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Coulomb blockade and hopping conduction in graphene quantum dots array DAEHA JOUNG, LEI ZHAI, SAIFUL KHONDAKER, Nanoscience Technology Center, Department of Physics, Department of Chemistry, University of Central Florida, Orlando, Florida 32826 — We show from the low temperature electron transport measurements that the transport properties of chemically reduced graphene oxide (RGO) sheets can be explained as a sequential tunneling of charges through a two dimensional polydispersed array of graphene quantum dots (GQD), where graphene domains act like QDs while oxidized domains behave like tunnel barriers between QDs. As the temperature is decreased to lower than 15 K, a complete suppression of current (I) below a threshold voltage (V_t) was observed due to Coulomb blockade (CB) of charges through GQD array. For $V >$ V_t, the current follows a scaling behavior, I $\propto [(V - V_t)/V_t]^\alpha$ with α ~ 2.8, implying a quasi 2D GQD array. Temperature dependent current – gate voltage ($I - V_g$) curves show reproducible Coulomb oscillations due to a single electron tunneling through GQD array that washes out between 70 and 120 K corresponding to charging energies of 6.2 $\sim$ 10 meV giving estimated GQD sizes of 5 - 8 nm. Temperature dependent resistance data show Efros-Shklovskii variable range hopping (ES VRH) arising from CB, structural and size induced disorder.

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