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Tuning hydrogel properties: counterion specific effects and addition of nanoplatelets

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Hydrogels are at the forefront of scientific attention especially in the biological and biomedical fields providing the basis for stimuli-responsive artificial tissues etc. We study physically crosslinked hydrogels based on ionenes, positively charged polymer chains, for which strong counterion-specific effects have been observed previously [1]. The nature of the ionene counterion modifies significantly the rheological properties of the hydrogels. Small angle scattering data (SAXS, SANS) reveal different mesh sizes for the cross-linking polymer networks and help to rationalized the observed elastic moduli and their concentration dependence [2]. Further, introduction of charged clay nanoplatelets into the hydrogel is possible [3]. Nanoplatelets organise in a regular face-to-face stacking manner, with a large repeat distance, following rather closely the hydrogel mesh-size (20-30nm). The degree of nanoplatelet ordering in the hydrogel is very sensitive to the negative charge location on the clay platelet (different for each clay type). Increased nanoplatelet ordering leads to an improvement of the elastic properties of the hydrogel, especially for concentrations close to the cgc. On the contrary, the presence of dense clay aggregates (tactoids), destroys the hydrogel network.

[1] N. Malikova, A.-L. Rollet, et al, PCCP 17, 5650-5658 (2015).

[2] C. Hotton, N. Malikova et al, submitted.

[3] C. Hotton, N. Malikova et al, JICS 604, 358-367 (2021).

Primary author: MALIKOVA, Natalie (CNRS, Sorbonne University)

Co-authors: Dr CHENNEVIERE, Alexis (Laboratoire Leon Brillouin, CEA, CNRS); Dr HOTTON, Claire (CNRS, Sorbonne University); Dr DUCOURET, Guylaine (CNRS, ESPCI); Dr SIRIEIX-PLENET, Juliette (Sorbonne University); Dr MICHOT, Laurent (CNRS, Sorbonne University); Dr PORCAR, Lionel (Institut Laue Langevin); Dr BIZIEN, Thomas (Synchrotron Soleil)

Presenter: MALIKOVA, Natalie (CNRS, Sorbonne University)

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