Poster-1-2

STEM-EELS studies of interfaces between perovskite oxide membranes and single-crystal carrier substrates

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Perovskite-structure transition metal oxide epitaxial thin films exhibit a variety of functionalities that make them highly promising for the development of novel electronic devices. In recent years, interest has arisen in transforming these thin films into perovskite membranes because of their potential benefits of, for instance, no structural mismatch strain effects, possibilities to create texture (wrinkles), and versatile stacking [1]. In our work, $SrTiO_3$ (STO) membranes are grown on $Sr_3Al_2O_6$ (SAO) sacrificial layers on STO(001) substrates using pulsed laser deposition. After dissolving the SAO layer in deionized water, the resulting STO membrane is transferred onto a Nb-doped STO(001) carrier substrate. This membrane heterostructure is either left "as is", or is subjected to a thermal annealing at one of a series of temperatures. We focus on cross-section studies of these membranes using Cs-corrected scanning transmission electron microscopy, where atomic structure quality and flatness/roughness can be precisely assessed. By combining with electron energy-loss spectroscopy, we further apply this approach with a goal of probing the bonding of membranes transferred to single crystal substrates, and how this evolves with thermal annealing.

[1] A. J. Yang et al., ACS Nano. 17, 9748-9762 (2023).