UDC 621.79

INFLUENCE OF THE CRYOLITE MODULE ON THE PHYSICAL AND CHEMICAL PROPERTIES OF THE FLUX IN THE AUTOMATIC WELDING OF ALUMINUM WITH A CLOSED ARC

V.Ya. Zusin *Doctor of sciences., Prof.,*
A.M. Zusin *PHD,*
S.V. Siminenko *stud.,*
State Institution of Higher Education "Priazovsky State Technical University", c. Mariupol, Ukraine

The flux for welding aluminum with a closed arc contains potassium chloride, sodium chloride and cryolite, the concentration of which is 44% of the total weight. Factories produce cryolite with a different module (cryolite module, or cryolite ratio, consider the molar ratio of NaF / AlF_3). The use of cryolite of various compositions for the manufacture of welding fluxes leads to a change in the physicochemical properties of fluxes (melting point, density, electrical conductivity, viscosity), which in turn affects the formation of a weld on the properties of welded joints.

In electric arc welding of aluminum with a closed arc, the flux must have a melting point and a density lower than that of the metal being welded, a certain fluidity and low electrical conductivity, which ensures a stable arc welding process.

When the cryolite modulus changes from 1,52 to 1,65, the melting temperature of the fluxes changes insignificantly and amounts to 615 - 630 ° C. With an increase in the cryolite modulus over 1,65, an increase in the melting temperature of the flux occurs. With a cryolite modulus of 1,75, the flux melting point is close to the melting point of the metal being welded, and with a cryolite modulus of 2,13, it significantly exceeds it and amounts to 730 ° C.

With an increase in the cryolite modulus, the flux conductivity increases, since the concentration of low-melting Na+ cations increases and the number of complex AlF_3^{-6} anions, which practically do not participate in the transfer of electric current, decreases. With an increase in the cryolite module by 0,1, the specific conductivity of the flux increases by 0,06 – 0,07 $Ohm^{-1} \cdot cm^{-1}$.

An increase in the cryolite modulus leads to an increase in flux density. With an increase in the modulus by 0,1, the flux density increases by 0,04-0,06 g/cm^3, however, the obtained flux density values do not exceed the density of the molten metal being welded. With increasing temperature, the flux density decreases linearly.

A decrease in the cryolite modulus entails an increase in the fluidity of the flux, which is explained by an increase in the content of complex ions AlF_3^{-6}, which has a layered structure. With increasing temperature, the fluidity of all fluxes increases.

As a result of studies of the physicochemical properties of fluxes with various cryolite modules, fluxes manufactured on cryolite having indices of 1,55 – 1,70 are most fully compliant.