

**Direct fabrication of sub-20 nm nanopores using focused ion beam, and further closure with electron beams.**

**Saulius Juodkazis, Adrien Mau and Clémence Briosne-Frejaville**Centre for Micro-Photonics, Swinburne University, Australia.

**ABSTRACT**

Molecular-scale pores are promising as new ways of detecting and characterizing tiny molecules, such as DNA ribbons. Actually there are several ways of achieving nanometer-sized pores, by choosing a specifically thin membrane and using either ion beam milling, dry etching or electrochemical etching. The hole can then be further reduced with a TEM beam, a ion beam or by surface coating.  
We report the direct fabrication of 15nm-wide pores in ultrathin silicon nitride membrane using focused ion beam etching with a very small aperture. Using scanning electron microscopy, we then further reduced the pores to sub-8nm holes within minutes. This phenomenon may be due to surface tension

The fact that an electron beam can expand or shrink holes is not new (<http://www.nature.com/nmat/journal/v2/n8/full/nmat941.html>) but it has mostly been achieved with TEM.

Here, as we use a vertical electron beam column and a SEM device we achieve faster shrinking rate as with TEM (about 0.3nm/minute) but as a counterpart we have a smaller final resolution (~5nm)