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Chemical Ordering Modulated Electronic Phase Separation and Macroscopic Properties in Colossal Magnetoresistance Manganites YINYAN ZHU, KAI DU, LIFENG YIN, JIAN SHEN, Fudan University, LOW-DIMENSIONAL MATERIAL PHYSICS TEAM — Using unit cell by unit cell superlattice growth technique, we determine the role of chemical ordering of the Pr dopant in a colossal magnetoresistance $(La_{1-y}Pr_y)_{1-x}Ca_xMnO_3$ (LPCMO) system, which has been well known for its large length scale electronic phase separation (EPS) phenomena. Our experimental results show that the chemical ordering of Pr leads to dramatic reduction of the length scale of EPS. Moreover, compared to the conventional Pr-disordered LPCMO system, the Pr-ordered LPCMO system has ˜100 K higher metal-insulator transition temperature. We have further investigated the n-dependence of the physical properties of the $(LCMO)_{2n}/(PCMO)_n$ superlattices. Magnetic and transport measurements indicate that the physical properties change nonmonotonically with increasing n, reaching a minimum for both the Curie temperature and the meta-insulator transition temperature. The crossover thickness thus reflects the characteristic correlation length scale along the vertical direction of the superlattice. For superlattices with n smaller than the correlation length, we combine MFM studies and model calculations to explain the weakened ferromagnetism and metallicity with increasing n.

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