

Selective proton channel in monolayer graphene tuned by diazonium salt

Xiaofang Kang

Weizhe Zhang, Max Makurat, Wangyang Fu*, Grégory F. Schneider*
Leiden University, Einsteinweg 55, 2333CC Leiden, The Netherlands.
g.f.schneider@chem.leidenuniv.nl

Abstract

Ion-selective permeation membranes are used in various applications such as fuel cells, wastewater, and seawater desalination. However, General ion exchange membranes have selective permeability for anions and cations only. With the development of separation technology, the requirements for the performance of ion exchange membranes have become increasingly demanding, gradually developing into the separation of ions of the same charge and valence state. Selectivity and conductivity are major principles for membrane development. A trade-off between ion selectivity and conductivity¹, however, is one of the barriers to further promoting polymeric membranes due to minor-size channels. Nanopore in atomic thin 2D material provides new possibilities for the development of selective membranes based on delicate control of pore size and surface functionality. Innovations with graphene manifested impressive potentials owing to mechanical strength, chemical resistance, and nanometer-scale pore fabrication². Here, we introduce sp³ lattice dislocations paired with sulfophenyl groups on the basal plane of exfoliated graphene via a diazotization strategy using 4-sulfobenzendiazonium (4-SBD) as a reactant, towards increased proton conductivity, while keeping the basal plane impermeable to other substances.

References

- [1] H. B. Park, J. Kamcev, L. M. Robeson, M. Elimelech, B. D. Freeman. *Science* **356**, eaab0530 (2017).
[2] Sahu, S. & Zwolak, M. *Rev. Mod. Phys.* 91, 021004 (2019).

Figures

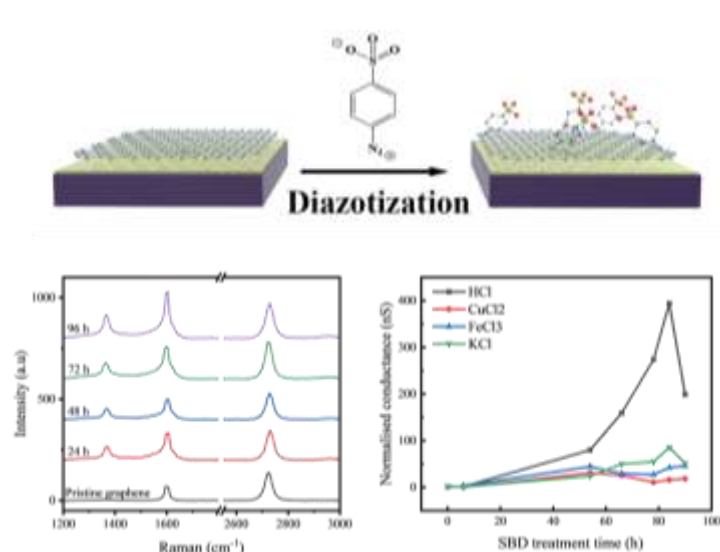


Figure 1 Proton-selective sub-nanometer pathway in exfoliated single-layer monocrystalline graphene by diazotization with 4-sulfobenzendiazonium tetrafluoroborate (4-SBD).