THE EFFECT OF NICKEL ALLOYING ON PHASE FORMATION IN CERMETS BASED ON THE Mo-Fe-B-C SYSTEM

T.N. VERSHININA[1], *M.B. IVANOV*[2]

[1] *Joint Institute for Nuclear Research, Dubna, Russian Federation*
[2]*S7 R&D Center, Moscow, Russian Federation*

The development of technologies in the field of cutting processing is directly dependent on the development of new tool materials with higher physical and mechanical properties. Cermets based on Mo-Fe-B and Mo-Ni-B systems are one of the promising and not yet widely used materials. The solid phases in them are the borides Mo_2FeB_2 and Mo_2NiB_2, and the metal matrix acts as a binder. These materials, according to a few published data [1-3], have an excellent combination of mechanical properties, wear resistance and corrosion resistance. And since the composition of these cermets does not include expensive tungsten, their development also has economic feasibility.

The purpose of this investigation is to determine the effect of Ni addition on the microstructure, phase composition and mechanical properties of Mo_2FeB_2-Fe hard alloys doped with carbon.

As can be seen from Fig. 1, the alloying of cermets of the Mo-Fe-B-C system with nickel leads to significant changes in their phase composition. The tetragonal boride Mo_2FeB_2 acts as a solid phase in a material containing 10 wt. % Ni. Also, due to the presence of carbon, M_6C type carbide is precipitated with an estimated composition of $(Ni,Si)_3Mo_3C$. The latter is formed due to the presence of silicon, which is included in the initial powder components as an impurity. The amount of the binder phase is very small and therefor a high hardness and low fracture toughness of the sintered material are observed. An increase of nickel concentration to 15 wt.% result in the precipitation of κ-phase $Mo_{10}Ni_3C_3B$ in the cermet. Its formation leads to a significant decrease in the volume fraction of M_6C carbide and increase of the amount of binder phase on the base of FCC-(Fe, Ni). When 20 wt.% Ni is added to the composition the formation of the orthorhombic boride Mo_2NiB_2 and the complete replacement of the carbide by the κ-phase are detected.

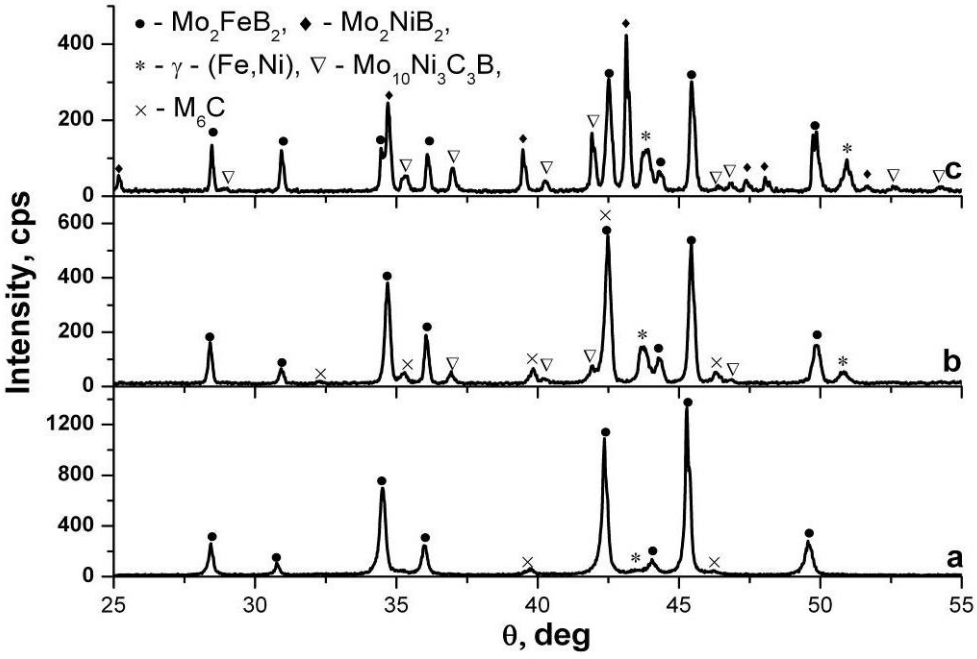

Fig.1. XRD patterns of cermets: a – 10 wt.% Ni, b – 15 wt.% Ni, c – 20 wt.% Ni.

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