Tuning Hydrophilic Segments to Achieve Acid-free Proton Conduction in COF

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Abstract

Rapid dynamics and remarkable proton conduction induced by confined water in nanospaces have attracted much attentions from researchers, which is crucial for advancing the development of innovative proton conductors and deepening comprehension of proton and water transport mechanisms within biological systems. In this aspect, carbon nanotubes (CNTs) are frequently employed as a research platform. However, they possess certain limitations, such as their inherent electronic conductivity and extreme hydrophobicity, which can impede the accurate assessment and precise regulation of proton conduction. We herein prepared two 2D COFs with different hydrophilic fragment, and obtains maximum acid-free proton conductivity of 3.04×10-4 S cm-1 at 70 °C and 100% RH with Grotthuss type activation energy of 0.14 eV. This is mainly due to that the water molecules in the center of channel form strong hydrogen bonds, enhancing proton dissociation and guiding fast directional diffusion.

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