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Synthesis and Characterization of Carbon Nanotube Arrays

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1. Introduction

Carbon nanotubes (CNT) constitute an allotropic form of carbon like graphite, diamond and fullerenes. Studies with single wall (SWNT), single length nanotubes and nanotube arrays are very important for fundamental sorption and transport studies with many potential applications, such as gas separation and water desalination.

2a. Single wall, single length CNTs

Single wall, single length CNTs (purity 80%) were modified either with hydrophobic (with oleilamine) or with hydrophilic groups (wrapping of the SWNTs with the polymer poly (sodium 4-styrene-sulfonate), and their sorption and diffusion properties have been compared with the properties of the unmodified ones.

2b. Assemblies of CNTs

Aligned CNTs are synthesized using anodized alumina as a template with or without the application of a catalyst [1]. The nanotubes are formed in the straight cylindrical pores connecting both faces of the alumina membrane. The dimensions of the CNTs are determined by the pore diameter and thickness of the membrane [2]. In our experiments, pore sizes were 20nm and 200nm, respectively. When a catalyst is used the membranes are immersed into nickel (II) nitrate solution, followed by hydrogen gas in order to reduce the nickel and form metallic nickel nanoparticles. The resulting nanotubes will be used in imbibition experiments of decane and other alkanes in order to verify the high mobility predicted by molecular simulation (Quirke). Future work will include the use of the CNT assembly as a model membrane for gas separations or the transport of water in aquaporin [3], [4].

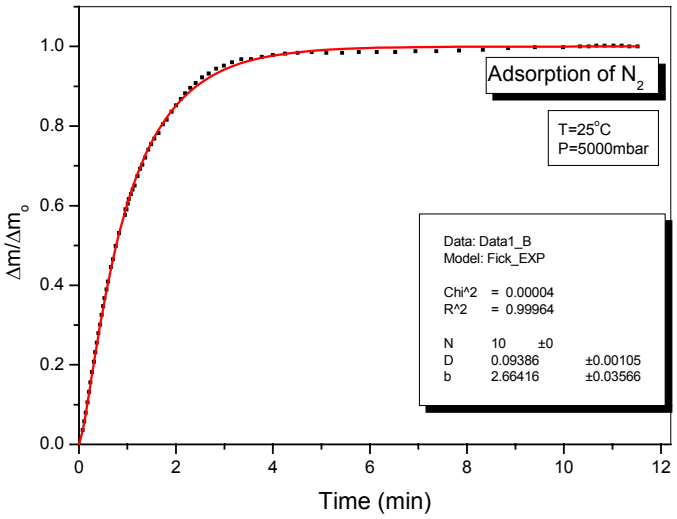

Figure 1. Adsorption curve of N_2 (commercial SWNTs) at room temperature and pressure P=5000mbar.

References

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