UDC 621.792.4.621.791.01

PHYSICAL AND TECHNOLOGICAL BASIS FOR FORMATION OF COATINGS BY ELECTRIC CONTACT SINTERING

Z.L. Alimbabaeva,
Branch of the Russian State University of Oil and Gas named after I.M. Gubkin in Tashkent
B.Sh. Bektemirov,
Materials Science department, Tashkent State Technical University
G.M. Kamilova,
Materials Science department, Tashkent State Technical University
Z.F. Chulliyev,
Materials Science department, Tashkent State Technical University

Sintering following GOST 17359-82 is a technological process for obtaining coatings, which consists in applying a powder-formed part or a layer of powder to the surface of a part and heating them to a temperature that ensures sintering of the powder material and the formation of a strong diffusion bond with the part.

Electrocontact sintering provides for the heating of the metal powder, which is poured between the part and the electrode, due to the thermal energy released by the electric current at the active resistance. The firing process is ensured by the combined action on the powder layer of high temperature (0.9-0.95 of the powder melting temperature) and pressure (up to 100 MPa). In this case, both diffusionless setting phenomena and diffusion processes of sintering and welding in the solid phase take part in the kinetics of the formation of a metal coating.

The heating of a metal powder is determined by the simultaneous processes of heat release (according to Joule Lenz's law) and its propagation (heat transfer). In electrocontact firing, the role of the former is especially important due to the use of short (0.02-0.04 s) current pulses.

The coatings applied by the electrocontact method have a sufficiently high adhesion strength to the base and low porosity, and the presence of powder or oxide films on the surface of the part practically does not affect the adhesion strength, since the films have the highest electrical resistance and are intensely heated by current pulses with subsequent removal from the connection zone.

In comparison with other methods of applying powder coatings, the processes of electric contact hardening have some advantages: high productivity and low energy consumption, minimal heat-affected zone, the ability to obtain the required geometric shape of the part without subsequent mechanical treatment. They provide better sanitary and hygienic working conditions due to the absence of light emission and gas emission and are preferable from an economic point of view.

Electrocontact sintering of metal is one of the processes in which the power and temperature factors of activation play the main role. Intense force action and a high rate of heating of the powder layer during electrocontact sintering make it possible to abandon the use of chemical activators and reduce the time required for the process by approximately two orders of magnitude compared, for example, with the induction method of coating.

Hardware support for the technology of applying hard-alloy composite coatings by the method of electrocontact sintering of powder mixtures.

A significant increase in the performance of many types of products is achieved by applying coatings on their surfaces based on tungsten and titanium compounds. The use of such coatings allows not only to increase the wear resistance of tool products by 1.5 ... 3 times but also to design fundamentally new types of tools and friction units.

In industry, coatings of high wear resistance are obtained mainly by flame and plasma spraying. Induction melting and sintering by electrocontact or electric pulse methods. All of these coating processes are at high temperatures.

Unlike other types and methods of coating, electrocontact sintering directly in the process of work allows you to form a working layer with a thickness of 0.5 ... 1.5 mm. Thus, the resulting coatings are no longer an integral part of the surface of the product, improving its properties, but work as an independent body, perceiving the entire load.

When applying hard coatings, the requirement of their good adhesion to the substrate surface is very important. The dominant factor in this process is the temperature, which in local areas of values of 1500 ° 2000 ° C and to increase in a leap, impulsively with a steep front should reach.

The technology of applying carbide coatings is provided by an installation operating on the principle of electric contact heating by a pulsed alternating current with a variable duty cycle.

References

1. Juravlev B.M. Matusov I.A. Sceplenie pokrytii s metallami // Zaschitnye vysokotemperaturnye pokrytiya [Adhesion of coatings to metals // Protective high-temperature coatings]. L.; Nauka. 1972. s.32-36.

2. Meshkov V.V., Myshkin I.K., Sveredenok A.I. O metodike rascheta tehnologicheskih parametrov processa elektrospekaniya provodyaschih poroshkov // Poroshkovaya metallurgiya [About the method of calculation of technological parameters of the process of electrospection of conductive powders // Powder metallurgy], 1976. -№11 –s.8-11.

3. Royh I.V. Adgezionnye pokrytiya [Adhesive coatings]. M.: Metallurgiya, 1975.