

Surface change in ion-plasma flows

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The interaction of electrodes with ion-plasma flows changes the state of their surface, including blistering in devices of plasma electronics. In addition, the state of cathodes based on aluminum oxides (Al-Mg), the change in the electrodes of magnetically controlled contacts (Fe-Ni), the electrodes of vacuum arc interrupters (Cu-Cr) is changing. Processes and mechanisms of interaction of plasma flows with a surface are still relevant. The report studies the evolution of the surface of electrodes in ion-plasma flows and simulates changes in the morphology of electrodes in an arc discharge under controlled gas and vacuum conditions. In the work, the processes were studied by a complex of methods of X-ray photoelectron spectroscopy, electron microprobe analysis, layer-by-layer and raster mode, and atomic force microscopy. A layer analysis, for example, of an aluminum cathode oxide of He-Ne laser containing dopants of magnesium and iron, reveals segregation of carbon to the surface and simultaneously a change in the concentration

of free aluminum, magnesium, and oxygen. Blistering, known for spacecraft and nuclear installations with ion beam energies of tens and hundreds of keV, was detected in electrodes of gas-filled devices containing neon atoms of the order of 2, 11 wt.%. In the vacuum arc discharge of the surface of Cu-Cr electrodes, the concentration of Cu atoms (the main substance of the alloy) and the oxygen on the surface are higher than the bulk values. The copper content is reduced in volume to 78.2%. In the cathode region, the auto electrons initiating the arc discharge, generated in the emission centers by high current densities that stimulate the heating of this zone and are accompanied by the spraying of the substance of the electrodes. In the melting zone, the oxygen concentration decreased more than twofold from 4.9 wt.% up to 2.2 wt.%.

Biography

Evgeny Moos is a Professor since (1997-2017) at Department of General Physics, Ryazan State University, Ryazan, Russia. Lectures on natural history and general physics: mechanics, molecular physics and thermodynamics, electricity, optics and Physics laboratory: mechanics, molecular physics and thermodynamics, electricity, optics, atomic physics and quantum electronics.

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