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The Polarization of a Diffuse Soft Particle Subjected to an Alternating Current Field SEBASTIAN UPPAPALLI, HUI ZHAO, University of Nevada Las Vegas — The polarization of a diffuse soft particle submerged in an aqueous electrolyte and subjected to a uniform, alternating electric field is theoretically analyzed with the standard electrokinetic model. The particle consists of a rigid uncharged core and a charged diffuse polyelectrolytic shell (soft layer), permeable to ions and solvent. Our focus is on the impact of the characteristics of the soft layer including Donnan potential, the soft layer thickness and the friction coefficient of the soft layer on the dipole coefficient, characterizing the strength of the polarization. Under the limits of thin double layers and thin polyelectrolytic shells, approximate, analytical expressions to evaluate dipole moment coefficients are derived, respectively, for high-frequency and low-frequency ranges. The analytical results are compared and agree favorably with those numerically computed by the standard model. Interestingly, we discover that when the double layer is comparable to the soft layer, the dipole moment behaves qualitatively differently at different Donnan potentials. When the Donnan potential is small, the dipole moment decreases as the double layer increases. In contrast, at large Donnan potentials, the dipole moment increases with the increase of the double layer. The distinct responses to Donnan potentials are attributed to the impact of the associated double layer on the charge distribution of mobile ions inside the soft layer. The theoretical model provides a fundamental basis for interpreting the polarization of heterogeneous systems including environmental or biological colloids or microgel particles.

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