



X-ray and electron microscopy imaging of porous polymeric membranes

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Membrane-based separations are now fundamental for water desalination and purification. Their application in chemical and pharmaceutical industries is growing fast with advantages of low energy consumption and low emissions. Membranes have a complex morphology with multilayers and gradient pore sizes. Precise morphology control and characterization with sub-nano to mesoscale resolution are highly relevant to guarantee the efficiency and progress of polymer membranes in different fields. We have explored different methods of advanced 2D and 3D electron microscopy, small angle x-ray scattering, and x-ray ptychography for membrane characterization. The advantages and challenges of different methods will be highlighted and compared, including the in situ characterization of polymeric samples in humid environments.