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FIB direct fabrication of sub-10 nm synthetic nanopores
JACQUES GIERAK, ALI MADOURI, ERIC BOURHIS, JEAN-YVES MARZIN, LPN-CNRS, GHANI OUKHALED, LAURENT BACRI, BENJAMIN CRESSIOT, JUAN PELTA, MPI-LAMBE, RALF JEDE, LARS BRUCHHAUS, Raith, LOÏC AUVRAY, MSC, LPN TEAM, MPI-LAMBE TEAM, RAITH TEAM, MSC TEAM
— Nanopores in thin solid state membranes are used as single molecule electronic detectors or sensors. The membrane acts as a dividing wall in an electrolytic cell and draws charged molecules attracted by an electric field through the pore. Among the very few patterning techniques applicable to nanopores, one promising approach is to use a FIB system, which can produce small holes directly at specified locations with customized organization and shape into dielectric membranes. We detail an innovative FIB-based approach and the methodologies developed for sub-10 nm nanopore realization. Our method allows direct fabrication of nanometer-sized pores in relatively large quantities with excellent reproducibility. This approach offers the possibility to further process or to functionalize each pore on the same scale keeping the required nm-scaled positioning and patterning accuracies, for i.e. adding detection marks or local membrane thinning at nanopore site. Then we describe solutions for conditioning surface properties and for integrating such single nanopore devices for translocation experiments. Results involving DNA, proteins, polymers, colloids are presented.

Jacques Gierak
LPN-CNRS

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