Influence of Material Properties on Scratch-Healing Performance of Intrinsic Self-healing Polymers

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Polymer coatings have been used to protect substrate surfaces from the external environment and/or to enhance aesthetic appearance. Recently, however, polymer coats have evolved to perform various 'smart' functions such as self-healing, self-cleaning, and stimulus-response functions. Intrinsic self-healing coatings are among the most important technologies for the use of high-value products that require long-term mechanical stability and chemical resistance, as required in automotive, architectural, medical, and electronic devices. However, the durability of the coating is inversely related to its scratch-healing performance because the former requires high crosslinking density, while the latter relies on enhanced polymer chain mobility so that polymer chain rearrangements and hence healing can occur more easily. In the current study, we conducted a detailed investigation of the relationship between the material properties and scratch-healing performance of intrinsic self-healing polymers containing diverse dynamic covalent bonds.