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Sensitivity of carbon nanotube and graphene transistors to local ionic structure IDDO HELLER, SOHAIL CHATOOR, JAAN MANNIK, MARCEL A. G. ZEVENBERGEN, CEES DEKKER, SERGE G. LEMAY, Delft University of Technology — Transistors based on single-walled carbon nanotubes (SWNTs) and graphene can be operated in aqueous solution where the electrolyte acts as a highly efficient gate. We show that the composition and spatial distribution of ions in the electrolyte intricately affect the conductance of SWNT and graphene transistors. Changes in the ionic strength, pH, and surprisingly, the type of ions affect the electronic transport through the electrostatic gating effect. In addition, changing pH leads to Schottky-barrier modification, while changing ionic strength affects the gate capacitance. Interestingly, the observed electrostatic gating effect for graphene is larger than for SWNTs. Most of our data is explained by a model that considers ionizable groups on both the underlying substrate and on the carbon surfaces. Our findings have significant implications for optimizing sensing experiments with nanocarbon transistors.

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