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Time-dependent electrokinetic flows of non-Newtonian fluids in microchannel-array for energy conversion[1] MYUNG-SUK CHUN[2], BYOUNGJIN CHUN[3], JI-YOUNG LEE, Korea Institute of Science and Technology (KIST), COMPLEX FLUIDS TEAM[4] — We investigate the externally time-dependent pulsatile electrokinetic viscous flows by extending the previous simulations concerning the electrokinetic microfluidics for different geometries. The external body force originated from between the nonlinear Poisson–Boltzmann field and the flow-induced electric field is employed in the Cauchy momentum equation, and then the Nernst–Planck equation in connection with the net current conservation is coupled. Our explicit model allows one to quantify the effects of the oscillating frequency and conductance of the Stern layer, considering the shear thinning effect and the strong electric double layer interaction. This presentation reports the new results regarding the implication of optimum frequency pressure pulsations toward realizing mechanical to electrical energy transfer with high conversion efficiencies. These combined factors for different channel dimension are examined in depth to obtain possible enhancements of streaming current, with taking advantage of pulsating pressure field. From experimental verifications by using electrokinetic power chip, it is concluded that our theoretical framework can serve as a useful basis for micro/nanofluidics design and potential applications to the enhanced energy conversion.

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