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Cast bimetallic composition in the basis of molybdenum-structural steel for tool production

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Nowadays, it is important to increase the economic efficiency of industries, on the development of a new composition of the materials produced, as well as the efficient and cost-effective improvement of technologies for the production of products by casting in order to enhance the performance of economic: in this aspect the purposeful scientific - research work is the very improvement, as well as the carrying out of scientific - research in the direction of the development of composite materials using special cast bimetallic composition ensures product quality; creation and production of new energy and material saving metal layered compositions based on the latest scientific and technological achievements, which economize scarce tool materials and increase productivity.

Cast bimetallic compositions (LBK) are the most important class of composites with wide range and a unique combination of such valuable properties as high strength, corrosion resistance, electrical and thermal conductivity, heat resistance, wear resistance, etc. parts and equipment, but also significantly reduce the consumption high-alloy steels, scarce and expensive non-ferrous metals (nickel, chromium, copper, molybdenum, etc.), reduce energy consumption and specific quantity of metal, maintenance costs, production of spare parts and repair equipment [1-2].

For the manufacture of matrices, molybdenum and its alloys are becoming more common, due to their high heat resistance and long-term strength at 1000 ^{0} C, high thermal conductivity and relatively low coefficient of thermal expansion. The use of molybdenum alloy matrices gave good results when pressing, both ferrous metals and non-ferrous alloys. The use of the alloy as gauge inserts of prefabricated dies for pressing molybdenum alloys to a circle with a diameter of 45 – 95 mm and heat resistant alloys to a circle with a diameter of less than 200 mm on vertical and horizontal presses with a force of 15 to 63 MN provided an increase durability of the pressing tool (dies) in 10-50 times [2]. In the process of the matrix – the insert is in conditions of all-round compression – the punch through the workpiece and the lead-in portion of the matrix acts on the insert and ring. The reaction of the rigid support on the chamfer side balances the pressure on the insert from the bar side. Under conditions of all-round compression, cast carbide-containing materials have the longest service life, and the increased heat resistance of such a material prevents formation of hot cracks, which dramatically increases the durability of the die and the quality of pressing [2].

The entry cone of composite matrix of steel 3Х2В8Ф undergoes uniform abrasive wear with the formation on its surface of sufficiently deep scratches, traces of which, however, are not present on the extruded metal. Compared with steel matrices, the life of this matrix has increased 10 times [2].

Currently, the matrix of this type is successfully operated at a number of metallurgical enterprises in the country. The results suggest that for high-temperature pressing of refractory metals a composite matrix is promising, combining the advantages of inserting eutectic alloys of the Mo-(W)-Ti-C system for the zone of the calibrating point and steel lead-in portion of a given geometry [2].

The disadvantages of the alloy include smelting and casting technology, which characterized and by high labor intensity, complexity and power consumption, and the process of the mechanical processing requires the use of special tools with cutting elements made of superhard materials, which together significantly reduces the efficiency of this alloy. The use of inserts of molybdenum alloys requires the selection of special materials for die bodies. In addition, the introduction of molybdenum alloys is constrained by their high cost. The cost of the tool is not always offset by increasing its durability. Nevertheless, the high performance properties of molybdenum alloys suggest that they are promising materials for hot pressing matrices of non-ferrous and ferrous metals. In order to eliminate the above disadvantages, it is advisable to use cast bimetallic compositions between molybdenum alloys and structural steels for die tools and tooling. This method attracts the rational use of molybdenum alloys, reducing the complexity and duration of the production cycle and, most importantly, allows you to retain all the advantages of forged tool material, combining them with the advantages of casting technology. When using molybdenum alloys for die tools, the question of the rational use of these very expensive and scarce materials always confronts designers and technologists. One of the ways to solve this problem is the development of scientific and technological foundations for creating effective LBK and high-strength products from them by casting on gasified models , which together open wide opportunities for reducing consumption of scarce materials and for realizing potential resources of a combination of materials in the composition.

Obtaining a metallic layered LBK composition of type casting structural steel – a working insert is possible if the physicomechanical characteristics of materials are comparable. Compositions of this type are a compound between molybdenum foundry structural steels. The main advantage of this class of compound is a reduction in the consumption of molybdenum alloys due to partial replacement of them with more accessible structural steels, and a reduction in the labor intensity of manufacturing die and multi –blade cutting tool complex profile.

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