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Real-time Observation of Vo ordering dynamics in LaCoO3/STO superlattice[1] JAE HYUCK JANG, Oak Ridge National Lab, ROHAN MISHRA, Vanderbilt University, YOUNG-MIN KIM, Korea Basic Science institute, QIAN HE, LIANG QIAO, MICHAEL D. BIEGALSKI, ANDREW R. LUPINI, Oak Ridge National Lab, SOKRATES T. PANTELIDES, Vanderbilt University, STEPHEN J. PENNYCOOK, SERGEI V. KALININ, ALBINA Y. BORISEVICH, Oak Ridge National Lab, OAK RIDGE NATIONAL LAB. COLLABORATION, VANDERBILT UNIVERSITY COLLABORATION, KOREA BASIC SCIENCE INSTITUTE COLLABORATION — Properties of solid oxide fuel cell, catalysts etc. is dependent on the distribution and transport behavior of oxygen ions. In this study, we observe the dynamics of vacancy ordering in LaCoO3/SrTiO3 (LCO/STO) superlattice and LCO films using high angle annular dark field and annular bright field (ABF) STEM. Vo ordering was directly observed by tracking interatomic spacings, withs nucleation, propagation and interaction of different Vo nuclei demonstrated. Moreover, ABF images show that on 1-D (110) vacancy channels form in the depleted layers.In the case for superlattice, very small contribution of vacancy injection was observed. When this approach is applied to 15 u.c. LCO film, however, a sequence of different phases is observed, starting from disordered perovskite LaCoO3-x to a brownmillerite La3Co3O8-x to eventually brownmillerite La2Co2O5-x. Kinetics of the ordering and vacancy injection, as well as implications for beam-driven phase-transformation at an atomic scale, will be discussed.

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