
Harnessing Molecular Transport through 2D Material Membranes: Precision and Potential Applications

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Abstract: Permeation through nanometre-pore materials has been attracting unwavering interest due to fundamental differences in governing mechanisms at macroscopic and molecular scales, the importance of water permeation in living systems, and relevance for filtration and separation techniques. Latest advances in the fabrication of artificial channels and membranes using two-dimensional (2D) materials have enabled the prospect of understanding the nanoscale and sub-nm scale permeation behaviour of water and ions extensively. In particular, several laminate membranes made up of 2D materials show unique permeation properties such as ultrafast permeation of water and molecular sieving. In my talk, I will discuss our recent results on controlling molecular transport through various 2D materials-based membranes by an external parameter and will discuss the prospect of developing next-generation intelligent membranes based on 2D materials.

References

1. Nair *et al.* **Science** **335**, 442 (2012).
 2. Joshi *et al.* **Science**, **343**, 752 (2014).
 3. Su *et al.* **Nature Communications** **5**, 4843 (2014).
 4. J. Abraham *et al.* **Nature Nanotechnology** **12**, 546-550 (2017).
 5. Q. Yang *et al.* **Nature Materials** **16**, 1198 (2017).
 6. A Esfandiar *et al.* **Science** **358**, 511-513 (2017).
 7. K. G. Zhou *et al.* **Nature** **559**, 236-240 (2018).
 8. Huang *et al.* **Nature Communications** **11**, 1097 (2020) .
 9. Zou *et al.* **Nature Materials** **20**, 1677-1682 (2021).
 10. Hu *et al.*, **Nature** **616**, 719-723 (2023).
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