INFLUENCE OF MECHANICAL ACTIVATION ON MECHANICAL ALLOYING OF COMPOSITE POWDERS FOR GAS-THERMAL COATINGS

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Development and mastering of low-cost, environmentally safe, high-efficiency technologies for obtaining new powder composite materials possessing the necessary complex of physical and mechanical properties is one of the promising directions of solving the problem of increasing the service life of machine parts operating under conditions of abrasive wear and impact of various corrosive environments.

The high cost of coatings produced by gas-thermal methods is primarily due to the price of materials for spraying, as which are used powders produced by complex technologies with a high content of expensive components.

Recently, the use of reactive mechanical alloying has been developed for the production of composite powders of various compositions. The method consists in processing of powder charge in ball mills. As a result of the formation of a huge active surface, the chemical activity of the milled substances increases. This opens the way to modify the conditions under which chemical reactions normally take place either by modifying the activity of the components being milled, since mechanical activation increases reaction rates by lowering the reaction temperatures of powders, or by initiating chemical reactions during the milling process - mechanochemistry.

Composite dispersion-hardened powders based on nickel are the most promising for obtaining wear-resistant coatings operating in abrasive and aggressive environments.

As starting materials for obtaining powder mixtures for spraying coatings, powders of titanium grade VT1-0, boron B, carbon grade PM-15 for the synthesis of titanium diboride, thermosetting nickel aluminide powder PT-NA-01, aluminum powder PAP-1 of GOST 5494-95, and iron oxide Fe_2O_3 were used. The fractional composition of all the initial powder components was in the range of (63...100) microns.

Mechanical alloying was carried out in a ball mill at the degree filling of the grinding chamber with steel balls of 8 mm diameter by 70-80% and the ratio the volumes of working bodies and charge – 8/10, processing time was 3 hours.

As a result of the research it was established that during the processing of powder mixtures in a ball mill there is a destruction of particles and welding their fragments. In parallel with the destruction of particles, their agglomeration occurs as a result the action of electrostatic and van der Waals forces at the contact of juvenile surfaces. The impact of steel balls leads to welding of agglomerated particles, accompanied by interdiffusion and chemical interaction between the components.