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Single-Charge Sensitivity of Single-Walled Carbon Nanotube Multifunctional Quantum Transistor

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Single-walled carbon nanotube (SWNT) field-effect transistors show hysteresis in their electrical characteristics owing to the amorphous carbon around the carbon nanotube. Here, we show the reduction in the hysteresis characteristic by a refining process applied repeatedly to the carbon nanotube. Moreover, an SWNT multifunctional quantum transistor that shows a transition between resonant transistor (RTT) characteristics and single-hole transistor (SHT) characteristics with a change in applied gate voltage is developed. By fabricating a few charge storage units around the channel of a purified SWNT multifunctional quantum transistor, an abrupt discrete switching of the source-drain current is observed, which corresponds to the single-charge transition between a storage unit and an SWNT. In addition, storage energy was controlled by adjusting applied bias.

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