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Mass Transport and the Ion Beam Sculpting of Solid State Nano-scale pores TOSHIYUKI MITSUI, Harvard University, DEREK STEIN, Delft University of Technology, JENE GOLOVCHENKO, Harvard University — We report on AFM and TEM studies of mass transport during the formation of isolated nano-scale pores formed in silicon nitride membranes with the aid of surface ion beam exposure. This ion beam sculpting process allows the fabrication of nanopores with nanometer scale control for use in single molecule detection experiments. The nano-scale pores generally close under ion beam exposure and we show from AFM studies that excess material is transported to the vicinity of the pore position and accumulates over regions surrounding the pore that extend hundreds of nanometers from it. TEM images of multiple pore arrays formed by Ion Beam Sculpting indicate proximity effects associated with the surface diffusion and membrane stress effects leading to pore formation. In addition we discuss the dramatic role of accumulated surface charge during ion beam exposure on surface atomic transport in the formation of these nano-scale pore structures.

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