Preparation of shape memory polymers or self-healing composites based on cyclodextrin-based inclusion

By Chao, Zhi-Chao; Guo, Kun; Xiao, Yao-Yu; Li, Bang-Jing; Zhang, Sheng

From Abstracts of Papers, 253rd ACS National Meeting & Exposition, San Francisco, CA, United States, April 2-6, 2017 (2017), POLY-644. | Language: English, Database: CAPLUS

Smart materials that exhibit special functions in response to external stimuli have been progressively developed. In recent years, utilize noncovalent interactions, such as cyclodextrin (CD)-based host-guest interactions, to construct smart materials has attracted more and more attentions from both academia and industries. For shape memory polymers (SMPs), one of the most important smart materials, supramol. interactions have been increasingly designed as mol. switchers to construct novel SMPs. Firstly, we developed a series of supramol. SMPs based on partial inclusion complex formation between CDs and polymer chains. The resulting materials contained two phase: fixing phase formed by stable CD-polymer crystallites for remembering the permanent shape, and reversible shape formed by non-complexed polymer segments for the temporary shape forming and recovering. It has been demonstrated that various polymers could be endowed shape memory properties by this approach. In addn., we also designed a series of SMP using the reversible interactions between CD and guest groups as mol. switches. As the CD-guest complexes formation/dissocn. in response to an external stimulus such as light, redox and pH, the mol. mobility of the materials switch off/on correspondingly. As a result, the shape memory effect could be triggered by light, redox or pH resp. We also developed a new design strategy for self-healing functional materials by connecting functional inorg. particles (such as SWCNT) and a polymer network through CD-based interactions. The resulting materials not only combined the mech. strength of the polymer network and the function of inorg. particles, but also showed self-healing ability owing to the host-guest interactions.