

Applicability of Microchip-Based Streaming Potential for Electrokinetic Microbattery

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The streaming potential is generated by the electrokinetic flow effect within the electric double layer of charged surface. This study mainly focuses on the enhanced streaming potential through microfluidic channels fabricated on several types of poly(dimethyl siloxane) (PDMS) microchip. It is expected that higher streaming potential can be obtained as the surfaces of microchannels become more hydrophilic. The poly(2-hydroxyethyl methacrylate) (polyHEMA) treatment makes the PDMS surfaces hydrophilic. Both the solution pH and the Debye double layer thickness affect the magnitude of the streaming potential. In addition to the streaming potential, the electric current would be measured in an electric circuit, where multi-channels in parallel amplify the magnitude of electric current. Experimental results are compared with theoretical predictions solving both the Navier-Stokes equation coupled with the Poisson-Boltzmann field as well as the Nernst-Planck equation. Our study shows feasibility that the well-designed microchip could be applied to the microbattery.