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Tunneling Spectroscopy of Ultrathin Insulating Films: CuN on Cu(100).[1] CHARLES D. RUGGIERO, TAEYOUNG CHOI, JAY A. GUPTA, The Ohio State University — Insulating films comprising only a few atomic layers offer insight into the evolution of electronic structure at the nanoscale and are useful for controlling electronic coupling of adsorbates. We have studied the electronic structure of one monolayer thick CuN islands grown on Cu(100) with a low temperature (5K), ultrahigh vacuum scanning tunneling microscope. We find that CuN acts as an insulator, with a band gap that exceeds 4 eV. Measurements of the tunneling barrier height and image potential states indicate that the CuN work function is $\sim$0.9 eV larger than bare Cu. This suggests a significant surface dipole, consistent with charge transfer predicted by theory. We find no significant dependence of these results on CuN coverage, from small islands ($\sim$ 10 nm^2) to complete films. This suggests that collective electronic structure is already established in the smallest islands. We use the CuN films to decouple metal nanoclusters from the Cu surface electron density. Tunneling spectra of few-atom Nb clusters on CuN reveal an atomic resonance that is not observed for clusters on Cu. http://www.physics.ohio-state.edu/$\sim$jgupta

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