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Measuring single electron charging energy in self-assembled single nanoparticle devices: Coulomb blockade threshold vs. Arrhenius energy AL-AMIN DHIRANI, AMIR ZABET-KHOSOUSI — Single-nanoparticle (NP) devices formed by self-assembling NPs onto alkanedithiol-functionalized break junctions exhibit Coulomb blockade (CB) conductance suppressions at low temperatures. We have studied temperature dependence of conductance inside the CB region and find *multiple* activation energies (Ea): A small Ea at low temperatures, and a larger Ea at high temperatures. The small Ea is independent of NP size and is attributed to an energy state located at the metal–molecule contact. The larger Ea scales with NP size and is attributed to single electron charging energy of the NPs. Importantly, we observe a significant ($\sim$5–100 fold) discrepancy between values of charging energies obtained from CB voltage thresholds and Ea. To account for the discrepancy, we propose a model in which electrons are temporarily localized at the energy states near the metal–molecule interface and lose energy. The proposed model is supported by ultraviolet photoelectron spectroscopy of alkanedithiol monolayers on gold which indicates a presence of energy states close to the Fermi level of gold likely arising from gold–thiolate bonds. A suitably modified Orthodox theory successfully describes our measurements.

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