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Water and polymer dynamics in highly crosslinked polyamide membranes BRADLEY FRIEBERG, EDWIN CHAN, MADHU TYAGI, CHRISTOPHER STAFFORD, CHRISTOPHER SOLES, National Institute of Standards and Technology — Highly crosslinked polyamides for reverse osmosis are the state-of-the-art active material in membranes for desalination. The thin film composite membrane structure that is used commercially has been empirically designed to selectively allow the passage of water molecules and minimize the passage of solutes such as salt. However, due to the large roughness and variability of the polyamide layer, there is a limited understanding of the structure-property relationship for these materials as well as the transport mechanism. To better understand the water transport mechanism we measure the water and polymer dynamics of polyamide membranes using quasi-elastic neutron scattering (QENS). By hydrating the membrane with deuterated water, we are able to isolate the dynamics of the hydrogenated membrane on the pico- and nanosecond time scales. By subsequently hydrating the membranes with hydrogenated water, the QENS measurements on the same times scales reveal information about both the translational and rotational dynamics of water confined within the polyamide membrane. Further understanding of the water diffusion mechanism will establish design rules in which the performance of future membrane materials can be improved.

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