Nanocomposite layers on the basis of polymeric forms of C_{60}

Kazachenko V.*[1], Razanau I.[2]

[1]*Belarusian State University of Transport, 246653, Gomel, Belarus*
[2]*Francisk Skorina Gomel State University, 246019, Gomel, Belarus*
**e-mail: kvp_@mail.ru*

The main methods of C_{60} polymer coatings synthesis such as irradiation of the thermally deposited in vacuum fullerite layers by the electromagnetic radiation in the ultraviolet-visible spectral range, modification by electrons with different energies and current densities, plasma polymerization, explosive fullerite vaporization and coating deposition by the convergent electron beam with the energy of 20 keV and the power of about 1 kW, are reviewed and discussed in the report. Special attention is paid to the method of electron-beam dispersion, which is being developed by the authors of this report. In this method, synthesis of nanocomposition layers on the basis of polymeric forms of C_{60} takes place from the active gas phase, produced by the irradiation of a fullerite target by an electron beam with the energy of 1-1.5 keV and power of 30-75 W.

The stages of fullerite dispersion and layer growth are analyzed. It has been shown that on the first stage, heating and radiation-thermal-induced modification of the surface layer of the fullerite target takes place without target dispersion and coating growth. On the second stage, at the temperature of about 540-560 K, a nonstationary period starts with an abrupt increase of the target dispersion and coating deposition rates. Stationary period of the dispersion and coating deposition takes place at the temperature of the target surface of about 850 K and the deposition rate of about 0.03 nm/s at 140 mm distance between the target and the substrate. The influence of the fullerite target charging on the stages of dispersion and coating deposition is also discussed. It has been shown that the molecular flow produced by fullerite C_{60} electron-beam dispersion contains positive ions and the coatings are deposited onto the substrates under the irradiation of the true secondary and back-scattered primary electrons, which significantly influence the structure of the layers being formed. Examples of the coatings synthesized using this method and having different content of dimers, linear polymer chains, two-dimensional and three-dimensionally cross-linked polymeric forms of C_{60}, as well as the nanocomposition coatings containing C_{60} and polyaniline, C_{60} and polytetrafluoroethylene, polymers and detonation-synthesized nanodiamonds are shown and discussed.