

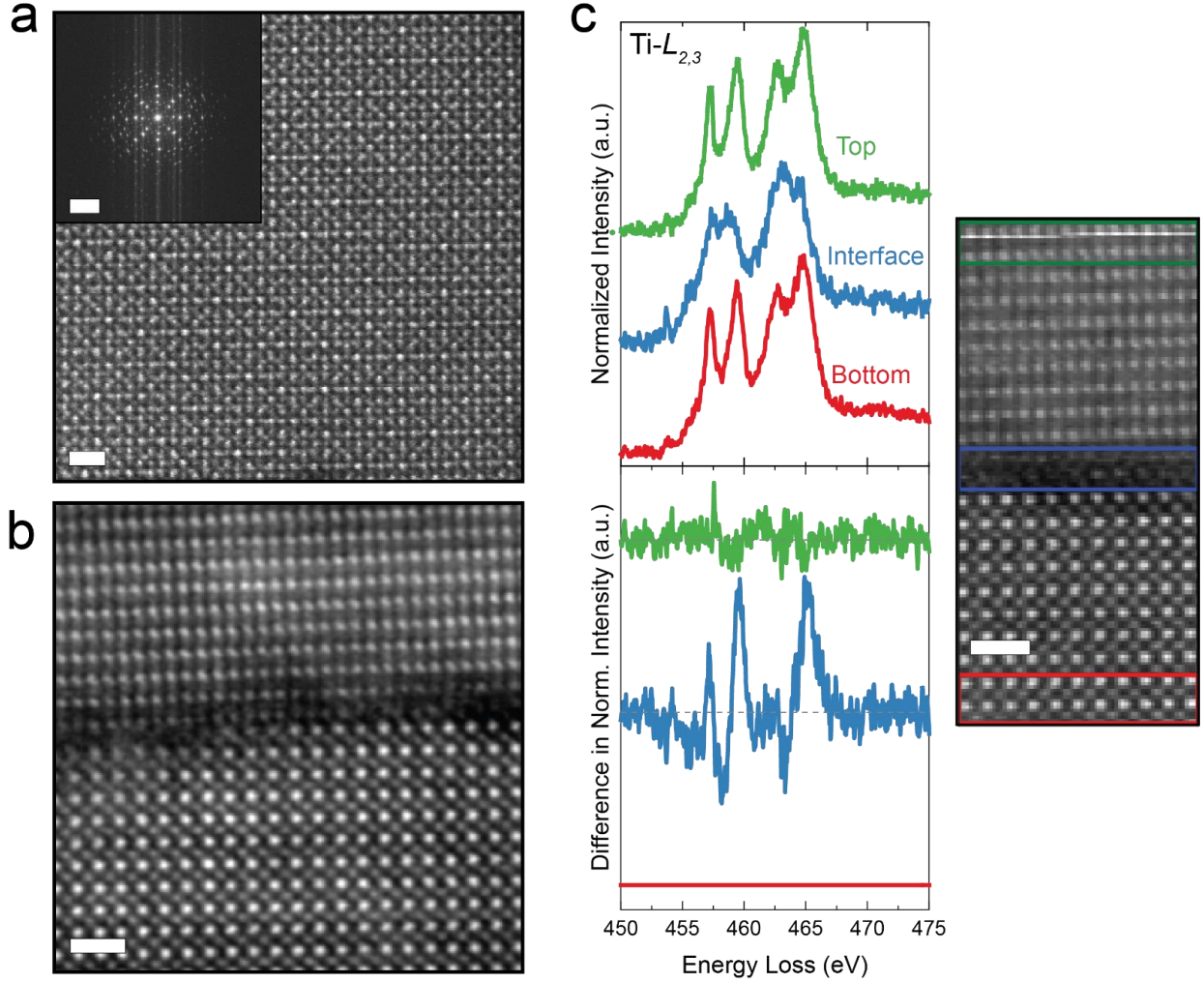


Figure 1. (a) HAADF-STEM image of the 45° twisted, stacked STO membranes observed in the plan-view orientation. The inset is the fast Fourier transform (FFT) of the image, illustrating the 8-fold rotational symmetry of the quasi-periodic structure. (b) The HAADF-STEM image of the interface shows the bottom membrane along the $[100]$ zone axis while the top membrane is along the $[110]$ zone axis. (c) $\text{Ti-}L_{2,3}$ edge spectra are shown for the bulk regions of the top and bottom membranes, as well as for the interface region. The boxes in the dark-field image correspond to the EEL spectra. The bottom figure shows the difference in the $\text{Ti-}L_{2,3}$ spectra obtained by subtracting the spectra from the different regions along the stacked membranes from the spectrum of the bottom membrane bulk region. The spectrum at the interface region is distinct from that of the bulk. All scale bars for atomic resolution images are 1 nm, while the scale bar for the FFT image is 5 nm^{-1} .