

Integration of a grafted solid-state nanopore chip into a simple to make and use microfluidic system

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Solid-state nanopores have been developed since 2001[1] when the available proteic nanopores like α -hemolysin were proved too wide for DNA sequencing.[2] Modern manufacturing techniques like TEM[3] piercing or dielectric breakdown[4] piercing can indeed lead to pores with under one nanometre radius. However, solid-state nanopore analysis still lack the reliability and reproductibility of proteic nanopores. The very nature of proteic nanopore makes them biocompatible whereas solid-state nanopores, often made of silicium-based materials need further treatment.[5] On another hand, an advantage of solid-state nanopores resides in the durable membrane they are pierced in. These membranes can easily be transported after piercing to perform analysis on the field or in a laboratory. An easy to use fluidic device to handle the nanopore chips is all it take to permit easy nanopore analysis to be done anywhere.

We propose an easy way to reliably graft polymer chains on a nanopore chip to make it biocompatible. Also we developed an easy to use microfluidic chip made in PDMS from a low cost, 3D-printed mold.[6]

- [1] Li et al, Ion-beam sculpting at nanometre length scales, *Nature*, **421**, 166-169 (2001)
- [2] Kazianowics et al, Characterization of individual polynucleotide molecules using a membrane channel, *PNAS*, **93**, 13770-13773 (1996)
- [3] McNally et al, Electro-mechanical unzipping of individual DNA molecules using synthetic sub-2 nm pores, *Nano Lett.*, **8**, 3418-3422 (2010)
- [4] Beamish et al, Precise control of the size and noise of solid-state nanopores using high electric fields, **23**, 405301 (2012)
- [5] Wanunu and Meller, Chemically modified solid-state nanopores, *Nano Lett.*, **6**, 1580-1585 (2007)
- [6] Roman et al, Functionalized Solid-State Nanopore Integrated in a Reusable Microfluidic Device for a Better Stability and Nanoparticle Detection, **9**, 41634-41640 (2017)