THE NATURE AND CAPACITY OF HYDROGEN STORAGE IN CARBON-BASED STRUCTURES

(A critical review of the current literature)

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Comparing recent reviews [1-3] of experimental and theoretical data on hydrogen storage in carbon-based structures shows that the problem of the nature and capacity of hydrogen storage in these materials is still an open question. In this connection, some substantial aspects of the problem are formulated below, with the aim of further developments. 1) The effect of high stationary concentrations of deformation lattice defects under mechanical alloying [4] on hydrogen solubility (absorption) in graphite exhibits in [5, 6]. Such effect can promote the hydrogen storage capacity of graphite up to 7,4 mass % ($CH_{0\text{-}y6}$) at Рш = 1,0 MPa and the milling temperature (>300 K) [5, 6]. As is shown [6], more than one-half of the absorbed hydrogen atoms form a covalent bond with the carbon atoms (that is, the chemisorption capacity), and the rest absorbed atoms enter into the graphite interlayer and expand the lattice between the graphite layers (that is, an additional absorption capacity). These results are consistent with the data [7] on the storage capacity of fullerenes (C60H57) at P_m = 7 GPa and T = 723 K. The influence of lattice defects on characteristics of hydrogen sorption processes for multiwalled aligned carbon nanotubes is, particularly, shown in [8]. 2) As is noted in [2], the strong deformation is induced by chemisorbed hydrogen both in nanotubes and in graphite. This can be one of the main reasons of a negligible hydrogen solubility in monolithic or porous graphite, and a reason of the pore shrinking under hydro-

genation observed in a series of works [9]. 3) The physisorption capacity of the materials in question at room temperature and $P_{ш} \sim$ 1...10 MPa can achieve several mass % [1-3, 10, 11]. **4)** In a plenty of works, the volumetric density (capasity) [1] of the structures is not considered. In this connection, the very recent data [12] on both the gravimetric and volumetric energy densities (capacities) of cold pressed (compacted) into tablets single-walled nanotubes are seems rather useful for technological developments.

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