Attraction between Like-Charge Surfaces in Polar Mixtures

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We discuss the force between two similarly charged surfaces immersed in partially miscible aqueous mixtures. For a homogeneous water-poor phase, as the distance between the surfaces is decreased, a water-rich phase condenses at a distance D_t in the range 1-100nm. At this distance the osmotic pressure can become negative leading to a long range attraction between the surfaces. The osmotic pressure vanishes at a distance $D_e < D_t$, representing a very deep metastable or globally stable energetic state. We give analytical and numerical results for D_t and D_e on the Poisson-Boltzmann level. We discuss the relevance of our results to recent experiments on colloidal suspensions in aqueous mixtures.