

Poly(N-isopropylacrylamide) hydrogel / polydimethylsiloxane composites for one-way water flow

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The flow of water used in the various applications such as hydropower generation, purification of wastewater, etc., is usually made by a height difference or a power unit. Herein, using a hydrogel composites, we can make a novel water pumping system that operates with temperature changes. In this study, water swelling and deswelling were controlled by using composites of thermosensitive poly(N-isopropylacrylamide) (PNIPAm) hydrogel and polydimethylsiloxane (PDMS). The composites were prepared by directional freezing of PNIPAm hydrogel to make cylindrical pores, and subsequent infiltration of PDMS substrate to the end of aligned porous PNIPAm. The composites can repeat deswelling and swelling in water following temperature cycles. When they deswell, water droplets can form on the surfaces of PNIPAm. The PNIPAm/PDMS phase at the end of hydrogels acts as a one-way flow valve, and water cannot backflow through the PNIPAm/PDMS phase, only roll over the substrate out of the PNIPAm. The successfully prepared one-way water flow system using PNIPAm/PDMS hydrogel composites can be utilized in various water applications in future.