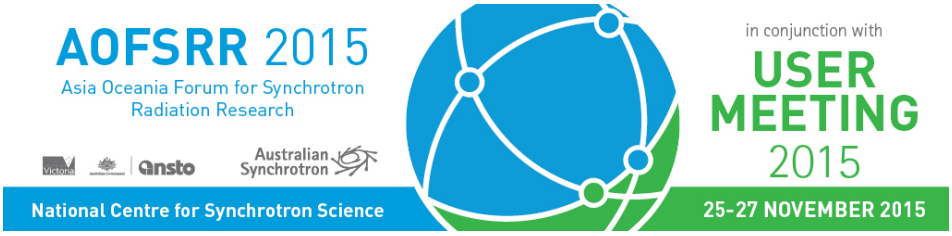

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SAXS Investigation of SiO2 Nano-Pore Membranes

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Membranes with nano-sized pores are ideal for many advanced applications including bio-sensing, filtration processes, nano-fluidics, nano-electronic and nano-optic devices. To effectively realise these applications, pores with controlled shapes and narrow size distributions are needed. Irradiation with high energy heavy ions and subsequent chemical etching can be used to form highly uniform nano-porous membranes in a variety of materials, including polymers like polycarbonate, PET and polyimide, and in solid state materials such as silicon dioxide (SiO2). SiO2 membranes can be integrated with routine semiconductor fabrication processes, and they exhibit superior thermal stability compared to polymer membranes. We are currently developing a technology for controlled fabrication of nano-pore membranes using 0.5-2 μm thin SiO2 layers. Freestanding membranes were irradiated with 185 MeV Au ions and etched in dilute HF solution, preferentially etching the radiation damage to form the pores. SAXS, in combination with advanced Monte-Carlo (MC) simulation techniques, provides an ideal method for characterisation of the complex pore structures formed in SiO2 . These structures can exhibit conical or double conical shapes, depending on the etching conditions. Compared to cross-sectional transmission and scanning electron microscopy, SAXS in combination with MC simulations enables a more accurate reconstruction of the size and shape of the pores, taking advantage of superior statistics since a large number of pores may be measured simultaneously. This information is essential for development of the membrane technology.

Keywords

Small Angle X-ray Scattering, Etched Ion Tracks, Membrane

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