STRUCTURE OF LOW-DENSITY MATERIALS FOR LASER TARGETS BASED ON HYPERCROSSLINKED ORGANOSILOXANE AND VINYLARENE POLYMERS [[1]](#footnote-1)\*)

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Investigations in the field of high energy physics are extremely important for both fundamental science and industrial energy production in Russia. In this regard, the study of the processes of interaction of high-power laser radiation with materials of various structures is an urgent task.   
The aim of this work was to obtain new types of low-density polymer media and study their porous structure. Such materials were obtained on the basis of synthesized hypercrosslinked polymers [1] of oligophenylmethylsiloxane, vinylnaphthalene, vinylcarbazole and acenaphthylene using bis-chloromethyl derivatives of benzene and diphenyl. Polymeric materials with a low density of 60–170 mg/cm3 were obtained by drying the organogels of the synthesized polymers in supercritical carbon dioxide. To determine the parameters of the porous structure, the method of low-temperature nitrogen sorption was used. Based on the experimental isotherms of nitrogen sorption-desorption and the calculation algorithms of the NovaWin 11.04 program, pore size distribution functions are obtained and the main characteristics of the porous structure are established. The calculations were performed for the cylindrical model of pores using the BJH (theory of capillary condensation) and DFT (density functional theory, “quenched solid density functional theory (QSDFT)” methods based on the “carbon equilibrium transition kernel at 77 K”) [2]. It has been established that the most developed micropore system 2–3.5 nm in size has xerogel of hypercrosslinked polyacenaphthylene with a 300% degree of crosslinking. The specific pore surface of this polymer reaches 1800 m2/g, and their total volume is 5.5 cm3/g (pores up to 140 nm in size). In the swollen state, the polymer is able to retain up to 8 cm3/g of water, despite the hydrophobicity of the polymer matrix. The use of the QSDFT method for calculating the pore size distribution functions made it possible to identify three groups of pores with sizes of 2–3.5 nm, 3.5–5 nm, and 10–30 nm in the synthesized polymer networks. Depending on the type of linear polymer, the volume fraction of each pore group is different. The volume portion of the groups 1, 2, and 3 in samples dried in carbon dioxide can reach 20, 10 and 65% of the total volume of all pores of 2–50 nm in size.

References

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2. Lowell S., Shields J.E., Thomas M.A., Thommes M. Characterization of Porous Solids and Powders: Surface Area, Pore Size, and Density, Springer, 2004, 347 p.

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