Adsorption capacity and its dynamic behavior of the hydrogen storage on carbon nanotubes

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Abstrak

The potential of carbon nanotubes (CNTs) produced in our laboratory to be used for hydrogen storage was tested in this study. The test includes the determination of the hydrogen gas adsorption capacity and the dynamics of the adsorption and desorption of hydrogen on CNTs at isothermal temperature of 25oC and pressures of 0–1,000 psia. A similar test was also conducted on commercial CNTs obtained from the Chinese Academy of Sciences for comparison. The results showed that the hydrogen adsorption capacity of the local CNTs is lower than that of commercial CNTs. At pressures around 960 psia, the adsorption capacities of local and commercial CNTs are 0.09% and 0.13% weight, respectively. In general, the hydrogen adsorption data of both the adsorbents can be represented well by the Langmuir model, with less than 3% absolute average deviation (AAD). The dynamics of adsorption and desorption can be represented well by the Gasem and Robinson model with less than 2% AAD. The adsorption and desorption processes on both local and commercial CNTs occurred very quickly. At the highest pressure (960 psia), the adsorption and desorption equilibriums on the local CNTs were reached in approximately 30 s, while on commercial CNTs, they were reached in 2 s. The rates of the adsorption equilibriums on both local and commercial CNTs increase at a higher pressure. In the desorption process, while the equilibrium time is reached slightly faster at a higher pressure on commercial CNTs, the time is almost similar at all pressures for local CNTs.