Negative Differential Resistance, Memory and Reconfigurable Logic Functions Based on Monolayer Devices Derived From Gold Nanoparticles Functionalized With Electropolymerizable Thiophene-EDOT Units

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Résumé en anglais	We report on hybrid memristive devices made of a network of gold nanoparticles (10 nm diameter) functionalized by tailored 3,4-(ethylenedioxy)thiophene (TEDOT) molecules, deposited between two planar electrodes with nanometer and micrometer gaps (100 nm to 10 μm apart), and electropolymerized in situ to form a monolayer film of conjugated polymer with embedded gold nanoparticles (AuNPs). Electrical properties of these films exhibit two interesting behaviors: (i) a NDR (negative differential resistance) behavior with a peak/valley ratio up to 17 and (ii) a memory behavior with an ON/OFF current ratio of about 103–104. A careful study of the switching dynamics and programming voltage window is conducted demonstrating a nonvolatile memory. The data retention of the “ON” and “OFF” states is stable (tested up to 24 h), well controlled by the voltage, and preserved when repeating the switching cycles (800 in this study). We demonstrate reconfigurable Boolean functions in multiterminal connected NP/molecule devices.
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