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DNA translocation through a solid-state nanopore coated with a self-assembled monolayer BINQUAN LUAN, GUSTAVO STOLOVITZKY, GLENN MARTYNA, IBM RESEARCH TEAM — The translocation of DNA through a solid-state nanopore can be dramatically affected by surface properties of a pore, such as charge density, roughness and hydrophobicity, since the pore surface serves as a boundary for the hydrodynamic flow accompanying with DNA motion. Recent experiment demonstrated the coating of a self-assembled monolayer (SAM) on the surface of a nanopore, allowing an active control on the surface property. Using all-atom molecular dynamics simulation, we investigated the tribological effect on DNA translocation through a solid-state nanopore coated with a SAM. When DNA is confined to the center of a pore, i.e. no direct interaction between DNA and pore surface, charge density and roughness of a pore surface can affect electroosmotic and hydrodynamic flows inside a nanopore, respectively. When allowing direct interaction between DNA and a SAM, adhesive interaction via hydrogen bonds can substantially increase friction force on DNA during translocation but repulsive interaction permits a fast translocation of DNA. We found two types of motion of DNA, stick-slip and steady-sliding, that are qualitatively explained using a Langevin-like model.

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