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Conductance Behavior of Molecularly Linked Gold Nanoparticle Films Near the Metal-Insulator Transition JEFFREY DUNFORD, YOSHINORI SUGANUMA, AL-AMIN DHIRANI, BRYAN STATT, University of Toronto — Self-assembled molecularly-linked metal nanoparticle films exhibit interesting electronic behavior that can range from insulating to metallic. In particular, the electronic behavior of 1,4-butanedithiol-linked gold nanoparticle films can be tuned by varying film thickness. We have investigated the temperature (T) dependence of the differential conductance (g) of 1,4-butane dithiol linked Au nanoparticle films. On the insulating side of the transition, the conductance behaves as$g = g_0 \exp\left[-\left(\frac{T_0}{T}\right)^{1/2}\right]$. Qualitatively, this is consistent with an Efros- Shklovskii "variable range hopping" model based on a competition between Coulombic and intercluster tunnelling processes. However, we find that hopping distances are too large (62 nm to 720 nm at 100 K) to be consistent with tunneling between clusters, and tend to scale with cluster size. We propose a modified "quasilocalized hopping" model based on competition between single-electron cluster charging and intracluster electron backscattering to explain this temperature dependence.

Jeffrey Dunford
University of Toronto

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