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DEVELOPMENT OF OPTIMAL TECHNOLOGICAL PARAMETERS FOR PLASMA COATING DEPOSITION

The problem of using ion-plasma spraying of mold surfaces is being discussed nowadays. Its solution makes it possible to replace scarce and expensive tungsten-containing steels with other materials. 4Х5МФС and 5ХНМ steel grades were chosen as materials for copper alloy die-casting molds in this work. The choice of these steel grades is due to the fact that these steels do not contain tungsten due to its sharply increased scarcity and limited molybdenum content, and they also meet the requirements for the substrate material on which the titanium nitride coating is applied. Coatings were applied to samples for laboratory tests and die-casting mold parts by the condensation method with ion bombardment. Titanium nitride is applied at different partial nitrogen pressures – from 3(10-3 to 1 Pa to determine the required nitrogen pressure, which ensures that the working surfaces of mold parts receive coatings with the best performance characteristics. The coatings obtained at different nitrogen pressures differ in the amount and size of the droplet phase. The largest amount of the droplet phase containing α-Ti is observed in coatings obtained at nitrogen pressures of 3(10-3, 3(10-2 Pa. An increase in nitrogen pressure (4(10-1, 1 Pa) significantly reduces the level of micro distortions of the crystal lattice in the coating, and its plasticity increases. That is why the coating brittleness is reduced to a sufficiently high hardness. The titanium nitride coating obtained at a nitrogen pressure of 1 Pa is the most effective in protecting the working surfaces of mold parts from destruction. Laboratory tests have shown that the titanium nitride coating applied under optimal process parameters increases the corrosion resistance of mold parts to which it is applied by 3 times and the scale resistance by 2–4 times.

Using titanium nitride coating of mold surfaces by the condensation method with ion bombardment has allowed obtaining different performance characteristics. It depends on amount of nitrogen pressure. To increase the stability of molds we should increase its resistance to cyclic temperature stresses and aggressive environments by presence of such layer. This layer can be of wear-resistant materials that can be applied by method of condensation with ion bombardment (CIB).

The development of optimal technological parameters for the deposition of plasma coatings is the process of determining the ideal conditions, such as temperature, pressure, gas composition and others, for applying plasma coatings with maximum efficiency and quality to the surface of the material. This is important to ensure high quality and sustainability.

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