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AC Electrokinetics in the Limits of Extremely High Voltage and Ion-Asymmetry[1] ARUNRAJ BALAJI, SHAHAB MIRJALILI, ALI MANI, Stanford University — The aim of this study is to extend understanding of AC electrokinetics to regimes involving Dielectric Barrier Discharge (DBD) plasmas. To this end, we consider a simple model utilizing the Poisson-Nernst-Planck and Navier-Stokes equations, as commonly used in analysis of electrokinetic phenomena. To study the specific regimes relevant to plasmas, we consider the limits of extremely high AC voltage ($V = O(10^4 V_T)$) and extremely high ion-asymmetry ($\frac{D^-}{D^+} = O(10^4)$). Direct numerical simulation (DNS) of the governing equations is performed in one- and two-dimensional spatial domains, and different regimes of response are identified in terms of input voltage and diffusion asymmetry parameters. In addition to the results of DNS, this work also focuses on modeling considerations for the plasma regime and steps toward a more complete simulation of DBD: one that includes the effects of thermal-nonequilibrium and reactions.

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