

Simulation Of Electrokinetic Ion Dynamics Through TPU Microtubes

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Abstract

The magnitude of ionic current through a conical microtube filled with an electrolyte solution depends on the polarity of the applied bias, indicating an asymmetric diode-like current-voltage (I-V) curve. This kind of phenomenon refers to ionic current rectification (ICR), which is of interest because many ion-channel proteins in cellular membranes are rectifying. In addition, ICR in microtubes can be used to control ion concentrations in nano- and microfluidic systems. In this study, the ICR phenomenon through a conical microtube simultaneously subjected to an electric field and an electrolyte concentration gradient is numerically investigated. A mathematical model consisting of the Nernst - Planck equations for the ionic mass transport, the Poisson equation for the electrostatics, and the Navier - Stokes equations for the flow field has been developed.