

Carbon phase diagram and the liquid carbon properties: the new results

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Carbon phase diagram is a basis for the graphite – diamond phase transition analysis. It defines these phase coexistence line parameters with carbon melt and vapor, as well as parameters of both carbon triple points. The results of the carbon phase diagram investigation and some properties of liquid carbon obtained recently by the authors are presented in this report.

Contact angle of graphite basal plane wetting by the liquid carbon $40 \pm 10^\circ$ was measured for the first time [1]. Thermodynamic estimation of the diamond melting temperature 4160 ± 50 K at the pressure 12 MPa was made. [2] The analytical curve (fig. 1) separating metastable diamond from supercooled liquid carbon coexisting region was plotted down to the 12 MPa [3] using Simon's two-parameter equation:

$$p = p_0 + a \left[\left(\frac{T}{T_{dm}^*} \right)^c - 1 \right]$$

where $a = 0.41$ GPa and $c = 18.42$ determined empirical parameters. The data for pressure range 10 MPa – 5 GPa were obtained for the first time, and for pressure range 5 – 12 GPa are in a good agreement with Bundy's data [4].

Minimal values of temperature 4750 ± 100 K [1] and pressure 10.7 ± 0.1 MPa at which graphite can be melted (carbon triple point graphite–liquid–vapor) were measured by us, and also are in a good agreement with the data from [4].

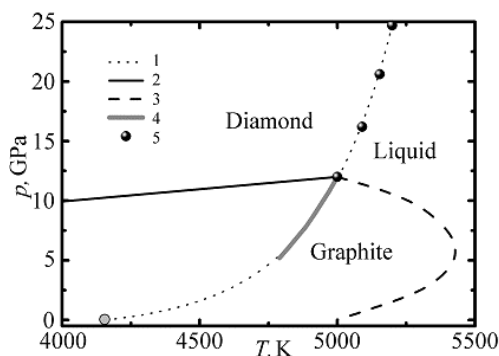


Figure 1. Carbon phase diagram. 1 – diamond melting curve (present work calculated data); ○ – metastable diamond melting point (12 MPa, 4160 K); coexistence curves according to Bundy et al. [4]: 2 – diamond - graphite, 3 – graphite - liquid carbon, 4 – metastable diamond - liquid carbon; 5 – data from [4], used for our calculation

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- [4] Bundy F.P., Bassett W.A., Weathers M.S., Hemley R.J., Mao H.K., Goncharov A.F., *Carbon* **34**, 141 (1996).