Nanocrystalline silicon quantum dots prepared by VHF plasma enhanced chemical vapor deposition

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Nanocrystalline silicon is a promising material for future ultralarge scale integrated circuits and display devices. Various methods have been demonstrated for the fabrication of nanocrystalline silicon with size less than 10nm. We have prepared nanocrystalline silicon ultrafine particles by VHF plasma decomposition of silane and hydrogen. Nanoparticles formed in the plasma cell are extracted through a small orifice and deposited onto substrates. The size of the particle is determined by the pulse sequence of gases supplied to the plasma cell, and an average diameter of 8nm with a size distribution of 1nm can be obtained. Coulomb blockade, a characteristic single-electron tunneling property, has been investigated in an array of nanoparticles and an individual particle deposited onto nanoscale electrodes.