FEATURED SPEAKER

A Model of Highly Concentrated Electrolyte Solutions

Nir Gavish, Ph.D.

Technion, Israel Institute of Technology

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The Poisson-Nernst-Planck (PNP) theory is one of the most widely used analytical methods to describe electrokinetic phenomena for electrolytes. The model, however, considers isolated charges and thus is valid only for dilute ion concentrations. The key importance of concentrated electrolytes in applications has led to the development of a large family of generalized PNP models. However, the wide family of generalized PNP models fails to capture key phenomena recently observed in experiments and simulations, such as self-assembly, multiple-time relaxation, and under-screening in concentrated electrolytes.

In this talk, we derive a thermodynamically consistent mean-field model for concentrated solutions that goes beyond the PNP framework. The result is a modeling framework that contains the essential ingredients for describing electrolytes over the whole range of concentrations. The model describes self-assembly, multiple-time relaxation, and under-screening, and reveals a mechanism of under-screening as well as predicts distinct transport properties which are not governed by Einstein-Stokes relations, but are affected by inter-diffusion and emergence of nano-structure. Note: Joint work with Doron Elad and Arik Yochelis.