Department of Materials Science and Engineering,

Candidacy Exam

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Supramolecular Structures Formed via Dissipative Self-Assembly (DSA)

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Abstract

In recent years, dissipative self-assembly (DSA) systems have attracted significant attention in the fields of materials science and supramolecular chemistry. Conventional supramolecular polymerization and self-assembly processes have predominantly focused on thermodynamically stable equilibrium states, where the resulting products exist at the global minimum of the Gibbs free energy. These systems are in equilibrium and characterized by their stability, with the assembled structures remaining unchanged over time. In stark contrasts, DSA systems form structures that are not thermodynamically stable and require a continuous energy input to be maintained. The non-equilibrium nature endows DSA systems with the ability to emulate biological processes, providing unique opportunities for a wide range of potential applications, such as nanoreactors and drug delivery systems. In this talk, different strategies to induce DSA, along with their mechanisms and kinetic processes will be discussed. Further, the challenges and opportunities associated with the development of DSA systems will be explored.