Coupled Nanopores for Nanofluidic and Sensing Applications

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Abstract

Beyond atomically thin 2D materials and nanopores, I will discuss the "coupled", guiding, and reusable bilayer nanopore platforms ("GURU"), enabling advanced ultrafast detection of unmodified molecules. Nanopores are nanometer scale holes in materials that allow passage of ions and molecules and their respective detection via changes in electrical signals. In this talk I will discuss new nanopore designs, beyond a single pore, that contain two layers of nanopores, allowing for added functionalities. We designed a bottom layer of nanopores that can collimate and decelerate the molecules under detection, and the top 2D pore enables accurate sensing of molecules passing by. We varied the number of pores in the bottom layer while fixing one 2D nanopore in the top layer. When the number of pores in the bottom layer is reduced to one, sensing is performed by both layers, and distinct T- and W-shaped electrical signals indicate the precise position of molecules and are sensitive to fragment lengths of molecules being detected. This is enabled by microsecond resolution capabilities and precise nanofabrication. Coupled nanopores present configurable systems for better electromechanical control and prolonged detection times.

References

[1] Y.C. Chou *et al*., "Coupled Nanopores for Single Molecule Detection", *Nature Nanotechnology, 2024.*