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Amplification of the electroosmotic velocity by induced charges at fluidic interfaces CLARISSA STEFFES, TOBIAS BAIER, STEFFEN HARDT, Center of Smart Interfaces, Technische Universität Darmstadt, Germany — The performance of microfluidic devices like electroosmotic pumps is strongly limited by drag forces at the channel walls. In order to replace the standard no-slip condition at the wall with a more favorable slip condition, superhydrophobic surfaces are employed. In the Cassie-Baxter state, air is entrapped in the surface cavities, so that a significant fraction of water-air interfaces at which slip does occur is provided. However, such surfaces do not enhance electroosmotic flow. Since no net charge accumulates at the water-air interfaces, the driving force is reduced, and no flow enhancement is obtained. We consider electrodes incorporated in the superhydrophobic structure to induce charges at these interfaces, thereby increasing the driving force. A theoretical model is set up, yielding an understanding of the influence of the surface morphology on the flow, which serves as a basis for ongoing experimental work. While a considerable enhancement of the electroosmotic velocity is already expected for standard superhydrophobic surfaces, greater amplifications of one order of magnitude may be achieved by substituting the air in the surface cavities by oil, reducing the risk for electric breakdown or transition to the unfavorable Wenzel state.

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