Hydrogen storage capacity of different nanoporous carbon adsorbents

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In this experimental research an extensive series of carbonaceous sorbents with different structural and porous characteristics were investigated for their solid-state H_2 storage gravimetric capacity (wt%) through physical adsorption processes, in an attempt to address the main classes of carbon nanostructures that are currently receiving attention as potential H_2 stores [1-3]. In this respect, both commercially available (carbon nanotubes, few-layer graphenes) and newly synthesized (graphene sponge, microwave-exfoliated graphene oxide) graphene-based and other carbon nanomaterials were examined. Their textural properties were determined by N_2 adsorption at 77K; important parameters were extracted such as BET specific surface area, micropore volume and pore size distribution. Additional characterization techniques were employed in order to elucidate further their structural properties, such as X-Ray Powder Diffraction (XRPD), Fourier-Transform Infrared Spectroscopy (FT-IR), Field-Emission Scanning Electron Microscopy (FE-SEM) and High-Resolution Transmission Electron Microscopy (HR-TEM). The H_2 sorption behavior was studied by systematic adsorption/desorption measurements at different pressures (0-20bar) and temperatures (77K-298K) using specialized volumetric systems [4,5]. All the examined materials were compared for their H_2 storage performance under the same operating conditions, while the H_2 uptake was correlated with specific textural features. The highest capacity of 1,7wt% at 77K and 20bar was demonstrated by a commercial few-layer graphene.

References

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