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Large strain deformation of hydrophobically modified polyelectrolyte hydrogels GUILLAUME MIQUELARD-GARNIER, COSTANTINO CRETON, DOMINIQUE HOURDET, ESPCI — Hydrogels made from charged polyelectrolytes have been widely studied for their ability to absorb large amounts of water. However this occurs usually at the expense of mechanical properties. Because of recent reports describing very tough charged hydrogels, we have investigated the large strain and fracture resistance of novel chemically and physically crosslinked hydrogels. The backbone was polyacrylic acid modified with hydrophobic side groups and subsequently chemically crosslinked with thiol-ene chemistry. We performed compression/decompression experiments up to large strains and found that at polymer concentrations of 5-8 wt% these gels depart significantly from Gaussian behaviour at strains above 150% showing a pronounced strain hardening. We argue that this hardening leading also to a significant hysteresis in the unloading cycle, is due to the formation of clusters of same charge segments of the polyelectrolyte chains. An increase in ionic strength or the substitution of water with an organic solvent reduces or eliminates the effect implying that it is the charges that cause the hardening and the hysteresis.

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