THE INFLUENCE OF RATE COOLING ON STRUCTURE AND PROPERTIES WC-W_2C

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Among the materials based on refractory compounds, the high wear resistance of the alloys have WC-W_2C (called relit). As a radical increase in the strength values of ceramic materials is achieved by reinforcing ceramic matrix ceramic fibers, the paper studied the formation of the microstructure of the alloy reinforced WC-W_2C.

Therefore, the aim is to develop a reinforced composite materials with high strength and hardness multifunctional purpose by controlling processes of structure formation in directional solidification of eutectic alloys of the WC-W_2C.

Due to the fact that relit used as a powder for hardening surfaces of the parts working under high dynamic loads, processes have been studied for the formation of structures obtaining powder by centrifugal spraying, thus increasing the cooling rate to 10^5 deg / s.

To study the kinetics of the process was carried out in the smelting furnace Tamman (cooling rate of 10^2 deg / s) and the method of electron beam melting compacts (cooling rate of 10^3 deg / s).

The matrix of tungsten semicarbide W_2C, riddled with elongated grains WC. At lower speeds the cooling WC grains mainly take the form of elongated plates, and rods interconnected.

The increasing cooling rate of the plate change their morphology to dendritic branches of order 1 and 2. In conditions of maximum crystallization rate of cooling is formed by a cellular structure , where there is only one order of dendrites. This process of formation of the structure indicates that, as the crystallization rate primarily changes the concentration of supercooling in a melt , which leads to a deviation from the equilibrium composition of the melt on a state diagram.

The excess of carbon formed eutectic alloy before the solidification front, which leads to the dendritic growth of tungsten monocarbide and cellular changes by temperature gradient with an increase in the melt.

By X-ray analysis showed that crystallized at cooling rates of all alloys consist mainly of monocarbide of tungsten and semicarbide of tungsten.

The content of the phase is not dependent on the rate of crystallization of the alloy. Availability phase WC_{1-x} alloys indicates partial loss of carbon during crystallization.

The X-ray diffraction analysis revealed that the size of coherent scattering for W_2C, and for WC and WC_{1-x} with increasing the cooling rate is reduced by 1.5-2 times, that is going on microstructure refinement .

The stress level of the phase components W_2C and WC alloy was determined by the tilt and shift of the interference lines. Found that by increasing the cooling rate as the stress of the matrix and the inclusions grow in 2-2.5. Phase WC alloys is stretched , and the phase W_2C - in a compressed state .

The integral averaged values of microhardness alloys obtained at different cooling rates. The highest microhardness (28 GPa) was observed at a cooling rate 10^5 deg / n. Durability alloys obtained at a cooling rate 10^5 deg / s, is 30-40% higher than at lower cooling rates (where wear is more intense), as increased by 30 % and a hardness of 2-4 times the strength.