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Epitaxial growth of polar $KTaO_3$ thin-films on polar perovskite substrates J. THOMPSON, J. NICHOLS, University of Kentucky, J. HWANG, Materials Dept., University of California, SB, S.S.A. SEO, University of Kentucky — The atomic polarity plays an important role in a wide range of physical phenomena at heterointerfaces. For example, the polar/non-polar nature of a $LaAlO_3/SrTiO_3$ system induces partial conducting electrons at the heterointerfaces to avoid diverging electrostatic potential, the so-called "polar catastrophe," which results in intriguing two-dimensional transport and magnetic properties. In this presentation, we discuss another system in which the role of the polar interface is important: the $KTaO_3/GdScO_3$ (KTO/GSO) polar/polar system. At the KTO/GSO interface, there is a "polar conflict" heterointerface along the [001] direction, where the AO and BO_2 layers have reversed net charges so that there is a conflict between the chemical bonding and the electrostatic charges, i.e. $K^{1+}O^{2-}$(1-)/$Sc^{3+}O_2^{4-}$(1-) or $Ta^{5+}O_2^{4-}$(1+)/$Gd^{3+}O^{2-}$(1+), which is unstable in the electrostatic point of view. We ask a fundamental question: "How is the polar conflict resolved in the atomically flat heterointerfaces of such polar/polar systems?" We have synthesized epitaxial KTO thin films on GSO substrates using pulsed laser deposition. From X-ray diffraction and high-resolution transmission electron microscopy, we have observed that the polar conflict is quite effectively avoided by forming only two non-polar mono-layers at the heterointerface, resulting in high-quality epitaxial thin films on top of the layers. Our result suggests a new way to create two-dimensional confined layers using the polar conflict of the heterointerfaces of two polar materials.

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