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Effect of the powder composition and cladding conditions on the mechanical properties of covers, based on nickel with WC addition, deposited by direct laser cladding

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Abstract

In the work the structure of the coverings based on the nickel with WC additions obtained by the laser cladding has been studied. The industrial powder for cladding *HOGANAS 1360* was assumed as a basis for the comparison, and the composite powders based on the tungsten carbide ([WC(85%)+Co(9%)+Cr(5%) +Ni(1%)] – series 1 and [65%(WC/Co) +35%(*ЭИ437*)] – series 2) were taken as the additions. The main difference of the mix 2 consisted in the initial components that corresponded to the complicate compounds or solid solutions obtained by the electrochemical reaction. In the work the influence of both the cladding technological conditions and the applying powder composition on the porosity, crack formation and microhardness of the obtained coverings were considered. It is shown process parameters of the laser cladding significantly depend on the heat-transfer properties of the cladding mixture and the optimal technological conditions have to be adjusted not only with changing the chemical composition of the applying powder but even with changing the phase composition of the powder mixture while its overall chemical composition remains nearly unchanged.

The mix 1 being added to the industrial *HOGANAS 1360* powder allowed us to obtain by the laser cladding the covering with advanced mechanical properties. For various amount of the additive the microhardness of the resulted coverings increased 1.5-2 times in comparison with the use of the pure powder *HOGANAS 1360*. The structure of the melted zone is in main consisted of the recrystallized extractions with the complicate composition enriched with chromium and tungsten nucleated in the matrix of the lighter elements. The average microhardness values for coverings of the series 2 are in the range of 550-650 HV that is under the level typical for the pure *HOGANAS 1360* covering. It is due to the covering dilution with the base material caused by the intensive agitation taking place even under the laser power of 600 W. It can be supposed that lower expenditure of energy for cladding the mix 2 arose from the other thermodynamic processes in the powder and the clad due to the initial phase composition that as different from the mix 1.

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