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Discrete Charge Effects on the Potential Distribution in and around Soft Particles

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Abstract

The potential distribution in and around a soft particle, i.e., a porous polyelectrolyte particle, in an electrolyte solution is usually derived via a continuum model in which fixed charges inside the soft particle are distributed with a continuous charge density. In this paper, on the basis of a previous result for a plate like soft particle consisting of a cubic lattice of fixed point charges, we derive expressions for the electric potential distribution for the case of a soft sphere and a soft cylinder. These expressions are given in terms of a sum of the screened Coulomb potentials produced by the point charges within the soft particle. We show how the discrete charge model approaches the continuous charge model as the lattice spacing becomes very small.

Keywords: Continuous Charge Model, Discrete Charge Effect, Donnan Potential, Surface Potential