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Repulsive interactions between two polyelectrolyte networks

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OLVERA GROUP COLLABORATION — Surfaces formed by charged polymeric species are highly abundant in both synthetic and biological systems, for which maintaining an optimum contact distance and a pressure balance is paramount. We investigate interactions between surfaces of two same-charged and highly swollen polyelectrolyte gels, using extensive molecular dynamic simulations and minimal analytical methods. The external-pressure responses of the gels and the polymer-free ionic solvent layer separating two surfaces are considered. Simulations confirmed that the surfaces are held apart by osmotic pressure resulting from excess charges diffusing out of the network. Both the solvent layer and pressure dependence are well described by an analytical model based on the Poisson–Boltzmann solution for low and moderate electrostatic strengths. Our results can be of great importance for systems where charged gels or gel-like structures interact in various solvents, including systems encapsulated by gels and microgels in confinement.

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