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STUDYING POSSIBILITY TO DETECT RECRYSTALLIZED STRUCTURE OF TUNGSTEN WIRE

Tungsten has great advantages and potential among refractory and heavy metals in the modern industrial production. It is used in the military and nuclear industries, electrical engineering, welding, aerospace field. Dispersion-reinforcedthoriated tungsten (W-Th) alloyscan be widely applied to many parts production. Due to the high density and most melting point among metals, tungsten has strength at high temperatures.

In this work we have investigated heating influence on the short-term strength of two alloy grades tungsten wire, the chemical composition of which is given in the table 1.

Table – Chemical composition of W alloys

Alloy grade	Mass fraction of elements, %							
	ThO_2	Re	SiO_2	CaO	Mo	Ni	Fe_2O_3	Al_2O_3
BT15	1,85	-	0,003	0,002	0,005	0,001	0,0011	0,0015
BP10T2	1,85	9,9	0,002	0,001	0,003	0,0013	0,0014	0,0017

Samples made by powder metallurgy are used for the study. Short-term strength tests are conducted on a tensile testing machine FM-250 equipped with temperature controlled oven according to the standard method.

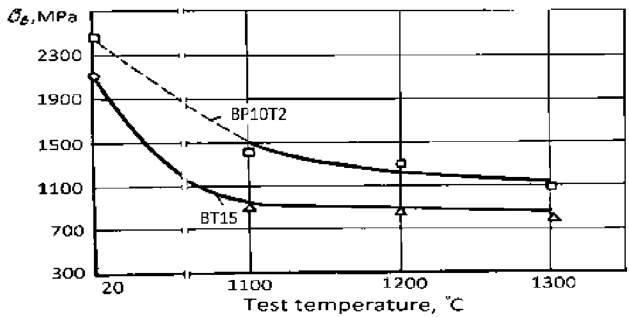

Figure – Relations of short-termstrength of W-alloys wire on temperature

The results of testing are showed in figure 1. High strength of these alloys at 20°C is mainly due to the degree of deformation. Higher level of alloy BP10T2 strength is associated with solid solution hardening achieved by alloying with rhenium. High temperature strength of BP10T2 alloy wire is also higher than BT15 alloy wire, but with increasing temperature BP10T2 alloy gets more intense softening.

In addition to strength, the W-alloys wire must also have some ductility. Tungsten and tungsten alloys in recrystallized stateare known to be brittle at room temperature because they have high ductile-to-brittle transition temperature (DBTT). DBTT of recrystallizedtungsten is above 300°C.The ductility of tungsten improvementcan have significant impact on both the manufacturing and the range of applications of tungsten. Although there has been a significant volume of reported research on improving the ductility of tungsten over the span of several decades, it remains a difficult challenge. For example, alloying with rhenium up to 27%, but rhenium is scarce and expensive, and also maintaining a certain degree of work hardening are ways of achieving increasedductility of tungsten.

However W-alloys production technologies have been developed, when working with finished wire, brittle sections appear in it. This makes it difficult to carry out technological operations and significantly reducesin yield. The presence of brittle sections is possibly related to the irregular distribution of hardening particles(ThO_2) and recrystallized structureappearance. The amount of impurities, alloying elements,hardening particles and their morphology,structural state, degree and temperature of deformation are factors caused by the process of tungsten recrystallization.

Consequently detecting brittle wire sectionsbefore using it in production is appropriate.Thereforeitisplannedtoanalyzenondestructive methods for determining recrystallized structure in subsequent works.