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Evidence of Coulomb blockade behavior in finite, one-dimensional quantum well VINCENT MEUNIER, MINGHU PAN, ORNL, Oak Ridge, TN, FREDERIC MOREAU, FUNDP, Namur, Belgium, KENNETH PARK, Baylor University, Texas, WARD PLUMMER, ORNL, Oak Ridge, TN and UT, Knoxville, TN
— We report on a new type of "quantum box" that is grown on an insulating TiO_2(110) surface and is effectively closed by the presence of two charged structures at both ends. The static end charges are responsible for a long-range potential that governs the behavior of the electrons inside the box. As expected from a system with quantum confinement, we observe oscillatory features that can be attributed to standing waves inside the system. The spatial distribution of the charge density fits remarkably well with the solution of the Schrodinger equation, provided that correlation effects are included. However, the astounding result is that they are all observed at room temperature and furthermore unchanged within the range of STM tip potential (about 0.5 V). Because the substrate is insulating and the electrons are well confined inside the structure, we can use the capacitor approach to evaluate the corresponding charging energy. Our theoretical analysis indicates that the energy needed to put an extra electron into the confining structure of 14-16 nm long amounts to about 1.14-1.30 eV in agreement with a simple classical picture of capacitor charging.

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