Ideal for Vacuum Furnaces

Molybdenum Technical Data

Molybdenum possesses a very high melting point, a low co-efficient of thermal expansion and a high level of thermal conductivity. In high temperature furnaces, it holds up well and maintains its form.

REQUIRED ATMOSPHERE

Moly reacts rapidly with oxygen, beginning at 250°C. Oxides of Molybdenum vaporize at relatively low temperatures, leaving the material unprotected. The result of heating Moly in air is rapid loss of surface material. Fluffy white or yellowish "parachutes" of re-condensed oxides usually appear in the surrounding cooler areas.

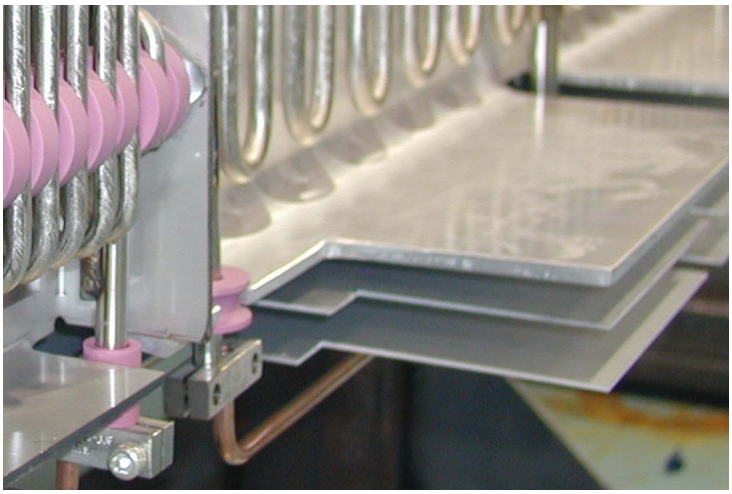
Therefore, it cannot be used in air. Good element life for Molybdenum (Moly) elements requires that they be used in vacuum, or atmospheres containing less than 10 ppm of oxygen, water, CO, CO_2, methane, or other gas sources of Oxygen or Carbon. Element designs using thicker sections can last much longer than thin sections, especially if these are present. Also note that methane can be formed from carbon or graphite items in Hydrogen atmospheres if traces of water or Oxygen are present.

REACTION WITH VARIOUS SUBSTANCES

Moly reacts with Carbon gases at temperatures of 1200°C. or higher. Molybdenum carbides form, starting on the outer surface. The result is apparent thickening of the element cross section as Molybdenum carbide grows on the surface. This surface material is a poor conductor of electricity and heat—often leading to early failure. Such carbide affected elements show increased electrical resistance as the remaining unaffected core material gets thinner.

Moly reacts with many solid substances at higher temperatures. Design and maintenance of equipment should keep hot Moly elements well clear of contact with ordinary furnace parts, dirt, dust, or any other substances.

Moly itself is the best element hangar material. Ceramics of high density and purity that are known to be compatible with Moly are also acceptable for supports. See the Reaction Temperatures Chart below for more information.



HANDLE WITH CARE

Molybdenum is frequently brittle at low temperatures. Thicker sections, and any pieces that have been formed or joined may sometimes break easily at room temperatures. Elements, hangars, terminals, and connectors that have once been heated may be very brittle at room temperatures. Always handle Moly heating elements and parts very carefully; think of them as glass. Generally, used elements are difficult to re-install, bend, straighten, weld, etc.

TEMPERATURE RESISTIVITY

Molybdenum has a very large increase of resistance between room temperature and operating temperatures—about 5 to 1. An electrical system designed for proper operation of Moly elements at high temperature might be overloaded at room temperature. See Resistivity of Molybdenum at Various Temperatures graph below. It is therefore necessary to carefully design and specify the power control system to handle the high startup current. Also, when heating up from room temperature, always begin heating slowly, especially with new, potentially brittle Moly elements.

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Pure Molybdenum with Various Substances

Reaction Temperatures

GASES

SUBSTANCE	TEMPERATURE	REACTION
Air or 0_2	250°C	Slight Oxidation Beginning
Air or 0_2	600°C	Rapid Oxidation
Br	800°C	Reacts
Cl	300°C	Reacts
CO_2	1200°C	Oxidation Begins
CO	1400°C	No Reaction
F	20°C	Reacts
H_2	> 2600°C	No Reaction
H_2S	1200°C	MoS Forms
Hydrocarbons	1100°C	Carbide Formation Begins
Hydrocarbons	> 1300°C	Rapid Carburization
I	500°C	No Reaction
N_2	1500°C	Nitrides Begin to Form
NOx	700°C	Oxidation
NH_3	> 2500°C	No Reaction
$S0_2$	700°C	Oxidation
Steam	700°C	Rapid Oxidation

OTHER ELEMENTS

C	1100°C	Carbide Formation Begins
C	> 1300°C	Rapid Carburization
Hg	20°C	No Significant Solubility
P		No Reaction (even at higher temperatures)
S	440°C	Sulfides Begin to Form
Si		Silicides Form at higher temperatures

MOLTEN OXIDIZING SALTS

KCl_3, K_2CO, KNO_2, KNO_3		Violent Reaction at molten salt temperature
Na_2CO_3, NaO_2, PbO_2		Violent Reaction at molten salt temperaturev

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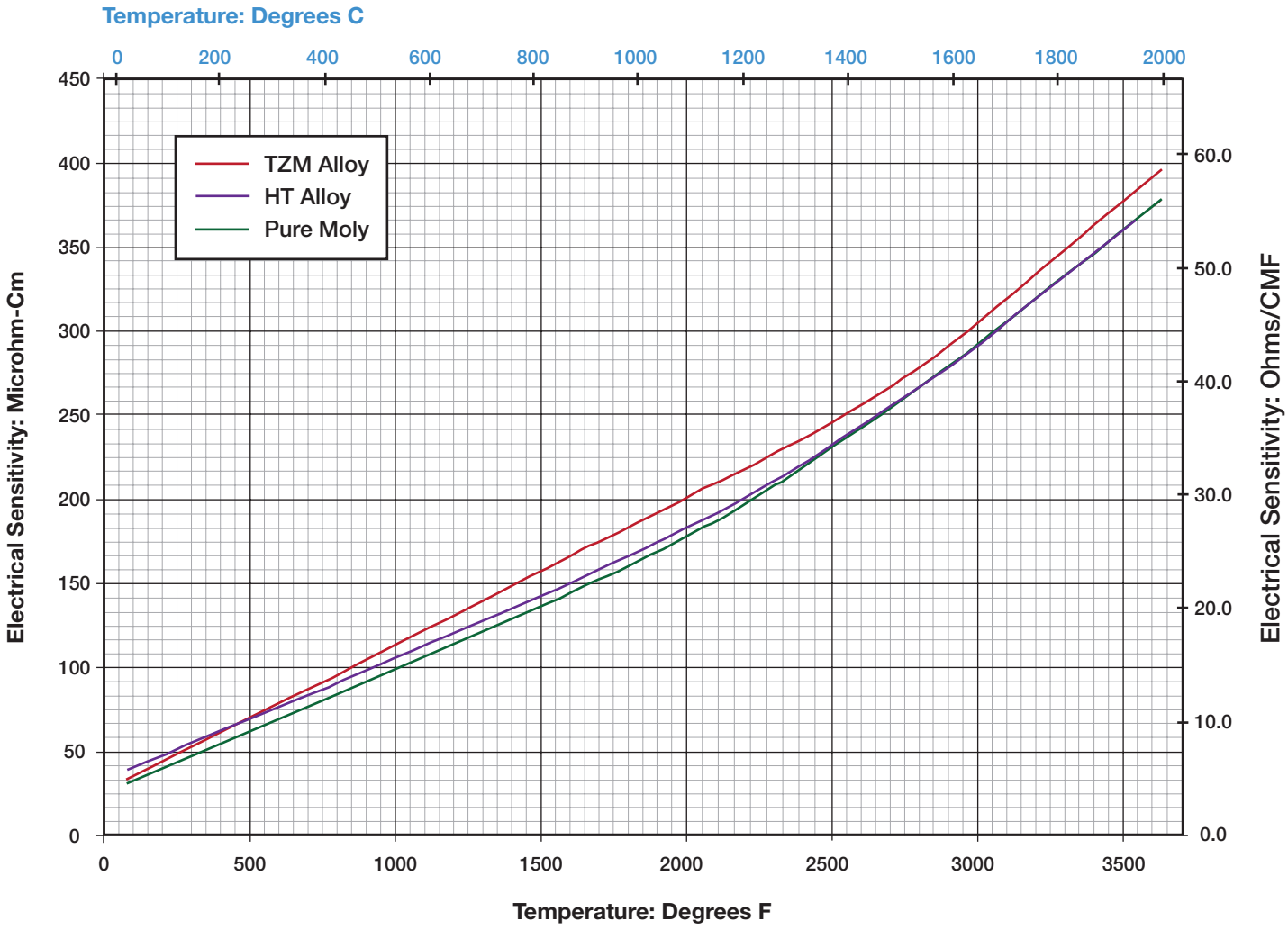
Resistivity

Molybdenum and Alloys



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