HARD COMPOUNDS AND COMPOSITE MATERIALS ON THEIR BASE

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Research papers devoted to the creation and technology of obtaining of hard compounds, to study of their physico-mechanical and physical-chemical properties were started in the 50s of the XX century in IPM AS USSR under the leadership of Correspond.-Memb. of AS USSR G.V. Samsonov. During relatively short time technology of hard compounds: carbides, borides, nitrides were developed. In parallels, the researches on composite materials development in which hard compounds were used as the components were conducted. Methods of powder metallurgy with the use of the technologies of sintering and hot pressing were developed. In the field of composite strengthened-dispersed metals the technology of preparing of Mo-AlN composition was developed one of the first [1]. The developed technology of hot pressing has given the possibility of obtaining strengthened-dispersed alloy of high density with fine-grained structure, high strength and plasticity. Hot hardness of Mo-4 vol.% AlN alloy is 3 times increased at 1000 °C compared to Mo and the rate of grain growth decreased in 3 order of values (from $1{,}380 \cdot 10^6$ for Mo to $3{,}311 \cdot 10^3$ $\mu m^2/h$ for the alloy with 4 vol. % AlN.

Developed in [2] was the technology of sintering of strengthened-dispersed Cr-AlN alloy and it was determined the optimal content of AlN (8 vol. %) at which the density reaches 98 %. Heat-resistance test at 1000 °C, 6 hours showed that the overweight of the alloy (1 mg/cm^2) in 100 times lesser than the overweight of the Cr samples (100 mg/cm^2). Compression test showed that AlN additives to Cr promoted significant increase of the alloys plasticity. Cr samples at compression destroy as brittle solid and samples with 2 vol.% AlN being compressed are deformed by 59 % without fracture and sample with 8 vol.% AlN are deformed by 63% without fracture. Currently, extensive searching and applied researches of methods of putting and properties of wear-, heat- and corrosion-resistant coatings of composite hard compounds-based alloys are conducted. One of the results of progress of this science trend is the development of electric-spark alloying technology.

Composite alloys based on W_2B_5 and Mo_2B_5 borides with permalloy alloy (iron-nickel) binding were obtained as compact electrodes for spark alloying of steel U8. Alloys W_2B_5, W_2B_5 +4 vol.% of binding, W_2B_5 +14 vol.% of binding, as well as alloy Mo_2B_5, Mo_2B_5 +10 vol.% of binding, Mo_2B_5 +20 % of binding and Mo_2B_5 +25 % of binding were heat resistance-tested at the temperature 1000 °C for 6 hours. Overweight for W_2B_5 was 4,2 mg/cm^2, for alloys with 4 and 14 vol. % of binding overweight decreased to 3,8 and 3,3 mg/cm^2 respectively. Mo_2B_5-based alloys were more heat resistant: overweight for Mo_2B_5 was 2,5 mg/cm^2, for alloys with 20 and 28 vol.% of binding – 1,4 and 0,8 mg/cm^2 respectively. The heat resistance-test results of electric-spark coatings on steel U8 showed the following: overweight of steel U8 – 97 mg/cm^2, overweight of steel electric-coated with W_2B_5-based alloys containing 4, 14, 25 vol %. of permalloy binding showed overweight 65, 22 and 15 mg/cm^2 respectively.

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