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Polarized Neutron Reflectometry Study of Tunable Metal-insulator Superlattices[1] QIANG WANG, YAOHUA LIU, SUZANNE TE VELTHUIS, Materials Science Division, Argonne National Laboratory, Argonne, IL 60439, USA, MICHAEL FITZSIMMONS, Quantum Condensed Matter Division, Oak Ridge National Laboratory, Oak Ridge TN 37831, USA, DAISUKE OKUYAMA, Institute of Multidisciplinary Research for Advanced Materials (IMRAM), Tohoku University, Sendai 980-8577, Japan, MASAO NAKAMURA, MASASHI KAWASAKI, YOSHINORI TOKURA, RIKEN Center for Emergent Matter Science (CEMS), Wako, 351-0198, Japan — Superlattices composed of equal thickness of ferromagnetic (FM) metal $La_{0.5}Sr_{0.5}MnO_3$ (LSMO) and charge-orbital ordered (COO) insulator $Pr_{0.5}Ca_{0.5}MnO_3$ (PCMO) on (011)-oriented $(LaAlO_3)_{0.3}(Sr_2AlTaO_6)_{0.7}$ substrate have been investigated using polarized neutron reflectometry. In a 200-Oe magnetic field, the magnetization depth profile shows strong temperature dependence. Between the FM transition temperature of LSMO and the COO transition temperature of PCMO, a uniform magnetization throughout the superlattices was obtained. Below the COO transition temperature of PCMO, the magnetization depth profile shows a strong contrast between the LSMO and PCMO regions. At 5000 Oe, both LSMO and PCMO show magnetizations close to their bulk saturation value at low temperature. Our result demonstrates the tunability of the PCMO/LSMO superlattices' magnetic structure with field and temperature and the behavior of this system could be explained as the result of coexistence of the FM and COO phases and their competition.

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