Abstract Submitted
for the DFD19 Meeting of
The American Physical Society

Non-isothermal electrokinetic effects in an electro-osmotic flow EDGAR RAMOS, FEDERICO MENDEZ, National Autonomous University of Mexico, JOSE LIZARDI, College of Science and Technology — In this work, we study numerically the combined influence of some non-isothermal electrokinetics effects derived from a Debye length versus the fluid viscosity, when both depend on the temperature for an electroosmotic laminar flow circulating in a slit microchannel. Considering then that the Debye length depends on temperature T, together with the fluid viscosity, we obtain additional temperature gradients along the microchannel and the isothermal hypothesis is no longer valid. Therefore, the Navier-Stokes equations together with the energy, Poisson and Ohmic current conservation equations are solved by using a routine finite element method. For this purpose, the governing equations are written in a dimensionless format and we introduce a dimensionless thermal parameter α that measures the temperature deviations of a reference temperature and a dimensionless parameter γ, which defines the effects of the variable viscosity. The numerical predictions show that the influence of these parameters yields different regimes for the behavior of the volumetric flow rate in comparison with a uniform Debye length and strong induced pressure gradients are sensibly altered by the existence of these dimensionless parameters.

Edgar Ramos
National Autonomous University of Mexico

Date submitted: 19 Jul 2019 Electronic form version 1.4