Bioinspired Interpenetrated Networks Hydrogels

Matteo Hirsch, Esther Amstad
Soft Materials Laboratory, Institute of Materials, Ecole Polytechnique Fédérale de Lausanne, CH-1015 Lausanne, Switzerland

Hydrogels were among the first biomaterials expressly designed for their use in biomedicine. However, state-of-the-art applications of hydrogels are severely limited due to their poor mechanical properties. Bioinspired strategies, such as developing interpenetrating networks (IPNs) encompassing opposite or complementary properties, unveil a great variety of powerful approaches that promise to extend the potential applications of hydrogels in the biological field. In this work, a bioinspired dually crosslinked poly(acrylic acid)/carboxymethyl cellulose (PAA/CMC) IPNs hydrogel is presented. The internal structure is composed of a covalent PAA network, and a physical and reversible ionic crosslink enabled by Ca^{2+} ions between PAA and CMC chains. Moreover, it is found that the mechanical properties of the IPNs hydrogel are strongly affected by the amount of Ca^{2+} ions added in the precursor solution. Furthermore, these properties can be tuned within a relatively broad range, thus expanding the applications of these hydrogels for tissue engineering and load-bearing applications.