

Negative Differential Resistance in Polyaniline Nanodevice

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Polyanion-stabilized polyaniline (PANI) nanojunction bridged with few or even single strands were successfully fabricated and measured. Each nanojunction was formed by bridging a pair of nanoelectrodes separated with a small gap (~60 nm) with PANI/polyanion complex. Conductance (G) versus electrochemical gate potential (E) curves (GE) and drain current (I) versus source-drain potential (V) curves (IV) were measured and fitted with Gerischer's model (Gaussian function). Quantized conductance distributions were observed and the conductance of single polyaniline strand was determined as 4.6nS in our device. The amount of conducting polymer strands and the interactions between them determined the shape and characteristics of GE and IV curves. Sharp conductance peaks in GE curves and obvious negative differential resistance (NDR) in IV curves were consistently observed when the number of polymer strands was reduced to a single or a few. The description of NDR effect through Gerischer's model allowed demonstrating that NDR behavior in IV curves is originated from PANI redox properties.

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