

## Electrohydrodynamic Flow induced by Onsager Effect

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We analyze the electrohydrodynamic (EHD) flow around cylinder and sphere in a weak electrolyte, which is induced by the Onsager effect. Onsager showed that the conductivity of the weakly dielectric liquid is proportional to the electric field strength. The Coulombic force by the Maxwell–Wagner polarization is induced when a uniform AC field is applied to a cylinder or sphere. In this paper, the time-averaged Stokes equations with the Coulombic force are solved using the method of perturbation expansion. The analytic solutions of the flow fields are dependent on the Clausius–Mossotti (CM) factor, which is a relative difference of complex conductivities of inside and outside particle. The EHD flow is classified as (i) unidirectional straining flow, (ii) straining field with vortex and (ii) bidirectional quadrupole-like flow according to the CM factor. The phase diagrams for the flow fields are suggested for cylinder and sphere cases, respectively.