Ion permeation through atomically thin crystals

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The basal plane of graphene is impermeable to all molecules and atoms – even for helium, the smallest of gases – at ambient conditions[1]. In fact, it was believed that graphene would be impermeable even to protons, nuclei of hydrogen atoms. Unexpectedly, experiments demonstrated that graphene is highly permeable to thermal protons[2] and that deuterons (nuclei of hydrogen's heavier isotope deuterium) permeate ten times slower than protons[3]. Graphene is a membrane with subatomic selectivity. This exceptional selectivity suggests that 2D crystals could enable separation of permeants that would be difficult or impossible to achieve with conventional materials. This talk will discuss the progress in using the crystal lattice of 2D materials as sieves and the various unexpected phenomena we have found along the way[4,5,6,7] .

REFERENCES

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FIGURES

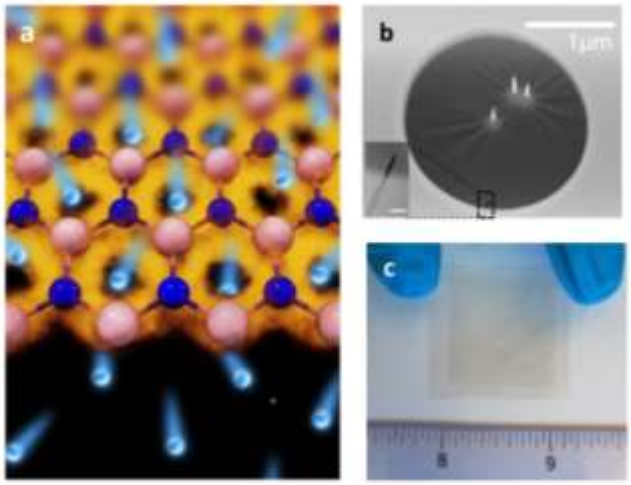

Figure 1: a. Artistic impression of proton transport through hexagonal boron nitride. **b**, Electron micrograph of a suspended graphene device. Membrane intentionally damaged to enhance visibility. **c**, Optical image of a CVD graphene proton transport membrane.