Bio-inspired mechano-functional gels through multi-phase order-structure engineering

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Adaptive gel materials can greatly change shape and volume in response to diverse stimuli, and thus have attracted considerable attention due to their promising applications in soft robots, flexible electronics and sensors. In biological soft tissues, the dynamic coexistence of opposing components (for example, hydrophilic and oleophilic molecules, organic and inorganic species) is crucial to provide biological materials with complementary functionalities (for example, elasticity, freezing tolerance and adaptivity). Taking inspiration from nature, we developed a series of high mechanical performance soft active materials, called organohydrogels, based on multiphase synergistic strategy. Traditional techniques such as post-polymerization modification, interpenetrating network and controlled microphase separation are combined with binary complementary concept to design and fabricate new organohydrogels with diverse topology of heteronetworks. Meanwhile, the synergistic effect of heteronetworks provided the organohydrogels with unprecedented mechanical functions such as freezing-tolerance, programmed high-strain shape memory and shaking insulation. Their applications in biofouling, thin-film fabrication, flexible electronics and actuators are also explored.

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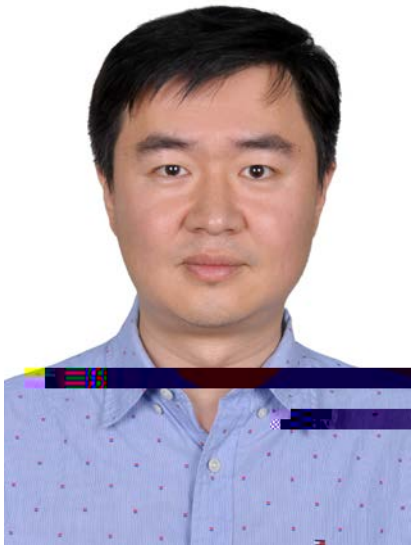

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