NUMERICAL SIMULATIONS OF ELECTRICAL DOUBLE LAYER AND ELECTROOSMOTIC FLOW IN A NANOPORE BY OPENFOAM

JIE LI，JIAN YE，DILIN CHEN, LI XU

Mail：yejianjerry@163.com, school of Energy and Power Engineering，Wuhan University of Technology, 1040 Heping Road,Wuhan 430063, PR China

Keywords: *EDL, EOF, OpenFOAM*

The microfluidic chip transfers the pretreatment, chemical reaction, separation, detection, and other functions of the sample to a chip of several square centimeters, which embodies the characteristics of miniaturization, integration, automation, and simplicity. The drive and control of microfluidic have become the key problems in the research of microfluidic chip. In this work, numerical simulation of the electrical double layer (EDL) formed next to a charged planar surface and an electroosmotic flow (EOF) in a nanopore is demonstrated using OpenFOAM. The electrostatics and the ionic mass transport are governed by the Poisson–Nernst –Planck (PNP) equations without considering fluid motion in the model for EDL. The numerical predictions of the electric field and ionic concentrations are in good agreement with the analytical solution. The model for EOF includes the modified Stokes equations for the flow field, the Poisson equation for the electrostatics, and the Nernst–Planck equations with the convective term for the ionic mass transport. The predicted EOF velocity quantitatively agrees with the analytical solution.