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Structure and Electronic Transport of Oxygen-Deficient $SrTiO_3$ Thin Films Buffered with $DyScO_3$ PURNIMA BALAKRISHNAN, URUSA ALAAN, MATTHEW GRAY, YURI SUZUKI, Stanford Univ — Oxygen deficiency in $SrTiO_3$ (STO) induces metallic behavior in bulk and thin film form. Thus far, reports of STO thin film metallicity have been limited to homoepitaxial growth on bulk STO substrates. Growth on other substrates has suppressed metallicity, suggesting the important role of lattice distortions. In this presentation, we report on the metallicity and corresponding structure of oxygen-deficient STO films deposited on $DyScO_3$ (DSO) buffered STO substrates and compare to STO films deposited directly on STO substrates. These films are epitaxial, atomically flat, expanded out-of-plane by $\sim$0.6%, and coherently strained to the STO substrate. Oxygen-deficient STO thin films grown on STO and DSO-buffered STO substrates are metallic, while films deposited on $LaAlO_3$, $(LaAlO_3)(SrTaO_3)$, and DSO substrates are insulating. The resistivities of metallic films follow a T^3 dependence near room temperature, transitioning to a T^2 dependence below $\sim$100 K, and are increased by the addition of a DSO buffer. Comparison of sheet resistance across films of various thicknesses indicates the presence of an insulating layer around 7 unit cells thick. These properties indicate the importance of both oxygen deficiency and lattice structure in obtaining metallicity.

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