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Optical Conductivity Studies of Small Polaron Hopping in $Sm_{1-x}Sr_xTiO_3$ Epitaxial Films WILLIAM FLAHERTY, CLAYTON JACKSON, SANTOSH RAGHAVAN, ADAM HAUSER, STRANGE LAW, BRANDON ISAAC, SUSANNE STEMMER, S. JAMES ALLEN, UC Santa Barbara, EXEDE MURI TEAM[1] — We present our findings in the optical conductivity in a doping-controlled metal-to-Mott-insulator transition. These samples, grown using hybrid MBE, span the transition from the Mott insulator $SmTiO_3$ to metallic, lightly-doped $SrTiO_3$. Zhou and Goodenough have studied a wide range of rare earth titanates and found that $SmTiO_3$ has thermally activated transport. We plan to measure the optical conductivity of doped samples to determine the conduction mechanism. Using FTIR spectroscopy, we extract the optical conductivity in the 0.06-2.5 eV range. If conduction in $Sm_{1-x}Sr_xTiO_3$ is due to small polarons, it will have a distinct optical conductivity feature, related to the DC transport, as described by David Emin. Alternatively, conduction could be due to variable-range hopping between defects. Further, from the combination of DC and optical conductivity, we can also test the prediction of Yee and Balents that the metal-to-insulator transition is first-order with percolative phase separation between metallic and localized regions. Such a sample would have a distinct Drude tail plus polaron contributions to its conductivity.

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