1-YEAR POST-DOCTORAL POSITION

Probing organisation and scaffold flexibility of hydrogels: a combined NMR and NMRD approach

Hydrogels are exciting soft permeable materials with a high potential for biomedical as well as food industry applications. We have at hand a well-characterised hydrogel system based on charged polymers, showing strong sensitivity to the scaffold counterion [1] and presenting a possibility of incorporation of charged nanoparticles, such as clay nanoplatelets [2]. Regular stacking of clay nanoplatelets in the hydrogel paves the way to a highly interesting system with potentially anisotropic permeability. NMR based methods are to be used here to study firstly the scaffold flexibility (chain dynamics) using PFG-NMR. We wish to link scaffold flexibility to permeability of the hydrogels to guest species. Secondly, nuclear magnetic relaxation dispersion (NMRD) will be used to probe the variety of environments accessible to water molecules, especially in the case of hydrogels with incorporated nanoparticles. This can clarify the availability of the nanoparticle surface for adsorption of guest species.

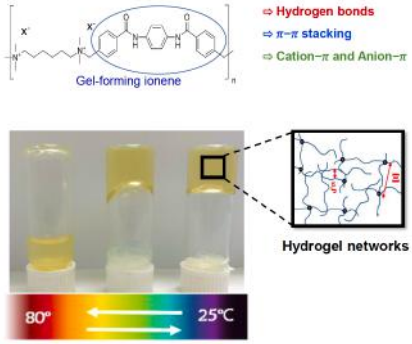

Fig. 1. Gel-forming ionenes are charged polymers with benzene-containing moieties. The sol–gel transition takes place between room T and 80 °C and is reversible. The rheology and structure of ionene-based gels is sensitive to the nature of ionene counterion and nanoparticle additives, such as clay nanoplatelets.

The post-doctoral position is funded by the **Institut de Science des Matériaux** at the Sorbonne University (SU) in Paris, France and is a joint project between the PHENIX and LCMCP laboratories of SU. PHENIX laboratory has a recognized experience in the study of charged porous systems, including charged polymers (polyelectrolytes) as well as charged inorganic nanoparticles such as clays. A particular attention is given to the study of transport / dynamics in such systems. The strength of PHENIX lies in a combination of experimental and modeling activities (theory and numerical simulations). LCMCP is a recognized player in the field of soft chemistry routes to inorganic or hybrid organic-inorganic functional materials and the assessment of their physico-chemical properties at different scales. Several international projects and networks are in place in both laboratories, providing a rich and multinational environment.

Keywords: hydrogels, clay colloids, charged polymers, water dynamics, NMR relaxometry, pulsed field gradient NMR (PFG-NMR)

Candidate: The candidate must have a PhD degree in physics or chemistry, obtained preferably within 24 months prior to the starting date, and a very good background in physical chemistry. Previous experience with PFG-NMR or NMR relaxometry is an advantage.

Salary and timing: from 2920€/month (gross salary), 12-month funding, starting in November 2023

Contact: CV and motivation letter to be sent to natalie.malikova@sorbonne-universite.fr, anne-laure.rollet@sorbonne-universite.fr, francois.ribot@sorbonne-universite.fr

[1] [Hotton21] Hotton, C.; Sirieix-Plénet, J.; Ducouret, G.; Bizien, T.; Chennevière, A.; Porcar, L.; Michot, L.; Malikova, N. Organisation of Clay Nanoplatelets in a Polyelectrolyte-Based Hydrogel. *J. of Colloid and Interface Science* **2021**, *604*, 358–367.
[2] [Hotton23] C. Hotton, G. Ducouret, J. Sirieix-Plenet, T. Bizien, L. Porcar and N. Malikova, Tuning structure and rheological properties of polyelectrolyte-based hydrogels through countering specific effects, *Macromolecules* **2023**, *56*, 3, 923–933.