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**A numerical method for electro-kinetic flow with deformable fluid interfaces** MICHAEL BOOTY, New Jersey Institute of Technology, MANMAN MA, Shanghai Jiao Tong University, MICHAEL SIEGEL, New Jersey Institute of Technology — We consider two-phase flow of ionic fluids whose motion is driven by an imposed electric field. At a fluid interface, a screening cloud of ions develops and forms an electro-chemical double layer or Debye layer. The imposed field acts on this induced charge distribution, resulting in a strong slip flow near the interface. We formulate a "hybrid" or multiscale numerical method in the thin Debye layer limit that incorporates an asymptotic analysis of the electrostatic potential and fluid dynamics in the Debye layer into a boundary integral solution of the full moving boundary problem. Results of the method are presented that show time-dependent deformation and steady state drop interface shapes when the timescale for charge-up of the Debye layer is either much less than or comparable to the timescale of the flow.

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