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Direct evidence of charge inhomogeneity during the commensurate-incommensurate phase transition in charge ordered $\mathbf{La_{1-x}Ca_xMnO_3}$[1] J. TAO, M. VARELA, S. J. PENNYCOOK, Oak Ridge National Lab, J. M. ZUO, UIUC — Commensurate-incommensurate (C-IC) phase transitions occurring in charge ordered (CO) manganites have been measured extensively by neutron scattering, x-ray diffraction and electron diffraction. However, these measurements only provide an average picture of the CO transition. Direct observations at the nano-scale are lacking, and the exact mechanism underlying the CO phase transitions remains unknown. Here, we report our *in-situ* electron microscopic studies of the CO C-IC phase transition in $La_{0.33}Ca_{0.67}MnO_3$. Scanning an electron probe about 1.7 nm in size over the sample, the local CO structures are recorded in the electron nano-diffraction patterns and the super-reflections associated with the CO phase are used to study the local effective doping. The mapping of the CO phase clearly shows inhomogeneous patterns of phase separation during the phase transition. The C-IC phase transition is interpreted by the change of the distribution of electrons/holes in $La_{1-x}Ca_xMnO_3$.

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