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Finite Size Effects on Electrical Transport of Nanoribbons of the Charge Density Wave Conductor $\mathbf{NbSe_3}$[1] ADAM STABILE, Department of Physics, SUNY at Buffalo, LUISA WHITTAKER, Department of Chemistry, SUNY at Buffalo, TAI-LUNG WU, Department of Physics, SUNY at Buffalo, PETER MARLEY, Department of Chemistry, SUNY at Buffalo, ZHENZHONG SHI, Department of Physics, SUNY at Buffalo, SARBAJIT BANERJEE, Department of Chemistry, SUNY at Buffalo, G. SAMBANDAMURTHY, Department of Physics, SUNY at Buffalo — $NbSe_3$ is a textbook example of a charge density wave material, and although its properties are well known in bulk, its nanoscale characteristics are relatively unexplored. In particular, owing to the chain-like atomic structure of $NbSe_3$, electric transport studies on quasi-one-dimensional devices remain a new frontier in scientific research in which unique finite size effects occur as a result of geometrical confinement and lattice reconstruction in the nanoscale. We used a novel, facile chemical vapor transport method for synthesizing nanoscale, single-crystalline $NbSe_3$ nanoribbons. This bottom-up method for preparing free-standing nanoribbon devices avoids potential sample degradation observed in top-down approaches. Typical ribbons have cross sectional area 10^4 nm^2 or less and lengths 10 - 50 μm. Single nanoribbon electrical transport measurements show expected charge density wave transitions at 59 and 141 K. We also observe significant enhancement in the depinning effect and sliding regimes mainly attributed to finite size effects.

[1]Stabile, A. A.; Whittaker, L.; Wu, T. L.; Marley, P. M.; Banerjee, S.; and Sambandamurthy, G., Nanotechnology, 22, 485201 (2011)

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