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Surface morphology and mechanical analysis of nanolaminate (TiAlSiY)N/ZrN and (TiAlSiY)N/MoN condensates deposited by vacuum-arc

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(TiAlSiY)N/ZrN and (TiAlSiY)N/MoN coatings are a system composed of alternating multielement and binary nitride layers of a nano-sized scale. The laminated structure allows to vary the number of interfaces and to influence the fine-grained structure of functional coatings, which in turn leads to a change in the values of hardness and longitudinal elasticity modulus. Nanolaminate condensates were deposited using the upgraded Bulat-6 device. The pressure of the working atmosphere in the deposition chamber (P_N) was $P_N = 4\times10^{-3}$ Torr. A constant negative bias potential ($-U_b = -110$ V) was applied to the substrate while the substrate temperature (Tp) was about 250°C. The presence of a droplet fraction and cathode particulates is detected on the surface, which is typical for most vacuum-arc condensates from non-separated plasma flows. The size of the droplet fractions is in the range from 1 to 10 μm, while on the surface of (TiAlSiY)N/ZrN coating, it is possible to detect enlargement of the droplet fraction and tendency to agglomeration, which is probably related to the coefficient of Zr erosion and with the change of the top layer of the laminated condensate. Based on the individual sections of micrographs of the molybdenum-containing coating, the corresponding numerical surface models were constructed. These models are designed for the surface visualization and will be used for calculation of the numerical characteristics of surface morphology. The highest values of nanohardness and longitudinal elasticity modulus are 35.9 GPa and 406.8 GPa, respectively, were obtained for the (TiAlSiY)N/MoN coating. The corresponding parameters for the (TiAlSiY)N/ZrN composition are significantly lower and are equal to 22.1 GPa and 271 GPa, respectively.

Keywords
structure
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