Meso-decorated switching-knot gels

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Gels exhibit no flow and behave like solids when in the steady state due to the three-dimensional cross-linked internal network structure, which may result from chemical bonds (chemical gels) or physical bonds (physical gels), as well as crystallites or other junctions. As a new material having properties ranging from soft and weak to hard and tough, gels have been applied in various fields of daily life, food, medicine, architecture, and chemistry. In our group, novel hydrogel of Shape Memory Gel (SMG) and Inter-Crosslinking Network (ICN) gel have been developed. In this paper, one new method of structure design at intermediate mesoscale, which is named Meso-Decoration (Meso-Deco), is proposed. We try to prepare one new multi-functional gel by introducing the groups of thermoreversible Diels-Alder reaction into gel. The DA reaction requires very little energy to create a DA adduct. At room temperature, furan and maleimide will react to form a DA adduct. Above 60°C, these bonds begin to break apart, and by 90°C, all DA adducts have been cleaved and furan and maleimide are recovered completely. The DA reversible bonds give gels novel remediable properties. The remediable gel materials are expected capable of repairing cracks and recovering from mechanical failure. The Switching-Knot (SK) gel prepared in this work is shown in the Figure.

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