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Graphene Oxide Derived Carbons (GODC); High-Surface Area NanoPorous Materials for Hydrogen Storage and Carbon Capture¹

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Even though there has been extensive research on gas adsorption properties of various carbon materials based on activated carbon and nanotubes, there has been little work done on the gas adsorption properties of graphite oxide (GO). In this study [1], we show that one-and-a-half-century-old graphite oxide can be easily turned into a potentially useful gas storage material. In order to create high-surface nanoporous materials from GO, we used two different approaches. In the first approach, we have successfully synthesized graphene-oxide framework materials (GOFs) by interlinking GO layers by diboronic acids. The resulting GOF materials have well defined pore size and BET surface area up to 500 m²/g with twice larger heat of adsorption of H₂ and CO₂ than those found in other physisorption materials such as MOF5. In the second approach, we synthesized a range of high surface area GO derived carbons (GODC) and studied their applications toward H₂, CO₂ and CH₄ gas storage. The GODCs, with wide range of pore structure, have been prepared by chemical activation with potassium hydroxide (KOH). We obtain largely increased surface areas up to nearly 1900 m²/g for GODC samples from 10 m²/g for initial GO. A detailed experimental study of high pressure excess sorption isotherms on GODCs reveal an increase in both CO₂ and CH₄ storage capacities compared to other high surface area activated carbons. Finally, we compared the gas sorption properties of our GO-based materials with other systems such as MOFs, ZIFs, and COFs.

[1] See <http://www.ncnr.nist.gov/staff/taner> for references and more information.

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