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
Lecture Hall 6, Wolfson Department of Chemical Engineering,
Wednesday May 22nd at 1:30pm

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Chemical Engineering

Phase Behavior of Carbon Nanotubes in Superacid Solutions Studied by Cryogenic-Temperature Electron Microscopy

Carbon nanotubes (CNTs), on their molecular level, are characterized with a special combination of mechanical strength, electrical and thermal conductivity, and low mass density. These excellent properties turn CNTs into leading candidates for development of wide variety of CNT-based applications. The best way to translate the single molecule properties into macroscopic material, is through liquid-phase processing. The integration of CNTs in applications was significantly promoted with the discovery of spontaneous molecular dissolution of CNTs in chlorosulfonic acid (CSA). The phase behavior of the CNT/CSA system exhibit different stages as a function of CNTs concentration. At low concentrations, the CNTs are individually dispersed in an isotropic phase, while higher CNT content leads to the formation of an ordered nematic liquid crystalline phase. The properties of the CNT-based macroscopic structures are dictated by the degree of alignment of the CNTs. In our research we showed the different stages of phase formation at the nanometric level, using cryogenic-temperature transmission and scanning electron microscopy (cryo-TEM and cryo-SEM). We explored the effect of CNTs aspect ratio, diameter, and number of walls on the phase behavior, and discovered a new phase behavior regime for small diameter, high aspect ratio CNTs.

While working to improve our cryo-SEM imaging methodology, we have studied the micrograph contrast mechanism at low-voltage SEM and cryo-SEM of different systems. Optimization of the SEM parameters improves the micrograph contrast, which is essential for the study of different-scale features in ceramics, polymers, organic materials, and liquids, and, especially, in biological research. We examined the effect of the acceleration voltage and detector type on the contrast of materials with different electrical conductivity and atomic number, with emphasis on materials rich in carbon and oxygen, e.g., water, oils, and CNTs.

Refreshments will be served at 1:15pm