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Thermoelectricity in Arrays of Thiolate Coated Au Nanoparticles E. COVINGTON, F. BOHRER, E.T. ZELLERS, C. KURDAK, University of Michigan — We have developed a new technique to measure the thermopower of highly resistive films of thiolate coated Au nanoparticles. Using e-beam lithography, we fabricate two long parallel gold wires, spaced by 500 nm, on an insulating substrate and subsequently coat with a thin film of nanoparticles. The wires are used as electrodes for electronic conduction and heaters for thermopower measurements. We characterize the Joule heating in the wires using noise thermometry. To characterize the thermopower of the film, we excite one wire by an ac current with frequency f. Due to Joule heating, we establish a temperature difference between the two wires modulated with frequency $2f$. We extract the thermopower by measuring the $2f$ voltage signal between the wires using lock-in techniques. We used this method on Au nanoparticles with 1-octanethiol (C8) ligands where the thermopower was less than 10 μV/K at room temperature. From the sign of the thermopower, we determined transport was mainly due to tunneling of electrons through the lowest unoccupied molecular orbital of the C8 molecule.

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