הטכניון - מכון טכנולוגי לישראל

TECHNION - ISRAEL INSTITUTE OF TECHNOLOGY

הפקולטה להנדסה כימית
ע״ש וולפסון
The Wolfson Department of Chemical Engineering

Wolfson Department of Chemical Engineering Seminar

Tuesday, August 19rd, 2025 at 13:30

Room 6

Exploring and Identifying Ion-Pairing Signatures in Dielectric Spectra of Polyelectrolyte Solutions

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MSc Seminar

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Understanding ion pairing is very crucial in studying of membranes, as ion associations could significantly influence membrane selectivity, conductivity, and overall performance. Dielectric Relaxation Spectroscopy (DRS) is a promising method for studying ion association in solutions. However, studying ion pairing in membranes or solid polymers is challenging due to their complex and heterogeneous nature, presence of many relaxation regimes, and difficulty of assigning specific relaxation modes to ion-pairing. Therefore, this research explored DRS as a tool for studying and quantifying ion pairing in polymers, focusing on polymer solutions as an intermediate model system between solutions and polymeric membranes. We chose solutions of Na^{+} and Mg^{2+} polyacrylates as on of the best known and extensively studied systems, for which the complexation behavior including ion-pairing is quantitatively understood. The dielectric permittivity and dielectric loss spectra in a range of polymer and ion concentration were measured in a frequency range from 200 MHz to 50GHz, where ion-pair relaxation signatures were reported for salt solutions. The data were analyzed using Debye fitting model, allowing us to extract key parameters such as relaxation times and amplitudes. These parameters are then correlated with known extents of ion pairing from complementary studies. Although the results are still inconclusive, the research provides preliminary indications of the possibility to observe and quantify ion association phenomena in polyelectrolyte systems using DRS and may form the basis for future studies of more complex solid-state systems.

Refreshments will be served at 13:15.