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Tuning the properties of ionene-based hydrogels via counterion specific effects

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ABSTRACT

Our interest focused on the structure and rheological properties of physical hydrogels formed from ionene-type cationic polyelectrolytes. Ionenes have a regular and tunable charge distribution along their chains and have shown strong counterion (anion) specific effects in aqueous solutions [1]. Within ionene based hydrogels, the counterions specific effects are all the more remarkable. The delicate balance between hydrophobic attractive interactions and electrostatic repulsions in these systems is highlighted. The rheological properties are linked to the hydrogel structure, as seen by X-ray and neutron scattering methods [2]. In the case of halide counterions, gelation is more effective for more weakly hydrated anions: the critical gelation concentration is lower and the viscoelastic properties are reinforced. Contrary to chloride containing gels, which present a single correlation length characterizing the distance between the crosslinking nodes, the structure of fluoride gels presents an additional network of nodes, with a strong contribution of ion-ion correlations. This is linked to a very fast increase of the elastic modulus of the hydrogel, as soon as the (belated) critical gelation concentration is reached [3].

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