

Adsorption of n-hexane on hollow carbon nanofibers prepared by template synthesis

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Abstract

Highly-ordered carbon nanofibers (CNFs) were prepared by template synthesis method in the present study. An anodic aluminum oxide membrane with a nominal pore size of ~200 nm and thickness of ~50 μm was employed as template. Experimental results of X-ray diffractometer (XRD) and field-emission scanning electron microscope (FE-SEM) showed that the “hollow” CNFs with an average inner diameter of 160 nm had well-defined 1-D structures and low crystallinity, respectively. N_2 adsorption experiment indicated that the mesoporous CNF array exhibited a high Brunauer-Emmett-Teller (BET) surface area of $780 \text{ m}^2/\text{g}$ and is mainly mesoporous. Compared with chemical vapor deposition (CVD) methods, the advantages of our method are convenient, material general, efficiency, and low cost. Gaseous-phase n-hexane adsorption onto the CNFs was investigated at 303 K in a thermal gravity analyzer (TGA) instrument. Compared with commercial activated carbon, CNFs has a higher equilibrium adsorption capacity in high partial pressure, but smaller capacity in low pressure. At a fixed partial pressure (~0.2 atm), CNFs can achieve an equilibrium coverage during a fairly short time (< 1.5 min for 80 %), indicating smaller diffusion resistance for the CNFs. This result is beneficial for the hollow CNF array as a real-time gas sensing material in future.

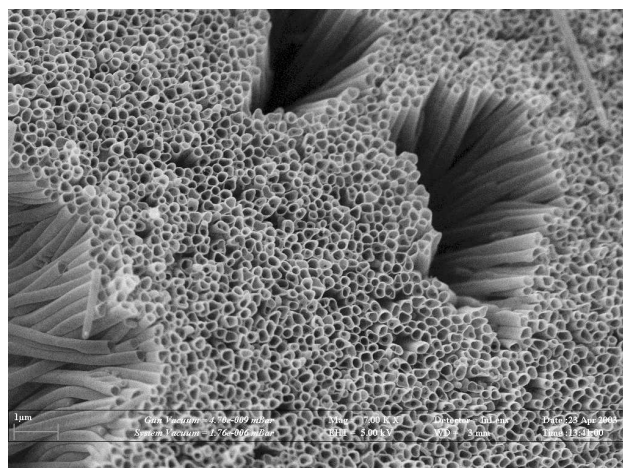


FIG. 1. SEM image of carbon nanofibers synthesized by template synthesis.

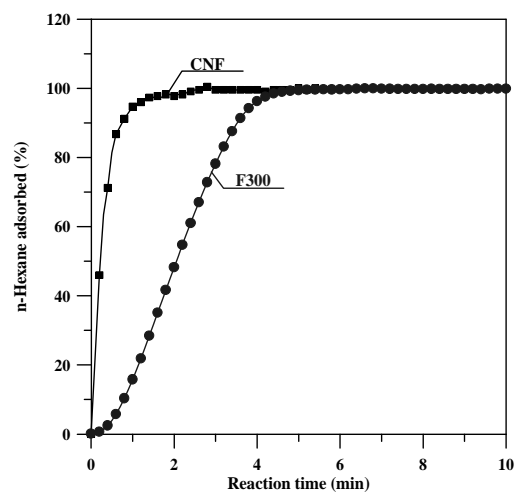


FIG. 2. Adsorption kinetics of n-hexane onto different adsorbents: CNFs and powder activated carbon (F300, Calgon Co.).

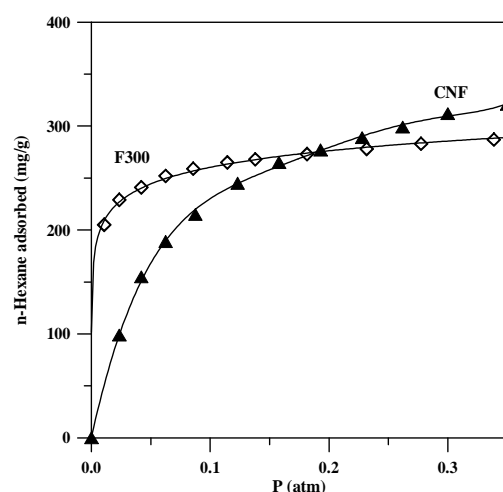


FIG. 3. Adsorption isotherms of n-hexane onto different adsorbents: CNFs and powder activated carbon (F300, Calgon Co.).