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Study of Morphology and Dimensions of Ultra- Dispersed Powders of Tungsten

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ABSTRACT: The article discusses the results of scientific research on the morphology and dimension of ultrafine tungsten powders by the crystal-optical method of sprinkling obtained by the plasma-chemical method using a ПУВ–300 hydrogen-plasma reduction unit.

KEYWORD: morphology, dimension, ultrafine powder, tungsten, tungsten powder, crystal-optical method, powdering, composition, structure.

INTRODUCTION

The development of the metallurgical industry is inextricably linked with the solution of urgent scientific and technical problems of great importance. These include the creation of structural materials with enhanced performance characteristics. The results of studies conducted in many countries indicate the real possibility of using highly dispersed powders of refractory metals for the manufacture of carbide tools, tool and other materials with enhanced performance characteristics. However, more detailed studies on the introduction and modeling of the composition of hard alloys to improve the mechanical properties have shown that carbide tools using highly dispersed powders of refractory metals, in particular composites, have not yet been adequately studied. In this regard, the study of the morphology and dimension of ultrafine tungsten powders obtained by plasma-chemical technology is of particular importance [1]. The object of the studyis the technological processof producing ultrafine powders (UFP) of tungsten at the PUV-300 hydrogen-plasma reduction unit andthe manufacture of hard alloys from them - BK6, BK8, BK15 grades (GOST 3882–74) and carbide inserts with service fully important characteristics [6].The research method is the crystal-optical method of scattering. The obtained scientific results and their analysis. The macroscopic characteristics of the samples of UFP tungsten are investigated. Grain UFP tungsten has a chipping character. They have an angular appearance, are generally isometric. However, there are also grain elongated in one direction. The length of such grains does not exceed a width of more than 2–3 times. The sizes of most grains are in the range of 3-5 microns, distributed unevenly in different parts of the scattering. But such grainsdo not occupy large volumes. The shape of the grains is not correct, along with rounded and oblong, there are also hypidiomorphic ones with 2-3 flat and even faces. Many of these grains have a tetragonal (square) shape. Because of the distortion of suchforms, sometimes in larger grains, their rhomboid sections arise. The type of scattering under reflected light reveals their heterogeneous density. Along with weakly reflecting light gray and dark gray, almost black areas, some parts of the grains intensely reflect light, which makes them appear white. Such reflective surfaces of part of the grains or the whole grain appear in polarized reflective light, which indicates the heterogeneity of the color. In transmitted light, all grains appear black [2].In the first screening of 1 WC powder, as can be seen from Figs. 1 and 2, coarser fractions of the powder appeared in a glass slide. In the second scattering (Fig. 4), the transmitted light is not polarized. The change in tonality of the color of grains here is associated with their thickness: thicker ones appear black, and less thick ones appear light gray.

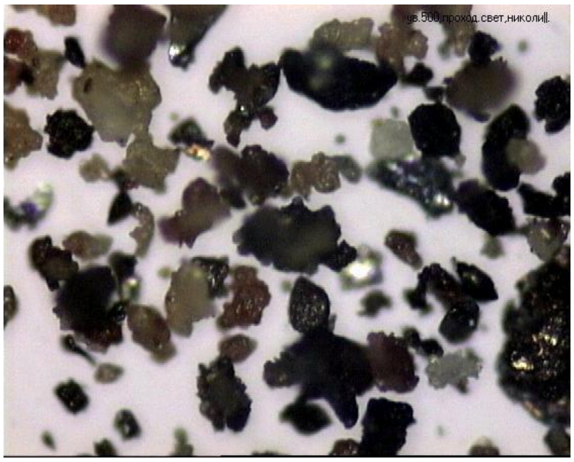

Fig. 1. View of the second powder distribution of 1 WC under a x2500 microscope

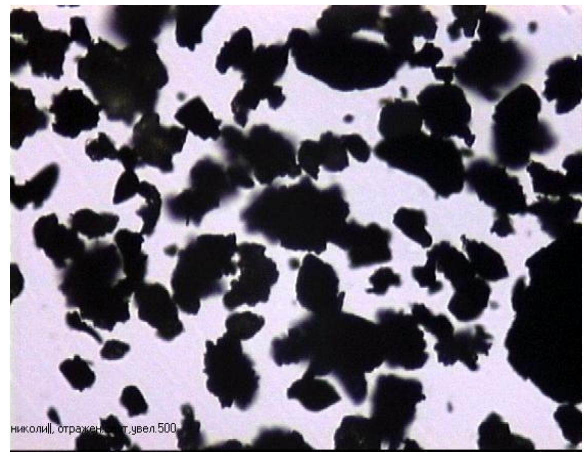

Fig. 2. Powder powder 1 WC in reflectedplain light x2500

Digital history aids all types oas well as other samples of powders, was characterized macroscopically. Here are the macroscopic features of 2WC powder grains. Unlike the other powders presented, this powder turned out to be finer granular, with a pronounced xenomorphism of fragments (shapelessness). However, sometimes among the powder there are individual ideally faceted shapes in the form of a cubic crystal whose dimensions do not exceed 0.001 mm. In transmitted light, along with completely isotropic grains, anisotropic and partially anisotropic particles are found. Most anisotropic particles have nanometric dimensions. It is impossible to determine whether they are an independent phase or represent fragments of larger clastic grains, because in X-ray spectral analysis, it is impossible to induce probe electrons on them due to the small grain size [4]. Such particles, due to the high surface energy, form cloud dimming between larger grains around large grains, sometimes also forming small clumps without a definite shape. In fact, such dusty nanoparticles have different degrees of compaction confined to the surface of large grain particles, often square sections, which often break in small differences, forming more or less developed rounded outlines. Small grains tend to coagulate, forming chains and islets-heaps, consisting of various amounts in the range of 2-10 pcs.

In reflected light, they often stand out in the form of white spots. Moreover, the reflecting surfaces of isometric, quasi-square grains are sharper than the

triangular and rounded surfaces of the faces of large grains.

A gradual decrease in the degree of reflection around large crystals is associated with partial reflection of light and nanoparticles surrounding or adhering to the surface of large grains. A gradual decrease in the intensity of white light around such grains indicates a different degree of compaction, decreasing from grain to the surrounding space.

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Based on the research work on the morphology and dimension of ultrafine tungsten powders by the crystal-optical method of sprinkling obtained by the plasma-chemical method on the installation of hydrogen-plasma reduction PUV-300, the following conclusions are presented.

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