Solid State Proton Conduction through Oxygen Functionalized Few-layer Graphene

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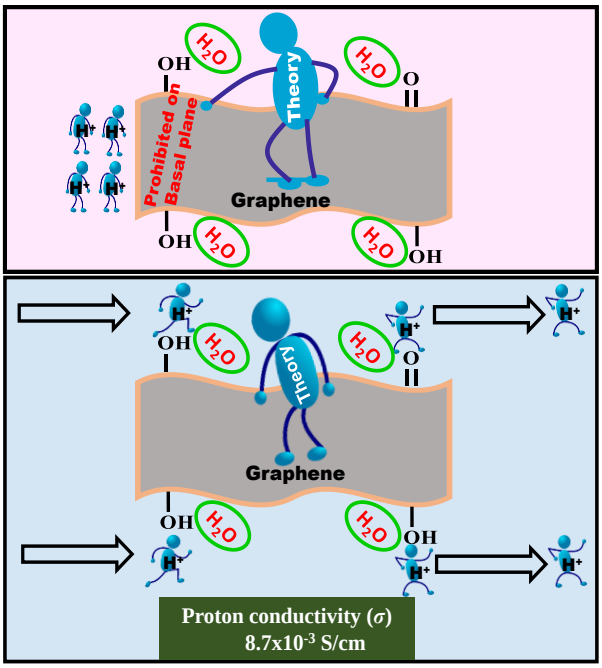
Abstract:

Graphene has attracted wide attention for various applications such as from catalyst to substrate, sensor to transducer or energy harvesting to storage but never been investigated as a solid state proton conductor due to large energy barrier (3.9 eV) and small interlayer distance (~3.6 Å) in few-layer graphene which prohibits solid state proton conduction through basal plane. Herein, first time we report bulk synthesized oxygen functionalized few-layer graphene (OFG) as an excellent proton conductor (8.7×10^{-3} S/cm at 80 °C, 95% relative humidity) utilizing hydrophilic oxygen functionalities (hydroxyl (C-OH) and ketone (C=O)) present at the sheet edges which helped in proton transport employing H-bonding with adsorbed water molecules. Furthermore, shorter grain size of OFG resulted enhanced grain boundary and contributed towards space charge enhancement. Synthesized OFG also exhibited excellent supercapacitor performance having very high specific capacitance (296 F/g) due to good electrical conductivity, excellent proton conductivity, and presence of sheet edge functionalities.



References and Notes:

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