Effect of time-dependent pressure imposed on electrokinetic flows in microfluidic channels

김광석, 전명석*
한국과학기술연구원
(mschun@kist.re.kr*)

Exploitation of streaming potential induced when fluid flows through a microsized channel bears possible applications from micro energy to bioMEMS. However, exact mechanisms involved in the transition of mechanical work to electrokinetic flows in a narrow channel is not yet sufficiently investigated. In this contribution, three-dimensional numerical simulations will be conducted to comprehensively explore a flow regime (spanwise and streamwise velocity profiles) and a streaming potential induced when time-dependent pressure (i.e., pulsatile) is imposed in the simple harmonic form to one end of a straight or a curved channel. The Poisson-Boltzmann equation describes an electric potential distribution across an electrical double layer (EDL) formed due to a charged channel wall. Three-dimensional Navier-Stokes equations associated with the EDL potential will be solved at various operational and hydrodynamic conditions such as different pulsating frequencies and whether fluid slips at the wall. And the results will be used to calculate the energy conversion, defined as ratio of electrical power generated to mechanical work needed to pump fluid, in different conditions.