

UDC 621.791.3

Borkovsky A.V.<sup>1</sup>, Lushchin S.P.<sup>2</sup>

<sup>1</sup> PhD student NU “Zaporizhzhia Polytechnic”

<sup>2</sup>PhD (Phys.-math. sciences), associate professor NU “Zaporizhzhia Polytechnic”

## **INNOVATIVE PROCESS FOR THE PRODUCTION OF ALUMINIUM-ZIRCONIUM LIGATURES**

The development of the use of various products based on aluminum alloys is determined by the availability of appropriate manufacturing technologies or the possibility of developing such technologies, taking into account their technical and economic efficiency. Achieving high performance characteristics of aluminum alloys depends on the use of suitable alloys. All these aspects are also limited by the requirements to achieve economic efficiency.

Two methods have been developed and tested for the production of aluminum ligatures with rare and rare earth metals: the direct alloy method and the aluminothermic reduction of metals from their salts and oxides (aluminothermic method).

The aluminothermic method for producing aluminum-zirconium ligatures allows the use of existing industrial equipment without the need for modernization, due to similar temperature conditions of the processes. This fact is significant when making decisions about the development of a new technological processes [1-4].

The purpose of this research was to develop a technological process for the industrial production of aluminium-zirconium ligatures using equipment that is already used at the plant for the production of conductor and cable products of “Croc GT” LLC without any modernization. Additionally, it was necessary to achieve comparable rates of production and consumption of the ligatures in the holding furnace used for the preparation of electrical aluminium ligatures with the addition of zirconium.

The temperature range for preparing the aluminum-zirconium ligatures in the auxiliary furnace should be in the range of 850...900 °C, and the temperature of complete dissolution of zirconium from the alloy in the aluminum melt in the

holding furnace should also remain in this range. These conditions must be accompanied by an appropriate time for complete dissolution, comparable to the time it takes to fill the holding furnace with molten aluminum from the shaft furnace.

The required composition of the Na, K, Al–Cl, F–ZrO<sub>2</sub> slag melt system was selected on the surface of aluminum in an auxiliary furnace to achieve a technical result. The obtained wire rod fully complies with European requirements for wire made of heat-resistant aluminum alloy used in overhead power line wires [5].

## REFERENCES

1. Patent 2234552 RF, C22C 35/00. Method for producing magnesium-iridium-rare earth metal alloy // G. I. Belkin, O. A. Rubel, S. G. Lyamin, etc.; publ. 30.08.2004.
2. Popov, D.A. Research and development of technology for the aluminothermic production of aluminum-zirconium alloy from zirconium oxide in chloride-fluoride melts: thesis ... cand. of techn. sciences: 05.16.02. – M.: MISIS, 2012. – 155 p.
3. Napalkov, V.I. Production of alloys for aluminum alloys / V.I. Napalkov, S.V. Makhov, D.A. Popov // Metal science and thermal processing of metals. – 2011. – № 10. – P. 26-30.
4. Ogorodov, D.V. Methods for producing Al-Zr alloy (review) / D.V. Ogorodov, D.A. Popov, A.V. Trapeznikov // Proceedings of VIAM. – 2015. – № 11. – P. 13–20.
5. IEC 62004. Thermal-resistant aluminium alloy wire for overhead line conductor. – International electrotechnical commission, 2007. – 16 p.