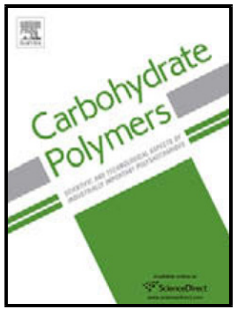

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One-step radiation synthesis of agarose/polyacrylamide double-network hydrogel with extremely excellent mechanical properties

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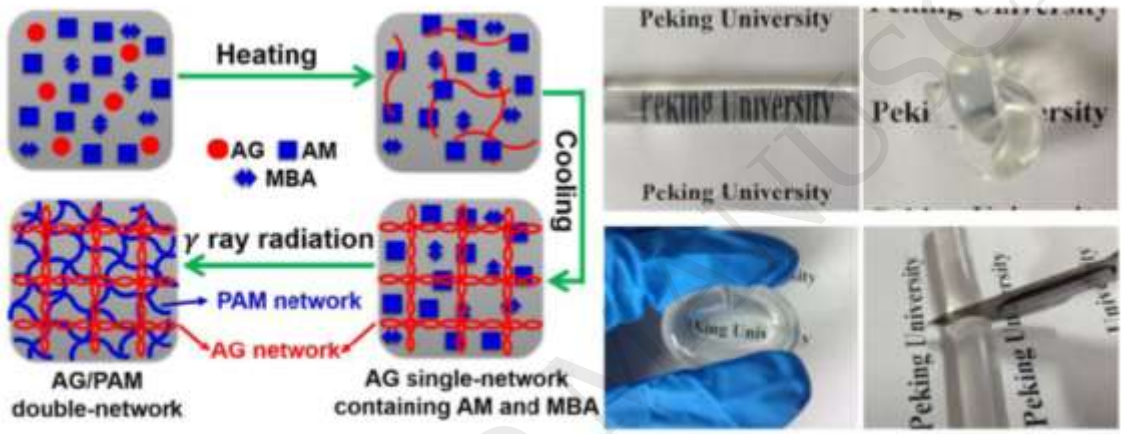

Highlights

- AG/PAM DN hydrogel was synthesized by one-step radiation method
- AG/PAM DN hydrogel with top-level tensile property
- AG/PAM DN hydrogel with super compression property
- Energy dissipation mechanism accounts for compressibility of AG/PAM DN hydrogel

Abstract

A facile one-step radiation method is first developed to synthesize agarose/polyacrylamide (AG/PAM) double-network (DN) hydrogel. Compared to other synthetic methods of DN hydrogels, our synthesis method endows the resultant AG/PAM DN hydrogel with not only top-level tensile properties with a tensile strength of 1263±59 kPa and an elongation at break of 3406±143 %, but also highest compression properties with a compression strength of 140±3 MPa and a fracture compression strain of above 99.9%. An expanding-necking phenomenon during compression process of AG/PAM DN hydrogel were observed. We propose a chain pushing-in model to interpret the energy dissipation mechanism accounting for the super-compressibility of AG/PAM DN hydrogel. This novel radiation synthesis strategy provides an insight into the development of DN hydrogels with extremely excellent mechanical properties.