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Aberration Corrected STEM imaging of ferroelectric domain walls in $\text{Ca}_3\text{Ru}_{2(1-x)}\text{Ti}_x\text{O}_7$\textsuperscript{1} DEBANGSHU MUKHERJEE, SHIMING LEI, The Pennsylvania State University, ZHIQIANG MAO, Tulane University, VENKATARAMAN GOPALAN, NASIM ALEM, The Pennsylvania State University — \text{Ca}_3\text{Ru}_2\text{O}_7 is a layered Ruddlesden-Popper oxide which is a strongly correlated metal at room temperature and undergoes a MIT at 48K. Ti doped \text{Ca}_3\text{Ru}_2\text{O}_7 is a Mott metal at 300K with the Mott transition temperature increasing with Ti concentration (90K at 5\% Ti), but without increase in strain due to the similarity in the size of Ti$^{4+}$ and Ru$^{4+}$ cations. The bulk crystals show the presence of domain walls as observed by polarized light microscopy. Aberration-corrected STEM imaging demonstrates the presence of both 90$^\circ$ and 180$^\circ$ domain walls along with domain junctions. EELS was performed at 300K and 77K to measure the Ru $t_{2g} \rightarrow O 2p$ hybridization in metallic and insulating ground states. The ferroelectric distortions inside the domains were measured to be isostructural to distortions in hybrid improper ferroelectric \text{Ca}_3\text{Ti}_2\text{O}_7. Additionally, as confirmed by STEM imaging the 180$^\circ$ domain walls exist in head-to-head, head-to-tail and tail-to-tail configurations, thus leading to the intriguing possibility of competition between local ferroic dipole moments and a global shielding from the metallic ground state at room temperature.

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