Annotation

The dissertation "Electrostatic Forces Between Surfaces in Liquids" presents a theoretical investigation into the physicochemical behavior of charged surfaces immersed in liquid environments. The study explores the mechanisms by which surfaces acquire charge—via ionization, ion adsorption, or charge exchange—and how this charge leads to the formation of the electric double layer (EDL), which governs long-range electrostatic interactions in fluids.

A central component of the work is the application of the Poisson-Boltzmann (PB) equation to describe counterion distributions between two planar surfaces, both in pure solvents ("counterion-only systems") and in the presence of added electrolytes. The analysis includes the calculation of “contact values” at the surfaces—such as electric potential, field, and ion concentration—and their impact on the resulting pressure between the surfaces.

Key concepts such as the osmotic limit and charge regulation are discussed, highlighting how surface interactions behave at short distances. The thesis also examines the interplay between repulsive double-layer forces and attractive van der Waals interactions, summarized within the DLVO theory, and explores methods for experimentally measuring these forces in systems such as lipid bilayers, clay minerals, and colloidal suspensions.

By bridging theoretical modeling with experimental observables, this research provides critical insights into electrostatic interactions across soft and hard interfaces, offering practical implications for biophysics, nanotechnology, and materials science.