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Screening of a flow of evaporated metal atoms by the Langmuir layer formed in zone of hot-plasma contact with metal

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Erosion of materials under the action of hot plasma on the surface of walls is among the biggest problems encountered in designing structures for various applications. Accordingly, correct estimations must be made in both designing device structures and selecting their operation regimes for determining the rate of material degradation. However, the models conventionally used for such analysis are based primarily on detailed description of plasma dynamics, while the presence of a Langmuir layer formed in the zone of hot-plasma contact with walls is not considered. This state of affairs is most probably related to the fact that the Langmuir-layer thickness in hot plasma only amounts to several nanometers and the Langmuir layer is assumed to be transparent for the flows of atoms, ions, and energy. The present work is aimed at analysis of the influence of a Langmuir layer on the process of ejection of evaporated material into plasma. Main feature of considered here model is the accounting ionization of evaporated atoms in Langmuir layer caused by their collisions with electrons emitted both from plasma and from the surface of a conducting wall. The importance of this effects is connected to the acceleration of ionized atoms by the electric field of Langmuir layer back to the wall. Analysis showed that effective screening of evaporated atoms by Langmuir layer is realize when plasma temperature and plasma density satisfy the conditions $T_e \geq 5$ eV and $n_{pl} \geq 8 \times 10^{19}$ cm^3.

Biography

V M Kozhevin has completed his PhD from Saint Petersburg University and Postdoctoral studies from Efremov Institute, Saint Petersburg. Currently, he works at the Ioffe Institute and developing new methods for the laser formation of metallic nanostructures He has published more than 50 papers in reputed journals.

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