

סמינר SEMINAR

Elastomeric, Emulsion-templated Polymers for the Controlled Release of Water

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HIPES are highly viscous emulsions in which the dispersed, internal phase constitutes more than 74 % of the volume. Pickering HIPES are HIPES stabilized by amphiphilic solid nanoparticles (NPs), such as silane-modified silica NPs, that spontaneously assemble at the oil-water interface. PolyHIPES (PHs) are usually synthesized within the external phases of water-in-oil (W/O) HIPES through free radical polymerization and produce porous polymers with open-cell structures. Liquid droplet elastomers (LDEs), which have been developed recently, are elastomeric, closed-cell, water-storing PH monoliths containing around 85 % water in the form of individually encapsulated micrometer-scale droplets. The objectives of this research were to develop PHs-based systems for storing water and to characterize the release of the water in an agriculturally-related setting. These objectives were attained by developing families of LDEs by varying the synthesis parameters (monomers, locus of initiation) and characterizing their effects upon the macromolecular structures, the morphologies, the properties (thermal, mechanical), and the water-release behavior. The monomers were 2-ethylhexyl acrylate (EHA) or lauryl acrylate (A12), with or without the addition of a polybutadiene (PBD) oligomer. The initiators were either oil-soluble or water-soluble. Several PHs were planted in a control experiment for evaluating their effects on plant growth.

For the PHs synthesized using interfacial initiation, the average size of the water droplets, 2 μm from cryogenic scanning electron microscopy, was significantly smaller than expected from previous studies. The glass transition temperature (T_g) of around -50°C for PEHA is typical of such elastomeric PHs. The T_g of PA12, on the other hand, could not be discerned. The mechanical behaviors of the PHs were typical of elastomers, with interfacial initiation producing higher moduli. PHs that were crosslinked through the stabilizing silane-modified silica NPs alone were highly elastomeric. The addition of PBD, which also acts as a crosslinker, dampened the elastomeric behavior and increased the modulus. The organic-phase-initiated polymerization of A12 in the presence of PBD produced a relatively high modulus PH (~360 kPa) that fractured at 30% strain with almost no water release. Polymerization of A12 alone, on the other hand, produced a relatively low modulus PH (~20 kPa) that released its water during compression, reaching 70% strain without failing. Interfacial initiation produced truly closed-cell structures that reached 70% strain without releasing water and that exhibited significantly longer release times than those from PHs synthesized using organic-phase initiation.

Supervisors: Prof. Michael S. Silverstein, Dr. Eric Assouline

ההרצאה תתקיים ביום ראשון, ה-15 באוקטובר 2017 בשעה 14:30
באודיטוריום ע"ש דיוויד וואנג, קומה 3, בניין דליה מידן

The lecture will take place on Sunday, October 15, 2017 at 14:30
David Wang Auditorium, 3rd floor Dalia Maydan Bldg.

כיבוד קל יוגש לאחר הסמינר