POROUS STRUCTURE OF LOW-DENSITY NANOSTRUCTURED LASER TARGETS—POLYMER-CARBON COMPOSITES BASED ON HYPERCROSSLINKED POLY-ALPHA-METHYLSTYRENE [[1]](#footnote-1)\*)

DOI: 10.34854/ICPAF.2022.49.1.077

Pastukhov A.V., Akunets A.A., Pervakov K.S., Kuvshinov I.R., Gromov A.I., Borisenko N.G.

P.N. Lebedev Physical Institute, Russian Academy of Sciences, Moscow, Russia, [avpast@gmail.com](mailto:avpast@gmail.com)

Currently, the creation of new environmentally friendly sources of high-capacity electricity is critically important for the world industrial energy. One such expected energy source is inertial confinement fusion (ICF). In this regard, studies related to the development of new materials for inertial confinement fusion are important both for fundamental science and for promising tasks of the Russian energy sector. This paper describes new low-density composite materials for laser targets. Nanostructured materials were obtained by the method of synthesis of hypercrosslinked polymers with the introduction of carbon nanomaterials into the reaction mass - thermally expanded graphite (TEG) (4.5 wt%) and carbon nanotubes (0.4 wt%). The synthesis of polymer networks was carried out according to the Friedel-Crafts reaction with crosslinking in a 1% solution of dichloroethane of macrochains of poly-alpha-methylstyrene with bis-chloromethyldiphenyl. Detailed structural studies of the synthesized composites by electron microscopy and sorption of inert gases, nitrogen and carbon dioxide have been carried out. It was found that the density and porous structure of the obtained composites depend on the composition of the reaction mixture and mainly on the drying method used (thermal desorption of water, freeze drying from benzene, drying in supercritical carbon dioxide). The block samples obtained by supercritical drying from CO2 have a density of about 80-100 mg/cm3 due to a developed porous structure with a specific pore surface area of ​​up to 1000 m2/g. Micro-mesopores with a size of 1.4-5.3 nm (Fig. 1a) occupy from 17 to 82%, and ultra-micropores with a size of 0.5-0.8 nm (Fig. 1b) 2-3% of the total volume of all pores up to 150 nm in low-density composite materials. As a result of studying the obtained composites by SEM and gas sorption, the effect of the formation of a polymer-carbon phase in a composite material based on hypercrosslinked poly-alpha-methylstyrene and thermally expanded graphite was revealed. The effect is due to the formation of a nanostructured polymer network as a result of the incorporation of monomer and tin chloride into thermally expanded graphite particles.

**a****b**

**Figure 1.** Differential pore size distribution. Composite with TEG: (a) according to N2 sorption data (QSDFT, slit / cyl., Equ.), (b) according to СО2 sorption data (NLDFT, ads.).

1. \*) [abstracts of this report in Russian](http://www.fpl.gpi.ru/Zvenigorod/XLIX/It/ru/DO-Pastukhov.docx) [↑](#footnote-ref-1)