Abstract Submitted
for the DFD16 Meeting of
The American Physical Society

From electroconvective vortices to current hot spots on ion selective membranes subject to concentration polarization KAREN WANG, ALI MANI, Stanford University — Electroconvective instabilities near ion-selective surfaces have been shown to greatly enhance ion transport and play a significant role in a wide range of applications in electrochemistry. When the driving voltage exceeds a threshold, electroconvection becomes chaotic and leads to intermittent spikes of current density on the ion-selective surface. We present an investigation of this phenomenon by considering a canonical setting consisting of a symmetric binary electrolyte next to a flat, ion-selective membrane subject to an external driving voltage. By tracking individual rolls of vortices, we reveal the common mechanism under which the three-way coupled fluid dynamics, ion transport, and electrostatic effects lead to advective displacement of ion concentration field, sustained vortices and vortex migration, and current hot spots on the membrane.

Karen Wang
Stanford University

Date submitted: 30 Jul 2016 Electronic form version 1.4