

Abstract Submitted
for the DFD19 Meeting of
The American Physical Society

Low-voltage onset of electrokinetic mixing at heterogeneous charge selective interfaces ANNE BENNEKER, University of Calgary, BURCU GUMUSCU, ERNEST DERCKX, ROB LAMMERTINK, JEFFERY WOOD, University of Twente — Electrokinetic mixing of the concentration boundary layer adjacent to charge selective interfaces can enhance the performance of electro dialysis systems and fuel cells by increasing the transport of ions towards the interface. Traditionally, electrokinetic instabilities occur at relatively high potentials, significantly reducing the system efficiency. In this work, we experimentally show that altering the topology of the charge selective interface can induce electrokinetic mixing at low potentials using patterned charge selective hydrogels. Fluorescence microscopy for mapping local ion concentration is combined with electrical characterization to unravel the development of ion depletion zones and the onset of electrokinetic mixing. For different geometries, we find that the development of these depletion zones is distinctly different as a result of the distribution of the field lines through the different geometries. Enhancement in the total transport is observed with increasing system heterogeneity as a result of electroosmotic contributions to the charge transport, starting at low applied potentials. This indicates that inducing non-uniform electric fields using membrane topology variations and spacers is a promising route for increasing charge transport to the interface.

Anne Benneker
University of Calgary

Date submitted: 19 Jul 2019

Electronic form version 1.4