A fast-healing and high-performance metallosupramolecular elastomer based on pyridine–Cu coordination

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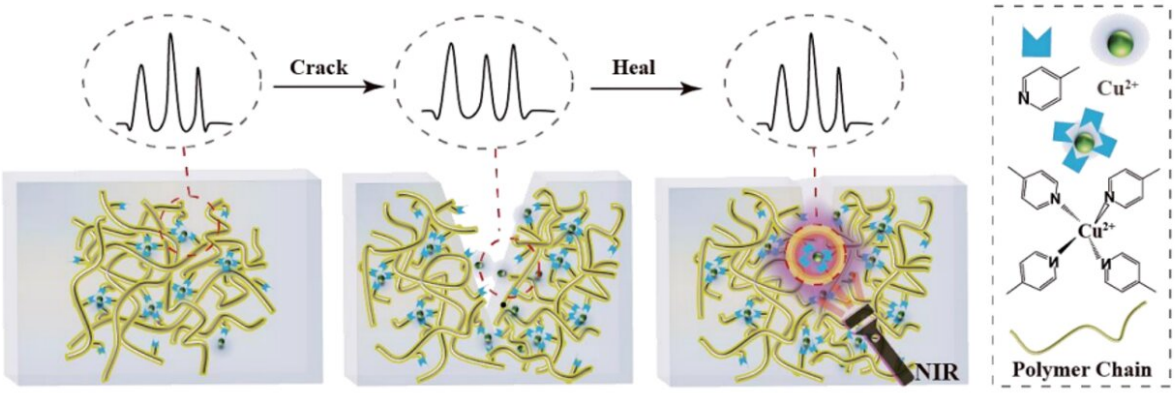

A NIR fast self-healing and high-performance metallosupramolecular elastomer is prepared by introducing pyridine-Cu coordination bond with photothermal effect into polyacrylate. Pyridine-Cu stickers are formed in the elastomer, which restricts the reptation mode but has little effect on local segmental motion. Meanwhile, pyridine-Cu absorbs NIR, which makes the surface temperature rise rapidly to the sticker's dissociation temperature so that the damage can be healed in 2 min. Specially, the damage and healing processes could be monitored by laser confocal micro-Raman spectroscopy, providing an insight into the underlying of damage-restoring mechanism. Credit: Science China Press

This study is led by Dr. Jinrong Wu (State Key Laboratory of Polymer Materials Engineering, College of Polymer Science and Engineering,

Sichuan University). In high-speed devices, cracks propagate very quickly and brings irreversible destruction. However, materials that can self-heal quickly often have poor performance. In many applications, once a crack appears, a catastrophic accident may occur if it is not repaired in time. Therefore, it is extremely important to develop fast self-healing materials without compromising their mechanical properties.

A NIR light self-healing metallosupramolecular elastomer with high mechanical properties was prepared by simply introducing pyridine-Cu coordination into a copolymer, in which the pyridine-Cu complex could absorb NIR light and convert it into heat. This intense photothermal effect endows the elastomer with the ability to heal scratches under NIR light for 2 min.

In addition, the team investigated the molecular dynamics that drives the rearrangement of the network and self-healing of the elastomer, and find that the dissociation and reconstruction of the coordination bonds can be reflected by the Raman spectrum change. Therefore, the bond-level self-healing process can be tracked by laser confocal micro-Raman spectroscopy.

This work represents a qualitative change in the development of fast-healing and high-performance metallosupramolecular elastomer. Moreover, this work also provides a method for real-time monitoring of bond-level healing kinetics.

The research was published in *Science China Materials*.

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