magnetic field of 15 Oe. In the FC magnetization mode, the samples were cooled down to 20 K inan applied field of 15 Oe and the magnetization was measured during warming up. The electronic structural changes of $La_{0.5}Ca_{0.5}Mn_{0.98}TM_{0.02}O_3$ were probed with the Mn L-edge and the O K-edge x-ray absorption spectra (XAS). We have investigated the magnetic properties of $La_{0.5}Ca_{0.5}(Mn_{0.98}TM_{0.02})O_3$ by observing the temperature dependence of magnetization and coercive field. The reduced Curie temperature and magnetization were interpreted based on the ratio change of Mn^{3+}/Mn^{4+}. By XAS, the change of Mn^{3+}/Mn^{4+} ratio is also checked. The temperature variation of coercive field is in good agreement with the Gaunt's model of weak domain pinning.