Abstract Submitted
for the DFD13 Meeting of
The American Physical Society

Overlimiting current through ion concentration polarization layer: Experimental verifications of the surface conduction mechanism[1]

SUNGMIN NAM, Seoul National University, JOONSEONG HEO, GEUNBAE LIM, Pohang University of Science and Technology, SUNG JAE KIM, Seoul National University — The mechanism of overlimiting current which observed in most practical electrochemical membrane systems has become a critical issue that numerous researchers have tried to resolve. Overlimiting current is closely related to the ion concentration polarization phenomenon which represents an imbalance of ion concentrations nearby the membrane. Among a number of studies, a recent theoretical study suggested that surface conduction is the core mechanism, while an electro-convective flow and water dissociation has been regarded as the major mechanism of overlimiting current. In this presentation, we provide rigorous experimental evidences of the role of surface conduction using a micro/nanofluidic platform. Conclusively the surface conduction enhances the overlimiting current characteristics, while the electro-convection retards the initiation of overlimiting current. Thus, this result can contribute to the advances for both understanding a fundamental electrokinetic theory and engineering applications based on the ion concentration polarization phenomena.

[1]This work is supported by Basic Science Research Program (2013R1A1A1008125) and Future-based Technology Development Program (Nano Fields) (2009-0082952) by MISP and by MOE (No. 2012R1A2A2A06047424), Korea.

Sung Jae Kim
Seoul National University

Date submitted: 31 Jul 2013 Electronic form version 1.4