MODIFICATIONS OF THE HARDENED METAL-CONTAINING NANOLAYERS FOR LASER TARGETS [[1]](#footnote-1)\*)

DOI: 10.34854/ICPAF.2023.50.2023.1.1.102

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

Lebedev Physical Institute of the Russian Academy of Sciences, Moscow, Russia, gromovai@lebedev.ru

Low-density layers of metal-containing nanomaterials are of interest when conducting experiments with laser targets. Being hardened such layers are more durable when moving and more stable at the beginning of pumping in the interaction vacuum chamber of the laser facility. Also, during hardening, the initial volume density of the nanomaterial may change with some of its subsidence. The production of nanodispersions and the ideas of hardening a layer of nanomaterials with metal have been developing at FIAN for several years. And a number of experiments were carried out on the manufacture and characterization of such layers [1, 2]. Layers with hardening are comprised from nanoparticles, Au, Ag and Cu, made according to our permanently developing technology, by evaporation or sublimation of metal and subsequent prolonged deposition of nanomaterial in the volume of inert gas. The size of the nanoparticles and the density of the layer depend on a number of variable parameters. The hardened layers of the nanodispersed metal begin to fuse while annealing in a separate thermal installation at ~0.3 or even less of the melting point of the initial metal, depending on the size of the nanoparticles. Phase transitions are of great importance here. To obtain composite low-density materials with silver nanoparticles, the natural polysaccharide chitosan was used as a polymer matrix [3]. Silver particles in the form of a dispersion obtained by chemical metal recovery were introduced into a chitosan solution. To obtain a composite hydrogel, chitosan was cross-linked with the help of dialdehyde. Composite polymer materials with a density as low as 30-60 mg/cm3 were obtained by freeze-drying of cryohydrogels of cross-linked chitosan. The silver content in the polymer matrix ranged from 8 to 18 wt. %. Our resultant samples were studied by optical and X-ray methods, as well as by scanning electron microscopy and roentgen-luminosity microanalysis. The studies carried out and the layers of nanomaterials obtained, including those with hardening, are used in current and may be useful for future experiments with laser targets [4,5].

The work was carried out within the framework of the RFBR grant project No 15-52-46116.

References

1. L.A. Borisenko, I.V. Akimova, A.A. Akunets, A.I. Gromov, A.S. Orekhov. Metal produced as nano-snow layers for converters of laser light into X-ray for indirect targets as intensive EUV sourses / Journal of Radioanalytical and Nuclear Chemistry, 2014, V. 299, N2, p.955.
2. A.S. Orekhov , A.A. Akunets, L.A. Borisenko, N.G. Borisenko, A.I. Gromov, Yu.A. Merkuliev, V.G. Pimenov, E.E. Sheveleva, V.G. Vasiliev. Modern trends in low-density materials for fusion. Journal of Physics: Conference Series, 2016 , 688(1) 012080.
3. Azarova Y.A., Pestov A.V., Bratskaya S.Y. Application of chitosan and its derivatives for solid-phase extraction of metal and metalloid ions: a mini-review / Cellulose, 2016, 23(4), p.2273.
4. Chanprint Kaur, S. Chaurasia, N.G. Borisenko, A.I. Gromov, A.A. Akunets, G.V. Sklizkov, G.A. Vergunova and S.Y. Gus’kov. Demonstration of gold plasma as bright x-ray source and slow ion emitters / Plasma Physics and Controlled Fusion, 2019, V.61, N8, 084001.
5. A.I. Gromov, A.A. Akunets, N.G. Borisenko. ”Method of obtaining low-density nanometallic coatings for laser targets” Collection of annotations reports of the International Scientific Prize Metallologist of the Year. Edition 2(2021). p.15.
1. \*) [abstracts of this report in Russian](http://www.fpl.gpi.ru/Zvenigorod/L/It/ru/DQ-Gromov.docx) [↑](#footnote-ref-1)