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Electroosmotic Flow in Rectangular Nanochannels with Variable Wall potential: Generation of Multiple Nano-Vortices LEI CHEN, A.T. CONLISK, The Ohio State University — Electroosmotic flow in nanochannels is characterized by a very small Reynolds number so that mixing is difficult. While several researchers have presented results for the case of periodic wall potential, and for a sudden change in potential there has been no systematic study of the effect of the variation of wall potential on the flow structure. We have calculated the flow and mass transport in a two-dimensional nanochannel having discontinuities in wall potential. Multiple nano-vortices are generated within the bulk flow due to the overpotential at the surface. The distributions of potential, velocity and mole fractions are calculated numerically and the structure of the flow within the "nano-vortices" resembles that of the classical Lamb vortex. The parameters that affect the circulation are investigated as well. The long electrode limit (the aspect ratio much less than one) is investigated for small channels (EDLs are overlapped) and wide (thin EDL) channels as well. It is found that the flow is two-dimensional only near the corners of the electrode and is fully-developed elsewhere. The flow can be thus decomposed into one-dimensional electroosmotic flow and Poiseuille flow. For a wide channel, a singular perturbation analysis is performed for the electroosmotic component. The results are compared with recently generated experimental data. *This work is supported by the Air Force Office of Scientific Research through its Multi-University Research Initiative(MURI) program.

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