

“Effects of Polarity, Solvation, and Interfacial Polarization on Charge-driven Assembly”

Wednesday
April 24, 2019
3:00 pm
Wu and Chen Auditorium
Levine Hall



Jian Qin
Assistant Professor
Chemical Engineering
Stanford University

Abstract

The electrostatic interaction between charged species is always screened by the polarizable, dielectric medium. Three examples are presented to illustrate the experimental consequences of such screening and how they are captured theoretically. The first example concerns the complexation of homologous polycation and polyanion in aqueous solution. We show that the two-phase window narrows with increasing monomeric *polarity*, and that the trend is fully accounted for by considering the interaction between solvent and monomers. The second example concerns the self-assembly of ion-containing block copolymers. We show that the morphological heterogeneity leads to dielectric heterogeneity, and that the *solvation* free energy of dissolved ions rationalizes the measured variation of phase behavior. The third example concerns the effective dielectric permittivity of particulate composites with sharp dielectric interfaces. We extend the Maxwell-Garnett model, which is known to underestimate the composite permittivity, by constructing a general dielectric virial expansion, and show that the *interfacial polarization* improves the existing model considerably.

Bio

Jian Qin received his B.S. and M.S. degrees in materials physics from Tsinghua University and his Ph.D. from the Department of Chemical Engineering and Materials Science at the University of Minnesota. Following postdoc fellowships at the Pennsylvania State University and the University of Chicago, he joined the faculty in Chemical Engineering at the Stanford University in 2016. His research focuses on theoretical study of morphological and rheological behaviors of polymeric fluids, electrostatic interactions in structured electrolytes, and surface charge polarizations. He has held the Kadanoff-Rice fellowship and has been recognized by the 3M Non-Tenured Faculty Award, the Hellman Faculty Award, and the NSF CAREER.

Spring 2019 CBE Seminar Series

