Linear Crack Arrays and Resistive Anisotropy in Nd$_{0.2}$Sr$_{0.8}$MnO$_3$
Thin Films Under Tensile Strain* KRISHNA NEUPANE, JOSHUA COHN, University of Miami, JOHN NEUMEIER, Montana State University — The structure, morphology, and electrical properties of epitaxial $a$-axis oriented thin films of Nd$_{0.2}$Sr$_{0.8}$MnO$_3$ are reported for thicknesses $10 \leq t \leq 150$ nm. Films with $t \geq 20$ nm grown under tensile stress on NdGaO$_3$ (100) and LSAT (110) substrates develop uniform linear crack arrays (cracks running along film c axis) with a crack spacing (0.3-10 $\mu$m) that decreases with increasing thickness. Films grown under compression on LaAlO$_3$(110) substrates exhibit no cracks. The room-temperature in-plane electrical resistance ratio, $\rho_b/\rho_c$, increases approximately exponentially with increasing film thickness to values of $\sim 1000$ in the thickest films studied. The temperature dependencies for $\rho_b$ and $\rho_c$ are essentially identical, suggesting that very long effective transport paths perpendicular to the cracks are responsible for enhanced values of $\rho_b$.

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