Synthesis of metal-carbon nanostructured materials by controlled laser deposition

Arakelyan S.M., Antipov A.A., Kutrovskaya S.V., Kucherik A.O.*, Nogtev D.S., Osipov A.V., Prokoshev V.G.

Department of Physics and Applied Mathematics, Vladimir State University, Vladimir, Russia
**e-mail: kucherik@vlsu*

Laser ablation is widely used for obtaining of nanoparticles and nanoclusters in a cloud of ablation products. It is well controllable and perspective process for many technological applications, the numerical decision for rectangular initial structures of density and pressure is resulted in, shown, that initial structures of distributions of density and pressure in a vapour cloud of material render essential influence on function of distribution formed of nanoclusters.

The carried out experiments of laser deposition show an opportunity of control formation of complex nanostructurized coverings on a substrate surface at used of a target as a mix metals nanopowder and carbon nanotubes. The most perspective appears on a laser method of action on a carbon nanotubes massive at the presence of growth catalysts of the given structures. As shown in work nanoparticles can be such catalysts for growth nanotubes. The question on the mechanism of nanostructures formation on a surface of a cold substrate up to the end is not clear, as during action there can be a reorganization carbon nanotubes at the expense of action of nanoparticles catalysts. In this case the sold scheme of nanostructures formation corresponds to an open reactor with speed of particles evaporation about sound speed. To research of a target surface after laser action show, that during interaction of laser radiation with carbon nanotubes, mixed with metal nanopowder, there is a local profusion. In this case, at active evaporation of substance (visually above area of laser action on a target the intensive plasma torch is fixed), nanotubes appeared on a surface of melting materials can be fond from a surface and be deposited on a substrate. In such system carbon - metal, as shown in work, the formation of fractal structures is possible at self-organizing carbon on metal during thermal laseraction. Simultaneously with it, during distribution of two-componental plasma probably formation of fractal clusters.

The offered method of obtaining of metal-carbon nanostructures has perspective for various applications, photonics and optoelectronics as allows to action on carbon nanotubes and to change their morphological and physical chemical properties at temperatures considerably smaller then temperatures of fusion of an initial material.