# Graphite remelting as a new method to obtain metastable carbon phases

Basharin A.Yu.

*Joint Institute for High Temperatures RAS, 125412, Moscow, Russia*
*e-mail: ayb@iht.mpei.ac.ru*

Advances in the investigations of carbon are associated with the search of new methods of its formation. Nowadays the opportunities of graphite remelting at gas-static conditions are investigated insufficiently. The versatility of mechanisms and crystallization products of liquid carbon (*LC*) from remelted graphite described in [1-4] showed this method to be promising to obtain metastable carbon phases (*MCF)*. The thermodynamics shows an opportunity of getting a *MCF* with the Gibbs potential $G_M$ beyond the limits of stability of this phase on the carbon phase diagram resulted in by the homogeneous nucleation (*HN*) in strongly supercooled *LC*.

Experiments on local graphite melting by a laser pulse at isobaric conditions in the helium atmosphere at pressures 10-100 MPa allowed to find the conditions at which the *HN* takes place in a melt. It is cleared up that the wave properties of the laser radiation and correct choosing of the original HOPG sample orientation towards the laser beam direction have a leading role for this process. We succeeded in obtaining at *HN* the admixture of carbon components *sp* (carbine), $sp^2$ (graphite) и $sp^3$ *(*diamond) and C8 phase [2], which is a carbon alloy, according to [5]. The formation of this alloy is likely to obey the Ostwald rule of stages, according to which the transition from *MCF* to the stable phase (graphite) occurs via a number of intermediate stages with the potentials $G_1 > G_2 > G_3 ... > G_g$.

The diamond is also obtained as separate phase by the heterogeneous crystallization of *LC* on the diamond substrate. In the field of diamond surface forces there have been obtained transparent diamond microcrystals and nano-diamond white-colored films [4]. The influence of extremely high thermal conductivity of the substrate made of the natural diamond crystal on the process of autoepitaxy has been discussed. There had been also discussed an agglomeration of liquid carbon thin films caused by its instability on the surfaces of graphite and diamond and opportunities of using non-graphite liquid phase precursors.

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[4] See this issue.
[5] Yasuda E., Inagaki M., Kaneco K., Endo M., Oya A., Tanabe Y. Carbon Alloys: Novel Concept to Develop Carbon Science and Technology, Elsevier, Tokyo (2003).