CONCEPT ALLOYS

Technical Data Sheet

11234 Lemen Road, Whitmore Lake, MI 48189
Phone: 734-449-9680 FAX: 734-449-9683
Website: www.conceptalloys.com

Tungsten Rhenium Alloys

Tungsten-rhenium alloy combinations can be used over a wide temperature range that extends from –320°F to over 5200°F. Standard temperature tables (ASTM E230) are available from 32°F to 4200°F. These alloy combinations are susceptible to rapid oxidation at high temperatures and are not recommended for use in oxidizing environments. They are very stable at high temperatures in reducing or inert atmospheres such as hydrogen, inert gases and vacuum. The cost of these materials is relatively low compared to noble metals. Of the three common combinations of these alloys (pure W vs. W26Re, W3Re vs. W25Re and W5Re vs. W26Re) the W5/W26RE combination has received the widest acceptance by industry. Unless otherwise stated, all materials produced by Concept Alloys conform to ASTM E696 and ASTM E988.

The pure W vs. W26Re thermocouple was the earliest combination developed in this system. It suffers, however, from the brittle behavior of the pure tungsten positive leg. For this reason, the positive leg is generally shipped in the as-drawn condition. This results in an emf shift when the thermocouple is exposed to elevated temperatures (generally in excess of 2000°F.) in use. The primary advantage in using this combination is the higher Seebeck coefficient obtained at temperatures in excess of about 900°F. Modern instrumentation minimizes the importance of this advantage.

Both the W5Re and W26Re thermoelements retain good room temperature ductility (in comparison to unalloyed tungsten) after heating to over 3000°F and are shipped in a stabilized condition. So long as use is restricted to 3000°F or lower this ductility is retained and handling problems are minimized.

W5Re/W26Re thermocouples may be used bare, with hard fired ceramic insulators or in mineral insulated, metal sheathed (MIMS) cable. At low temperatures common alumina or magnesia insulation is generally satisfactory. Their use is limited by the melting point of alumina (3650°F) and the low electrical resistivity of magnesia above 3600°F.

At temperatures over 3000°F insulators of beryllia, hafnia or thoria may be used. The most widely used is beryllia due to its higher electrical resistivity. Before selecting any insulator a thorough investigation should be conducted relative to material properties, chemical compatibility and ***necessary safety precautions***. In MIMS constructions the selected sheath should be compatible with the insulators, wires and atmosphere. Materials that have been used successfully include tantalum, tungsten and some tungsten alloys, columbium, molybdenum and various ceramics.

Mechanical Properties and Physical Properties

	Tungsten	W3Re	W5Re	W25/26 Re
Tensile Strength, ann. (x 10^3 psi)				
68°F	80	172	220	200
1832°F	35	60	65	95
3632°F	15	10	26	24
Elongation (% in 10”)				
68°F	0	15	20	11
1832°F	10	18	24	19
3632°F	23	23	24	27
Resistivity (Ω • circ. mil / ft.)				
68°F	33	57	70	170
1832°F	199	228	235	331
3632°F	398	420	434	524
Therm. Exp. Coef. (in./in./°F)				
68°F	1.7×10^{-6}			2.9×10^{-6}
1832°F	2.3×10^{-6}			3.1×10^{-6}
3632°F	3.1×10^{-6}			3.9×10^{-6}
Density				
g./cm^3	19.3	19.4	19.4	19.7
lb./in^3	0.697	0.700	0.701	0.714
Melting Point				
°C	3410	3325	3350	3120
°F	6170	6017	6062	5648