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A Mode-Mode Coupling Scheme of Colloidal Electrolyte Friction

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The self-diffusion of spherical colloidal polyions (i.e., macroions) immersed in an electrolyte solution depends on electrostatic, excluded volume and solvent-mediated hydrodynamic interactions between the ionic species. The electro-hydrodynamic coupling of the electrolyte and counter-ions to the macroion motion gives rise, in particular, to an additional contribution to the macroion friction coefficient. On the basis of the primitive model of asymmetric electrolytes and the generalized Smoluchowski diffusion equation for Brownian spheres, a simplified mode-mode coupling scheme is solved for quantifying this electrolyte friction effect. The influence of the finite sizes of the small electrolyte ions is accounted for using mean spherical approximation expressions of static pair correlation functions for unequal sizes. The importance of hydrodynamic interactions is assessed by comparing results obtained with and without hydrodynamic interactions included.

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