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Mapping nanometer-sized phase separation in La1-xCaxMnO3 VARELA, S.J. PENNYCOOK, Oak Ridge National Lab, D. JING TAO, M. NIEBIESKIKWIAT, M.B. SALAMON, J.M. ZUO, University of Illinois at Urbana-Champaign, W.D. LUO, S.T. PANTELIDES, Vanderbilt University — It is well known that three phases dominate over a wide doping range in La1-xCaxMnO3: the paramagnetic (PM) phase is favored for all x at high temperatures, while at low temperatures, the ferromagnetic (FM) phase is favored for x less than 0.5, and the charge ordered (CO) phase for x greater than 0.5. The transitions between these phases are not simple in this system and the mechanism is still not fully understood [1-2]. Here we report direct observation of the formation and melting of CO droplets in the PM-FM regime (x less than 0.5) using in-situ electron microscopy. The distributions of the CO droplets are directly mapped in real space and show maximum density near the PM-FM transition temperature. This behavior contrasts strongly with the behavior in the PM-CO (x greater than 0.5) regime, where the CO clusters are found to nucleate as nanophase domains and percolate on cooling through the transition temperature [3]. We attribute the nanoscale phase separation observed in this system to the competition between electron mobility and localization. Free energies of the competing phases will be estimated using density-functional calculations to understand the nature of the observed phase separation phenomena. [1]. G.C. Milward, M.J. Calderon and P.B. Littlewood, Nature 433, 607 (2004) [2]. J.M. Zuo and J. Tao, PRB 63, 060407 (2001) [3]. J. Tao and J.M. Zuo, PRB 69, 180404 (2004)

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