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12:15 pm

Room 1315 Chemistry

Materials Seminar

Mechanoresponsive Materials and Self-Healing Systems

Damage-prone regions in structural composite materials are difficult to detect and even harder to repair. Damage is preceded by complex spatial and temporal changes in stress state, and it is therefore desirable to utilize these mechanical changes to activate “without human intervention” chemical changes that favorably alter materials properties when and where needed. Desirable properties brought about in response to damage or high-stress conditions include: (1) signal generation to warn of ensuing failure, (2) molecular structure modification to slow the rate of damage and extend lifetime (e.g., stress-induced crosslinking), and (3) repair of large damage volumes to avoid catastrophic failure (e.g., crack-filling and interface rebonding). To achieve these properties, composites must be designed to respond to changes at various length scales. At the atomistic level, chemical bond changes and conformational changes occur. On the nanoscale, chain slippage occurs in response to force and deformation. At the microscopic level, voids, cavitation, yield or crazing, and crack formation take place along with large-scale viscoelastic deformation. This talk will describe molecular to macroscopic approaches to achieve self-healing functionality in polymer networks.