Graphene Oxide as Support for Layered Double Hydroxides: Enhancing the CO2 Adsorption Capacity

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Abstract

Layered double hydroxides (LDHs) show great potential as CO2 adsorbent materials, but require improvements in stability and CO2 adsorption capacity for commercial applications. In the current study, graphene oxide provides a light-weight, charge-complementary, two-dimensional (2D) material that interacts effectively with the 2D LDHs, in turn enhancing the CO2 uptake capacity and multicycle stability of the assembly. As a result, the absolute capacity of the LDH was increased by 62% using only 7 wt % graphene oxide (GO) as a support. The experimental procedure for the synthesis of the materials is based on a direct precipitation of the LDH nanoparticles onto GO followed by a structural and physical characterization by electron microscopy, X-ray diffraction, thermogravimetric analysis, and Brunauer-Emmett-Teller (BET) surface area measurements. Detailed titration confirmed the compatibility of the surface chemistry. After thermal decomposition, mixed metal oxides (MMOs) are obtained with the basic sites required for the CO2 adsorption. A range of samples with different proportions of GO/MMO were prepared, fully characterized, and correlated with the CO2 sorption capacity, established via TGA.

Keywords

Author Keywords: graphene oxide (GO); graphene; layered double hydroxide(s) (LDHs); hydrotalcite(s); CO2 sorption; CO2 capture and storage (CCS)

KeyWords Plus: WALLED CARBON NANOTUBES; HYDROTALCITE-LIKE COMPOUNDS; HIGH-TEMPERATURE; CAPTURE; HYBRID; COMPOSITES; WATER; SUPERCAPACITORS; NANOCOMPOSITES; PERFORMANCE

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