Abstract Submitted
for the DFD16 Meeting of
The American Physical Society

Thermoelectrokinetic instability in micro/nanoscales GEORGY GANCHENKO, NATALIA GANCHENKO, Laboratory of Micro- and Nanoscale Electro- and Hydrodynamics, Financial University — A novel sophisticated type of electro-hydrodynamic instability in an electrolyte solution near ion-selective surfaces in an external electric field is discovered theoretically. The key mechanism of the instability is caused by Joule heating but dramatically differs from the well-known Raleigh-Benard convection. The investigation is based on the Nernst-Planck-Poisson-Navier-Stokes system along with the energy equation and corresponding BCs. The 1D quiescent steady state in microscales can be unstable with respect to either short-wave Rubinstein-Zaltzman or long-wave thermoelectokinenetic instability. The last one prevails in long microchannels and good enough thermal insulation of the system. In addition to the linear stability analysis a direct numerical simulation of the full 3D nonlinear system is fulfilled using a parallel computing. In the final coherent structures salt concentration, temperature and electric current are localized in narrow long fingers normal to the ion-selective surface while space charge forms crown-like micro-patterns. The investigation results can be useful in desalination problem.

Georgy Ganchenko
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Date submitted: 22 Jul 2016 Electronic form version 1.4