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Superhydrophobic nanofluidic channels for enhanced electrokinetic conversion[1] ANTONIO CHECCO, AKTARUZZAMAN AL HOSSAIN, AMIR RAHMANI, Mechanical Engineering Dept., Stony Brook University, CHARLES BLACK, GREGORY DOERK, Center for Functional Nanomaterials, Brookhaven National Laboratory, CARLOS COLOSQUI, Mechanical Engineering Dept. and Applied Mathematics Statistics Dept., Stony Brook University — We present current efforts in the development of novel slit nanofluidic channels with superhydrophobic nanostructured surfaces designed to enhance hydrodynamic conductivity and improve selective transport and electrokinetic energy conversion efficiencies (mechanical-electrical energy conversion). The nanochannels are fabricated on silicon wafers using UV lithography, and their internal surface is patterned with conical nanostructures (feature size and spacing ˜30 nm) defined by block copolymer self-assembly and plasma etching. These nanostructures are rendered superhydrophobic by passivation with a hydrophobic silane monolayer. We experimentally characterize hydrodynamic conductivity, effective zeta potentials, and eletrokinetic flows for the patterned nanochannels, comparing against control channels with bare surfaces. Experimental observations are rationalized using both continuum-based modeling and molecular dynamics simulations. Scientific and technical knowledge produced by this work is particularly relevant for sustainable energy conversion and storage, separation processes and water treatment using nanoporous materials.

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