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Unsteady electrokinetic microfluidics with hydrodynamic slippage effect MYUNG-SUK CHUN, YOONA YANG, National Agenda Research Div., Korea Institute of Science and Technology (KIST), COMPLEX FLUIDS TEAM — The nature of low Reynolds number flows and confined spaces inherent in microscale or extended nanoscale channels imply the significant influence of solid wall boundaries. We investigate the unsteady pulsatile electrokinetic flows by extending our previous simulations concerning electrokinetic microfluidics. The body force originated from between the nonlinear Poisson–Boltzmann field and the flow-induced electric field is employed in Navier–Stokes equation, and Nernst–Planck equation in connection with the net current conservation is further coupled. Our explicit model allows one to quantify the effects of time delay, oscillating frequency, and conductance of the Stern layer, considering the fluid slippage at hydrophobic surfaces and the electric double layer interaction. This presentation reports new results regarding the implication of pressure pulsations toward realizing mechanical to electrical energy transfer with high conversion efficiency. A combined role of the fluid slippage and conductance of channel wall is examined to obtain possible enhancements of streamwise velocity and streaming potential, with taking advantage of pulsating pressure field. Note that our framework can serve as a useful basis for micro/nanofluidics design.

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