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LIQUID CARBON AT HIGH TEMPERATURES AND HIGH PRESSURES *)

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The most complete history of the study for the physical properties of graphite and liquid carbon, starting from 1911 and up to 2015, is described in the book [1]. The triple point of carbon at a pressure of 120 bar has been experimentally confirmed. Heating graphite by current in a short time (microseconds) has a number of advantages over stationary heating.

For the first time, we measured (1986) the relative expansion of graphite (about 70%) during melting (pressure ~200 bar). Subsequently, this result was confirmed by laser heating. The details of the studies are described in the reviews [1, 2].The electrical resistance of pyrolytic graphite with a density of 2.26 g/cm^3, related to the initial dimensions, increases from 450 to 630 μΩ·cm during melting (T = 4900 K).

The temperature was recorded from the graphite surface, through a layer of glass. Note that in the case of melting of the thin layer of glass, the optical transmission does not change (this is a positive difference from sapphire Al_2O_3). Under further temperature rising, the electrical resistance of carbon weakly increases, reaching 900 μΩ·cm at 8000 K. At the same time, there are no signs of boiling in the electrical resistance curve. It is assumed that the boiling point of liquid carbon is above 8000 K. The absence of boiling at 8000 K can also be explained by the increased pressure in the cell, at the end of pulse heating.

The specific heat C_V (~2 J/(g·K) was measured for liquid carbon at temperatures of 5000–7000 K, which turned out to be half as low as *Cp* (~4 J/(g·K), measured earlier also by the pulse method. C_V measurements were performed by rapid heating of a graphite plate clamped in two thick-walled TF-5 glass plates. At the same time, the electrical resistance of liquid carbon is a constant, like mercury heated in a limited volume.

Pressure above 50 kbar (estimation) was obtained under rapid heating of graphite in sapphire thick-walled capillaries [3]; temperatures—of the order of $25 \cdot 10^3$ K (estimate).

The statement [4] about the metal–nonmetal transition during graphite melting contradicts all known experiments. The subsequent publication [5] presented a graphite melting line that does not coincide with all previous experiments, in particular with the studies of F. Bundy (USA) and M. Togaya (Japan). Finally, a statement appeared in the press [6] by A. Rakhel [5] that "*the properties of liquid carbon have been investigated for the first time*", which does not correspond to the well-known historical picture of carbon research (which was discussed in [1, 2]).

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