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Water dynamics, polymer structure and relaxation in desalination membranes

Wednesday, December 8, 2021 1:15 PM (45 minutes)

Highly crosslinked polyamide (PA) membranes are extensively used in water purification and desalination by reverse osmosis (RO). The talk will present an overview of our recent work on the structure and dynamics of PA membranes, with a combination of neutron and X-ray reflectivity, and neutron spectroscopy. The membranes were synthesised by established interfacial polymerisation routes of m-phenylenediamine (MPD) and trimesoyl chloride (TMC), with prescribed reaction time, concentration and stoichiometry, in both smooth nanofilm and crumpled morphologies. We investigate the dynamics of both polymer network and water using quasi- and inelastic neutron scattering (QENS/INS), exploiting contrast variation and vapour hydration to isolate the dynamics of confined water dynamics. Water is observed to undergo several translational diffusive processes which are examined and quantified for the first time. This multimodal water diffusion is compatible with molecular dynamics simulations and transport models of water through membranes, and permits the estimation of RO performance in water desalination via descriptive engineering models.

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