MULTIPHASE DESIGN OF AUTONOMIC SELF-HEALING THERMOPLASTIC ELASTOMERS

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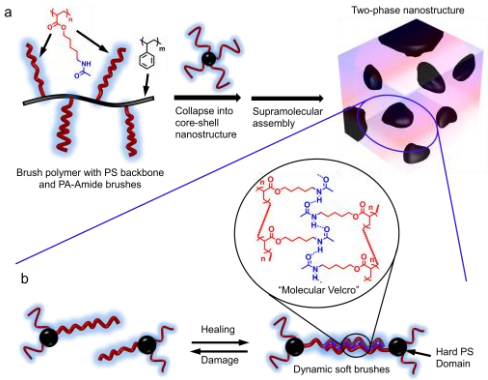
ABSTRACT

The development of polymers that can spontaneously repair themselves after mechanical damage would significantly improve the safety, lifetime, energy efficiency, and environmental impact of manmade materials. Most approaches to self-healing materials either require the input of external energy, or need healing agents, solvent or plasticizer. Despite intense research in this area, the synthesis of a stiff material with intrinsic self-healing ability remains a key challenge. Our laboratory has recently succeeded in a design of multiphase supramolecular thermoplastic elastomers that combine high modulus and toughness with spontaneous healing capability. In one design, H-bonding brush polymers (HBPs) self-assemble into hard-soft microphase-separated system, combining the enhanced stiffness and toughness of hybrid polymers with the self-healing capacity of dynamic supramolecular assemblies [1]. In another design, supramolecular ABA triblock copolymers formed by dimerization of 2-ureido-4-pyromidone (UPy) end-functionalized polystyrene-b-poly(n-butylacrylate) (PS-b-PBA) AB diblock copolymers are synthesized, resulting in a self-healing material that combines the advantageous mechanical properties of thermoplastic elastomers and the dynamic self-healing features of supramolecular materials [2]. In contrast to previous self-healing polymers, our systems spontaneously self-heals as a single-component solid material at ambient conditions without the need of any external stimulus, healing agent, plasticizer, or solvent.



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