PROTON CONDUCTORS

Working without water*Nat. Commun.* **11**, 1981 (2020).

Operating proton-exchange membrane fuel cells at elevated temperatures (100 °C and above) is attractive as it enables enhanced electrochemical rates and improved resistance to catalytic poisoning, among other positive factors. However, this introduces challenges for the design of the membrane, which must maintain high proton conductivity even under low humidity conditions; many membranes rely on the presence of water to mediate proton transfer. Membranes impregnated with phosphoric acid can maintain proton flow under anhydrous conditions, but combining high conductivity with stability is still a challenge. Now, Donglin Jiang and colleagues at the National University of Singapore and Nottingham Trent University design a covalent organic framework with phosphoric acid confined in its pores that is stable and exhibits a high proton conductivity of 0.191 S cm^{-1} at 160 °C.

The researchers synthesize an imine-bonded covalent organic framework with aligned one-dimensional channels. The pores are relatively large (3.36 nm) and the pore walls contain abundant nitrogen sites that anchor the phosphoric acid in the channels. These features allow a high loading of phosphoric acid and create a strong hydrogen bonding network. This leads to a proton conductivity double that of neat phosphoric acid that is stable over 20 h of testing. The material is also resistant to strong acids, alkalis and oxidation treatments. Further work would be necessary to incorporate the membrane into a device.

James Gallagher

Published online: 20 May 2020

<https://doi.org/10.1038/s41560-020-0629-2>