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Electrically Gated Solid State Nanopores ZHIJUN JIANG, WALTER REISNER, DEREK STEIN, Brown University — We are exploring the use of electrically functionalized solid-state nanopores for controlling the transport of ions and single DNA molecules in solution. We have integrated annular gate electrodes inside solid-state nanopores that can electrostatically adjust both the polarity and the density of the inner surface charge. An applied gate potential can thereby influence the density of mobile counter-ions inside a pore at low salt concentrations. Our theoretical calculations show that a 0.1 V change in the gate potential can change the pore conductance by more than a factor of 5, making the nanopore behavior similar to that of a transistor. Furthermore, the electrostatic interaction between the nanopore surface and negatively charged DNA molecules can be probed in the regime of Double-layer overlap. A negatively charged inner nanopore surface should repel DNA, and limit its possibility to insert into the nanopore. Positive surface charges, on the other hand, will attract DNA, and translocation should be favored. We seek to electrostatically control the translocation of DNA through the nanopore, and thereby mimic single-molecule regulatory capabilities of biological nanopores.

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