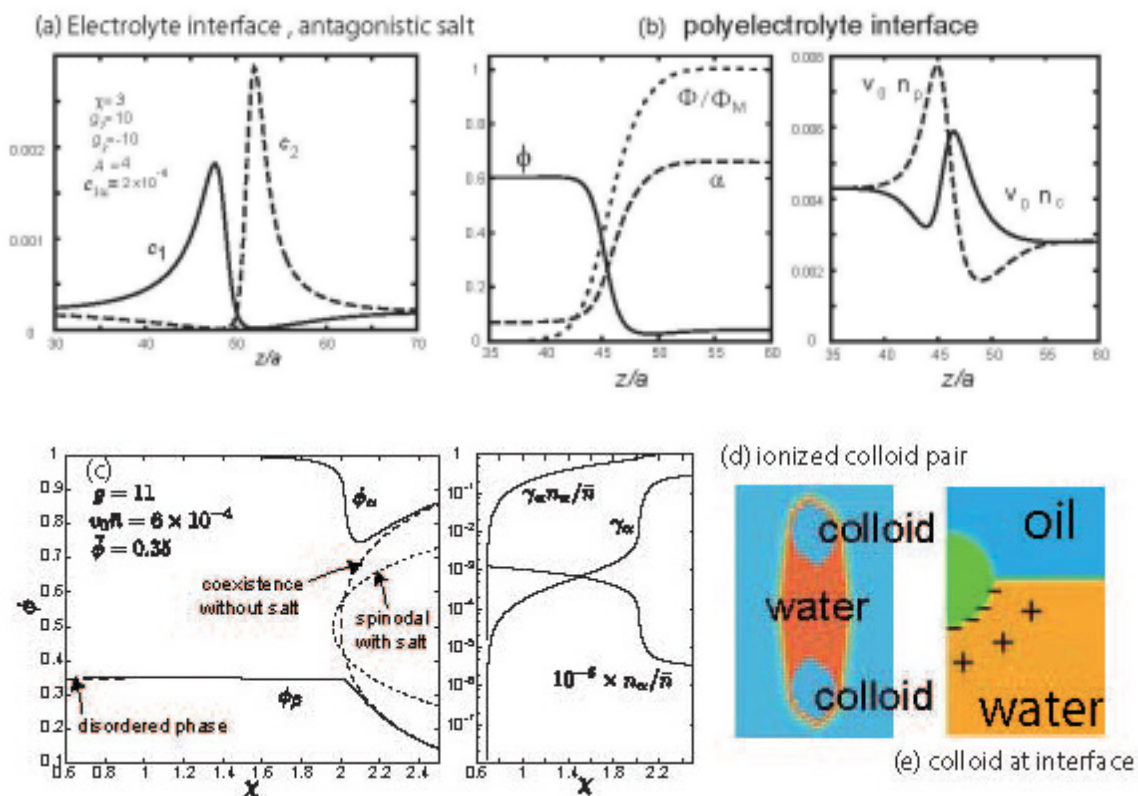


Solvation effects in phase separation of soft matters

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In soft matters such as polar fluid mixtures (water-oil or alcohol) and polyelectrolytes, ion solvation can strongly affect phase separation. This is because the solvation chemical potential of ions varies over wide ranges $\gg kT$ as a function of the water composition. We examined the ion distributions around interfaces determined by the solvation. For example, in fig.(a) we show the distributions of hydrophilic cations and hydrophobic anions (antagonistic salt)[1], where an electric double layer is enlarged, much reducing the surface tension. In fig.(b) we show the polyelectrolyte interface profiles[2], where ϕ is the polymer density, Φ is the potential, α is the degree of ionization, n_p is the density of ionized monomers, and n_c is the counterion density. In fig.(c) we show that preferential solvation can stabilize water domains enriched with hydrophilic ions (NaCl) in wide ranges of the temperature and the average composition[3], where the solvent would be in one-phase states without ions. This explains a long-standing problem of heterogeneities in salted aqueous mixtures observed by dynamic scattering. Here we show the composition ϕ vs the interaction parameter χ and the volume fraction of water domains γ_w . In fig.(d) we show accumulation of water around ionizable colloids as wetting. This is due to preferential solvation, giving rise to attraction among ionized colloids and their aggregation. In fig.(e) we show an ionizable pickering colloid, whose trapping to an interface can be governed by composition-dependent ionization.



[1] A.Onuki, Phys. Rev. E73, 021506 (2006); J. Chem. Phys. 128, 224704 (2008)

[2] R. Okamoto and A. Onuki, J. Phys. Chem. B, 113, 3988 (2009); J. Chem. Phys. 131, 094905 (2009).

[3] R. Okamoto and A. Onuki, arXiv:1001.3712}