High-pressure hydrographite

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Synthesis of a new hydrocarbon, hydrographite, has been a challenge for a long time. In the present work this reaction is implemented under high pressures of hydrogen.

High-purity graphite was ground using a ball mill with stainless steel balls and the argon atmosphere. The fine-grained graphite powder obtained was treated in the hydrogen atmosphere under a pressure of 7 GPa at temperatures to 450°C and then quenched to liquid nitrogen. The behavior of the quenched product recovered to atmospheric pressure was similar to that of the hydrogenated carbon nanofibers [1].

The new hydrocarbon evolved a small amount of physisorbed gases (less than 0.5 wt.%) upon heating to 0°C, and the main gas evolution occurred above 500°C. The combustion elemental analysis showed that hydrographite heated to room temperature contained about 5.25 wt.% H (H/C≈0.66). The X-ray diffraction and the IR optic spectroscopy demonstrated that covalent binding of hydrogen to the graphene layers resulted in an increase of the interplane spacing of the graphite crystal lattice by about 40 % (along the c axis), like in the hydrogenated carbon nanofibers.

[1] I.O. Bashkin, V.E. Antonov, A.V. Bazhenov, I.K. Bdikin, D.N. Borisenko, E.P. Krinichnaya, A.P. Moravskii, A.I. Kharkunov, Yu.M. Shul'ga, Yu.A. Ossipyan, and E.G. Ponyatovskii, *JETP Letters* **79**, 226 (2004).