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Effect of Electro-Osmotic Flow on Energy Conversion on Superhydrophobic Surfaces SESHADRI GOWRISHANKAR, Indian Institute of Technology, Bombay, TOBIAS BAIER, Centre for Smart Interfaces, TU Darmstadt, Germany — It has been suggested that a superhydrophobic surface, by virtue of the presence of no-shear zones, can greatly enhance the transport of surface charges. This would lead to a considerable increase in the streaming potential, a feature which could find possible applications in micro-energy harvesting devices. Such devices are of promise in micro-fluidic studies in view of their ability to act as effective energy conversion devices on the micro-scale. In our paper, we use a theoretical approach to show that the generation of a streaming potential in such superhydrophobic geometris is significantly limited from that otherwise expected because of the current generated from a reverse electro-osmotic flow. We also show that, for large values of free surface charge densities, the electro-osmotic flow current would engender a saturation in both the power extracted and efficiency of energy conversion that is achievable in such systems. Our analysis therefore indicates that fluids with very low conductivity should be preferred in energy conversion devices. Finally, we extrapolate our results to show that a saturation to both the energy conversion and the efficiency would be obtained in all flow geometries, although the charge density of the free surface at which this happens can vary.

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