RECENT ADVANCES IN LASER-PULSE MELTING OF GRAPHITE AT PRESSURE UP TO 6 KBAR

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Melting temperature of graphite and nature of liquid carbon remains a subject of permanent discussions in the literature for many decades. The main reason of this inconsistency is the extremely high melting temperature of graphite making it the most refractory material. The present study deals with a further improvement of the laser-heating technique first used in [1] with the aim to reach a higher reproducibility of the results, to improve and to broaden means of optical measurements and to better control the process of cooling and freezing of liquid carbon. The important aspect of this work is to study the nature of the inflection point on the thermogram ascending due to the formation of liquid carbon first reported in [1]. Since the nature of this inflection can be only attributed to the less thermal conductivity of liquid carbon in respect to the original solid, the study of the magnitude of the inflection with pressure can significantly contribute to the current knowledge of the nature of liquid carbon. In the present work, the changes in thermal conductivity of liquid carbon vs. pressure are studied in the domain of 0.15 to 6 kbar. It turns out that thermal conductivity increases steadily from the triple point pressure to ca.6 kbar. It means that if a certain correlation between the thermal and electrical conductivities is accepted the existing controversy between numerous studies of graphite melting can be successfully resolved. Moreover, through visualization of formation of liquid carbon by the ad-hoc developed system with a high-speed camera and the power diode laser used as a spotlight, the fact of graphite melting at high pressure is finally confirmed.

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1. M.Musella, C.Ronchi, M.Brykin and M.Sheindlin. The molten state of graphite: An experimental study. //J. of Applied Physics, 84, No.5 (1998), p.2530-2537.