Novel Fluorescent Hydrogel Developed to Achieve Soft Biomimetic Color-changing Skins

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The Smart Polymer Materials group led by Prof. CHEN Tao at the Ningbo Institute of Materials Technology and Engineering (NIMTE) of the Chinese Academy of Sciences (CAS), has synthesized a supramolecular multicolor fluorescent polymeric hydrogel, which enables the realization of soft biomimetic skins with adaptive color-changing behaviors.

Many organisms in nature, such as octopus, jellyfish, and chameleon, display diverse skin color changes in response to multiple environmental stimuli for attraction, warning, survival, or disguise in their environments. However, synthesizing artificial soft polymeric hydrogels with similar multicolor tunability and multi-responsiveness remains challenging.

To address this issue, two different types of fluorogens, i.e., blue aggregation-induced emissive ones (B AIE-gen) and red/green lanthanide coordinated ones (R/G La-gens), were employed and rationally organized respectively into different polymer chains of one single supramolecular polymer network. In this case, the B and R/G fluorophores were engineered to be orthogonally responsive, and the fluorescence intensity of each fluorophore could be controlled by different external stimuli independently, thus contributing to multi-responsive multicolor fluorescence response.

The synthesized hydrogel showed satisfying self-healing and remolding capacities, which benefits from the totally supramolecular crosslinking nature. Furthermore, the developed hydrogel was employed to fabricate soft biomimetic color-changing skins, which showed great application potentials in helping robots conduct desirable responses upon various external stimuli, including temperature, pH, ions, solvent, and light.

The polymer structure design proposed in this study may shed light on the further investigation and development of fluorescent materials.

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