A Synergistic Electron Nanodiffraction and X-Ray Diffraction Study of Thin Film Functional Materials
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Electron nanodiffraction (END) carried out in a transmission electron microscope (TEM) can produce diffraction patterns from a spot size of less than 10-nm in diameter, which has proven to be extremely useful for analyzing nanostructured materials. X-ray diffraction (XRD) has long been used to study thin films. Here, we study 25 and 100 nm thick single crystal $\text{La}_{5/8-x}\text{Pr}_x\text{Ca}_{3/8}\text{MnO}_3$ (LPCMO) films grown epitaxially on pure and Nb-doped strontium titanate (STO) single crystal (?) substrates using a synergistic approach of END and XRD. These strongly correlated oxides have attracted much attention because of the range of properties with promising functionality they exhibit. The magnetic and electronic properties of these thin films are affected by minute changes of the microstructure. Of great interest are how the interfacial structure and relaxation of the thin films vary as a function of film thickness and doping of the STO. This study demonstrates the sensitivity of END to the change of crystalline structure at nm-scale. XRD, although lacking high spatial resolution, gives accurate crystalline structure of the entire film. The artifacts associated with the TEM sample preparation will also be discussed in this presentation.

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