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

Monday, March 10th, 2025, at 13:30
Room 6

Self-Organization Strategy for Organic Photovoltaic Application

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Organic photovoltaic (OPV) devices based on π-conjugated polymers have garnered significant interest in recent years, with bulk heterojunction (BHJ) systems incorporating poly(3-hexylthiophene) (P3HT) being among the most extensively studied. In this study, we present methods for synthesizing well-defined rod-coil and rod-rod block copolymers containing P3HT and investigate their phase transformations and nanostructural properties. Furthermore, we introduce novel approaches for fabricating OPV devices using self-assembling block copolymers incorporating P3HT, which co-assemble directly with [6,6]-phenyl C61-butyric acid methyl ester (PCBM), ZnO, or TiO_2 into a well-defined “double-channel” network (DCN) nanostructure. This unique morphology enhances charge transport, improves exciton separation, and increases thermal stability. As a result, photovoltaic devices incorporating the DCN structure demonstrate superior power conversion efficiency (PCE) compared to conventional BHJ solar cells. These findings underscore the potential of all-conjugated block copolymers with diverse main-chain moieties for the development of OPV devices with enhanced stability and competitive optoelectronic performance. Fuel cells and water electrolyzes are to play key roles in future hydrogen economy, yet these technologies still face challenges. Specifically, currently used proton-exchange membranes (PEMs) show insufficient ion conductance and water permeance, which also sharply drop at low humidity and limit the size, cost, and efficiency of these electrochemical energy devices. Unfortunately, a long and extensive effort has not yielded a viable remedy to this problem, inherent to all common PEM materials, including Nafion, the established benchmark. Recently, anisotropic materials possessing through-plane (TP) aligned nanochannels showed some promise of boosting PEM conductivity, however, reported realizations are complex and the materials are challenging to synthesize and upscale.

Refreshments will be served at 13:15