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Formation and characterization of nanopores

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The ability to form holes in membranes with diameters of only a few nanometers (1 to 10 nm) is of interest in many fields of nanometer scale science including single molecule studies, ion proximity lithography, and single atom doping.

We report on studies of nanopore formation by local deposition of material in a dual beam focused ion beam system (FIB). Large holes with diameters of tens of nanometers are closed by the local deposition of platinum and TEOS oxide. We compare results from electron beam and ion beam assisted deposition of materials. Hole structure evolution is monitored in situ during hole closing by SEM. Hole profiles, local crystalline structure and materials composition are characterized ex situ by TEM. Nanopores with diameters in the 5 nm range have been formed in low stress silicon nitride membranes. We will discuss process reproducibility, and mechanisms of local structure evolution.

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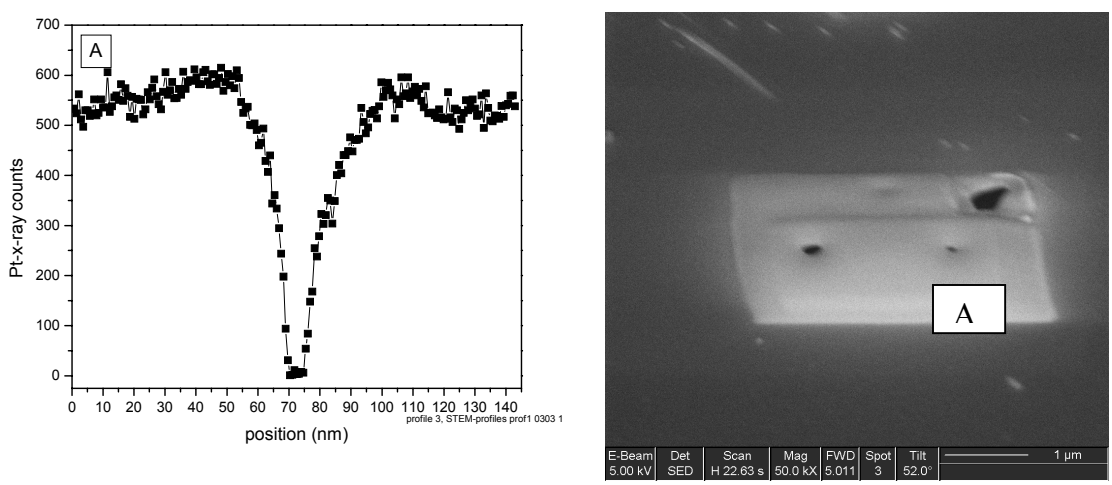

Figure 1: Line scan of Pt-ray intensity across hole A shown in the SEM image on the right.