CHARGE TRANSPORT IN TWO-DIMENSIONAL DNA TUNNEL JUNCTION DIODES

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Abstract - Recently, DNA has been studied for electronics due to its intrinsic benefits such as its natural plenitude, bio-degradability, bio-functionality and low-cost. However, its applications only limit to passive components because of inherent insulating properties. In this report, the metal-insulator-metal tunnel diode with Au/DNA/NiOx junctions is presented. Through the self-aligning process of DNA molecules, a two dimensional DNA nanosheet is synthesized and used as a tunneling barrier, and semitransparent conducting oxide, NiOx is applied as a top electrode for resolving metal penetration issues. These molecular devices successfully operate as a non-resonant tunneling diode and temperature-variable current-voltage analysis proves that Fowler–Nordheim tunneling is a dominant conduction mechanism in the junctions. The DNA-based tunneling devices appear to be a promising prototype approach to Bio-Nano electronics using DNA nanosheets.