Experimental investigation of the liquid carbon crystallization and amorphization

A.Yu.Basharin

Institute of High Energy Density (IHED) for High Temperatures, Russian Academy of Sciences, Moscow, tel/fax 7 (095) 362 56 03, Email: ayb@iht.mpei.ac.ru

The brightness pyrometry technique has been used to study as well the HOPG samples laser heating prior to melting (4800 K [1]) as cooling of the condensed carbon phase. Details of the experimental unit are described in [1]. The sample was heated up via a quartz plate mounted at a clearance of 20 mcm from it. At certain conditions was formed a liquid melt with the diameter 3 mm and the thickness up to 5 mcm. In some cases the molten layer had a contact with the quartz plate. Molten layer cooling rate R did not exceed 1.6 ÌÊ/s in the first case and 23 MK/s in the second one. After cooling down the carbon structures obtained were investigated by the Raman spectroscopy and raster electron microscope technique. We found graphite with the crystallites size up to 250 mcm in both cases and, additionally, shapeless particles of amorphous carbon with the size up to 25 microns and crystal silicon microspheres directly in the contact zone of quartz glass and molten carbon. Particles of amorphous carbon had nanostructure with a size of nanoparticles ~4 nm. They showed significant photoluminescence, which shows the low concentration of structure defects being the centers of the radiationless recombination. Presence of silicon and amorphous carbon in the zone of contact indicates the high cooling rate caused by the following endothermic reaction C(liq.)+SiO2®Si+CO2(gas)-518 kJ/mole.

Based upon the data obtained the accurate R definition would be difficult. We can only state that R³23 MK/s.

1. A.Yu. Basharin, M.V. Brykin, M.Yu. Marin, I.S. Pakhomov and S.F. Sitnikov, High Temperature 42 ¹1 (2004) 56-62.