Designer sub-nm ion channels

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Due to severe problems of accessible clean water, the world is looking at alternate technologies/mechanisms by which efficient separation of ions and molecules at the smallest length scale can be made possible. The importance of membranes with good filtration capabilities in the sub-nm scale is ever increasing. In this regard, carbon nanotubes, graphene nanopores, and graphene oxide have been tried; however, the large distribution of sizes and limited possibility for large scale integration makes these systems not very popular for technologies. Recently, we have reported a novel approach of utilizing the atomic flatness of van der Waals layered materials for the fabrication of sub-nm channels, beating the surface roughness limit traditionally encountered in lithographically fabricated systems [1]. This technique utilizes a combination of van der Waals assembly of layered materials and lithography to create fluidic channels of sizes 'at will' and 'choice'. We systematically studied the ion transport through these sub-nm channels and the schematic of the device is shown in figure 1. We present some of the interesting effects at sub-nm scale.

References

[1] Radha, B. et al. *Nature* **538**, 222-225 (2016).

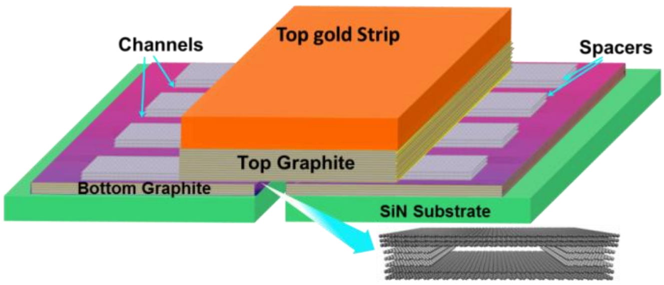

Figure 1: Schematic of the nanochannel device utilized for ion transport study. The width of the channel is 130 nm and the height can be varied from 1 atomic layer to several layers.