

Investigation of low-pressure discharges for elaboration of equipment and technology for pulse electron-beam evaporation and ion-plasma deposition of nanostructured coatings.

State registration –0110U002292

Head - Denbnovetskiy Stanislav V.

Results

Obtaining of different coatings by electron-beam evaporation in vacuum is one of the most widely using methods. However, obtaining of coatings from multicomponent materials, as well as from chemical compounds, which are inclined to thermal dissociation, is really difficult with using of continuous heating during evaporation. For deposition of such coatings applying of pulsing evaporation by electron beam, generated in high voltage glow discharge with cold cathode, with activation of steam and gas fluxes in the evaporation zone by low-pressure discharge, is very perspective. Using of gas discharge cold cathode electron sources for pulsing evaporation provided the possibility of coating deposition under wide range of operation pressure and gas media composition. Superposition of pulse evaporation with using of suitable gas media led to the possibility of obtaining coatings with required structure and phase composition.

A singularity of generation and forming of pulse electron beams in high voltage glow discharge with cold cathode is analyzed in this work. Defined, that with using triode electrodes systems with large cathode's emission surface obtaining of electron beams with power tens of kW and power density range of $10^5 - 10^6$ W/cm² is possible. These parameters allow using such kind of pulse beams for evaporation of different materials, including refractory ones.

The main singularities of fast control of electron beam electrical parameters by using low-voltage additional discharges are defined. It is determinate, that impulse modulation of electron beam is possible in the range, which correspondent to requirements of electron beam technology for coatings deposition, namely: modulation frequency – 10 – 200 Hz; impulse duration – 1 – 50 ms.

On the base of obtained results experimental devices are elaborated and technological process of thermal-ion deposition of coatings from chemical compounds is investigated with its applying. Some recommendations about technology of impulse thermal-ion deposition of compounds' coatings are formulated on the base of provided investigations.

PDF