EFFECT OF THE MULTILAYER STRUCTURE OF THE NI-AL FILM ON THE MELTING THRESHOLD AND MELT THICKNESS WHEN FORMING NI-AL SURFACE ALLOY UNDER THE INFLUENCE OF LOW-ENERGY HIGH-CURRENT ELECTRON BEAM

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A surface alloy has a significant advantage over coating since it provides the highest level of adhesion. The process of a surface alloy forming comprises two successive steps. First, one or several layers of surface alloy chemical composition are deposited on treating surface. The proportion of materials in the surface alloy chemical composition determines the thickness and number of layers to be deposited. Second, the deposited multilayer film is then treated with LEHCEB, whereby the layers of film are melted, mixed, and a surface alloy is formed.

It is technically more convenient to deposit thicker layer of material, but for uniform mixing, thinner layer is preferable. The purpose of calculations carried out in this work was to estimate the effect of different film multilayered structure on thermal regime characteristics such as melting threshold, melt thickness and lifetime of melt.

To form the Ni-Al surface alloy, Ni and Al layers were alternately deposited onto the carbon steel substrate. Calculations were made for 5 types of multilayer composition with the number of Ni and Al layers varied from 3 to 19, keeping the total thickness of the multilayer film 2.5 μm.

Dependencies are obtained for melting threshold, melt thickness and melt lifetime versus number of Ni and Al layers included in multilayer film. It was discovered that the melting threshold value for this type of multilayer composition can vary from 4.1 to 4.3 J/cm^2.