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Experimental and Theoretical Studies of Electroosmotic Membrane Micropumps ZULI XU, JIANYING MIAO, NING WANG, PING SHENG, Department of Physics and Institute of Nano Science and Technology, Hong Kong University of Science and Technology, Clear Water Bay, Hong Kong, China — Electroosmotic (EO) effect means fluid flow (through a porous medium) induced by an applied electric field E. EO pumps have the advantages of no moving parts and easily-controlled accurate flow rate at low applied voltages. We have fabricated nanochannel EO membrane pumps using anodic aluminum oxide (AAO) as the template [1]. The diameter of the uniform-sized nanochannels can range from 60-300nm, with a membrane thickness of 30-100 microns. The EO effect is enhanced by coating the nano-channels with silica. By using de-ionized water, the nanopump performance is shown to agree reasonably well with the theoretical model, with factors such as the ratio of the double layer thickness to channel diameter, channel geometry, and treatment of the AAO membranes playing important roles. With silica coating to the nanochannels, the nanopump can produce a maximum pressure of 1 atm and a maximum flow rate of 86,000μL/min·cm2 under an applied field of 0.94 V/μm. Besides DI water, the micropumps have also been tested to work well with salt, acid or base solution. [1] J.Y. Miao, Z.L. Xu, X.Y. Zhang, N. Wang, Z.Y. Yang, P. Sheng, submitted to Advanced Materials (Appeared online: 10.1002/adma.200700767).

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