# CATALOG OF MOLYBDENUM PRODUCTS

Molybdenum Products

Date of Preparation: 08/18/2011

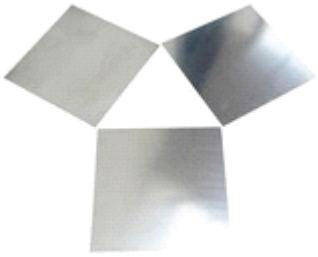
Reason for Issue: Updated Format

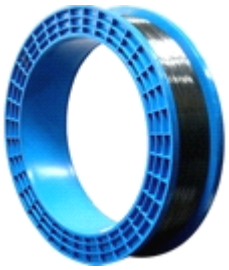
Chemical Name: Tungsten Carbide

Chemical Family: Refractory Metal (non-ferrous metal)

*Chemical Formula:* WC

E-Biz Center of China Tungsten Industry Association






# PRODUCTS CONTENTS

# 1. MOLYBDENUM MATERIAL

| | |
|---|---|
| Symbol: | Mo |
| Atomic Number: | 42 |
| Atomic Weight: | 95.94 |
| Density: | 10.22 gm/cc |
| Melting Point: | 2617 °C (2890.15 K, 4742.6 °F) |
| Boiling Point: | 4612.0 °C (4885.15 K, 8333.6 °F) |
| Thermal Conductivity: | 138 W/m K at 20°C |
| Coefficient of Thermal Expansion: | 4.8 x $10^{-6}$ / K at 25 °C |

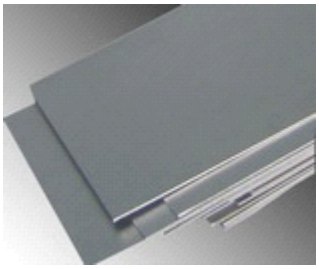
## Grade of molybdenum material

| Grade | | Mo-1 | Mo-2 | Mo-3 |
|---|---|---|---|---|
| Mo (%) ≥ | | 99.95 | 99.95 | 99.92 |
| Other Element Cont (%) ≤ | Pb | | | 0.001 |
| | Bi | | | 0.001 |
| | Sn | | | 0.001 |
| | Sd | | | 0.001 |
| | Cd | | | 0.001 |
| | Fe | 0.005 | 0.006 | 0.030 |
| | Ni | 0.002 | 0.001 | 0.005 |
| | Al | 0.002 | 0.002 | 0.005 |
| | Si | 0.003 | 0.001 | 0.010 |
| | Ca | 0.002 | 0.002 | 0.004 |
| | Mg | 0.001 | 0.001 | 0.003 |
| | P | 0.001 | 0.001 | 0.002 |
| | C | 0.005 | 0.003 | 0.010 |
| | O | 0.003 | 0.005 | 0.008 |
| | N | 0.001 | 0.001 | |
| Use for example | | Drawing Molybdenum wire | Spraying Molybdenum wires | High Temperature Components |

# 2. MOLYBDENUM PLATES / SHEET / FOIL

## Production process

Materials → hot rolling → annealing → cold rolling → leveling → annealing → machining → Molybdenum plates



Material from .005 inches to .090 inches in thickness is classified as molybdenum sheet. It is used for fabrication of sintering boats, high temperature furnace heating elements and heat shields. Standard availability is described below. Other sizes and tolerances are available.

## The specification of molybdenum sheet

| Thickness | Max. Width |
|---|---|
| .005" to .015" | 24" |
| > .015" to .040" | 24" |
| > .040" to .090" | 24" |
| Length is dependant on surface condition required and width. | |

## Molybdenum sheet standard thickness tolerance

| Thickness | .25″ to 6″ | 6″ to 12″ | 12″ to 24″ |
|---|---|---|---|
| .005" - .009" | ± .0005" | ± .0005" | ± .002" |
| .009" - .015" | ± .0008" | ± .0009" | ± 10% |
| .015" - .020" | ± .0010" | ± .0010" | ± 10% |
| .020" - .040" | ± .0015" | ± .0015" | ± 10% |
| .040" - .050" | ± .003" | ± .003" | ± 10% |
| .050" - .065" | ± .004" | ± .004" | ± .004" |
| .065" - .090" | ± .005" | ± .005" | ± .005" |

## Molybdenum sheet standard width tolerance

| Thickness | .25″ to 6″ | 6″ to 12″ | 12″ to 24″ |
|---|---|---|---|
| .005" - .009" | ± .012" | ± .015" | ± .025" |
| .009" - .015" | ± .012" | ± .015" | ± .025" |
| .015" - .020" | ± .012" | ± .020" | ± .025" |
| .020" - .040" | ± .020" | ± .030" | ± .030" |
| .040" - .050" | ± .020" | ± .030" | ± .030" |
| .050" - .065" | ± .020" | ± .030" | ± .030" |
| .065" - .090" | ± .030" | ± .031" | ± .031" |

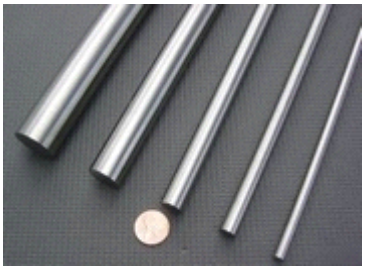
## 3. MOLYBDENUM ROUND ROD / BAR

**Molybdenum round rod / bar**

1. 1, Diameter: 1.0-100.0mm
2. Length: 50-2000mm
3. Density: 10.15g/cm3
4. Surface: Sintering surface, Forged surface, Ground surface

**Production process**

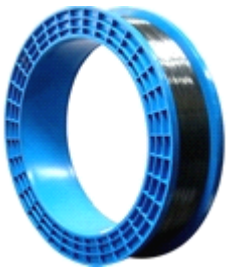
Materials → CIP → IF induction sintering → forging → annealing → mechanical processing → Molybdenum rod



Molybdenum rod divided forging molybdenum rod and polished molybdenum rod; forging molybdenum rod surface is allowed to have oxidize film and slight forging hammer mark; polished molybdenum rod surface presents metallic luster and has no oxidized phenomenon notably; the two surfaces have no defects, such as divided layer, crackle, burr and vertical crackle, etc.

We produce pure and lanthanide doped molybdenum rod. The lanthanide doped molybdenum rods are targeted for use in higher temperature applications where ductility is retained after recrystallization for material with smaller cross sections.

## 4. MOLYBDENUM WIRE



**Molybdenum wire / heater**

1. Grade: Mo-1, Mo-2, Mo-3
2. Density: not less than 10.17g/cm3
3. Appearance: black surface

**Specifications of molybdenum wire**

| mm | diameter | length | Diameter tolerance | surface | State |
|---|---|---|---|---|---|
| rod | 8.0~16.0 | 10~850 | 10~660 | Black | forged |
| | 3.0~8.0 | 10~5000 | 10~800 | Black | forged |
| wire | 1.5~3.0 | 10~8000 | 10~1600 | Black | drawing |
| | 0.5~1.5 | 10~8000 | 10~2650 | Black | drawing |

**Molybdenum wire recommends applications**

| Grade | Description | Recommend Application |
|---|---|---|
| MO1 | Pure molybdenum wires | Used in making heat parts for electronic vacuum device, heating parts, hooks of various type of bulb, mandrels of tungsten coiled coil wire, etc. |
| | | Used for wire cutting |
| MO2 | Pure molybdenum rods | Used in making electronic vacuum devices, electrode for the gas discharge tube and lamp, support and lead for electron tubes. |
| MO3 | Molybdenum mixed with other elements | High - temperature structure material (printer needle, nut, screw) halogen lamp support, heating filaments, the axis in radial tube. |

## 5. MOLYBDENUM TARGETS / SPUTTERING TARGETS

**Molybdenum targets / Sputtering Targets**

1. Appearance: Silver white metal luster
2. Purity: Mo≥99.92%
3. Density: not less than 10.17g/cm3
4. Supply state: Surface polishing, CNC machine processing

**Production process**

Materials → CIP → IF induction sintering → hot rolling → annealing → cold rolling → annealing → cutting → machining → molybdenum targets

**Application of molybdenum targets**

Molybdenum target is mainly used in plasma sputtering industry. With the electric field, electron collided with the argon atom when fly to the substrate, and then argon atoms and electrics were ionized .the electrics fly to the substrate while argon atoms accelerate to bomb the target, the neutral atoms (or molecules) in the target deposit on the substrate and become the coating.

Since the molybdenum resistant to high temperature and corrosion, molybdenum targets are widely used in petroleum chemical industry, aviation, machine manufacturing, and electronics semiconductor industries and so on.

## 6. MOLYBDENUM CRUCIBLE

**Molybdenum crucible**

1. Purity: W≥99.95%
2. Appearance: silver grey metal luster
3. Supply state: sintering or processing
4. Quality standard: according to customer

### Production process

Raw materials (MOLYBDENUM powder) → isostatic pressing → mechanical processing → IF induction sintering → mechanical processing → detection checks → MOLYBDENUM crucibles

### Application of molybdenum crucible

Since the melting point of molybdenum has reached 2617°c, molybdenum crucible is widely applied in industry furnace such as sapphire growth furnace, quartz glass melting furnace, and rare earth smelting furnace. the temperature in working environment of molybdenum crucible is above 2000 ℃ . for sapphire crystal growth furnace, high-purity, high- density, no internal-crack molybdenum crucible with other features of exact measurement and smooth surface has decisive influence on success ratio of seed growth, quality control of pulling crystal, metamictization pot-committed and service life during sapphire growth process, and we are willing to be checked by professional units.

### Specifications of molybdenum crucible

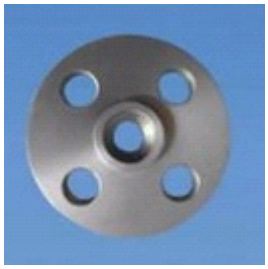
| diameter(mm) | thickness(mm) | Height(mm) | Surface finish | inner surface finish | Inner bottom finish |
|---|---|---|---|---|---|
| 30 ~ 50 | 2 ~ 10 | ≤500 | ≤Ra2.0 | ≤Ra2.4 | ≤Ra2.8 |
| 50 ~ 100 | 3 ~ 15 | ≤1000 | ≤Ra2.0 | ≤Ra2.4 | ≤Ra2.8 |
| 100 ~ 150 | 3 ~ 15 | ≤1000 | ≤Ra2.0 | ≤Ra2.4 | ≤Ra2.8 |
| 150 ~ 200 | 5 ~ 20 | ≤1000 | ≤Ra2.0 | ≤Ra2.4 | ≤Ra2.8 |
| 200 ~ 300 | 8 ~ 20 | ≤1000 | ≤Ra2.0 | ≤Ra2.4 | ≤Ra2.8 |
| 300 ~ 400 | 8 ~ 30 | ≤1000 | ≤Ra2.0 | ≤Ra2.4 | ≤Ra2.8 |
| 400 ~ 450 | 8 ~ 30 | ≤1000 | ≤Ra2.0 | ≤Ra2.4 | ≤Ra2.8 |
| 450 ~ 600 | 8 ~ 30 | ≤1000 | ≤Ra2.0 | ≤Ra2.4 | ≤Ra2.8 |

# 7. MOLYBDENUM PARTS

## Molybdenum fabricated parts

Most of our molybdenum fabricated parts and molybdenum fabricated parts are used as ion implantation parts for semiconductor industry and as sputtering targets for the solar industry. We also produce parts for x-ray and electron tubes which be made of molybdenum and molybdenum. Molybdenum crucibles and molybdenum crucibles for quartz melting and high temperature vacuum furnace are also our main products.

## Furnace components



High temperature industrial furnaces frequently require molybdenum components for their successful operation. Molybdenum rod or flat sheet heating elements are used in vacuum and hydrogen furnaces. Molybdenum metal is also used for heat shielding and other furnace components and structures.

## Electronic/Semiconductor equipment components

Silicon wafer processing relies on the use of ion implantation systems which inject ions at high energy directly into silicon wafer surfaces. The ion plasma source is energized via molybdenum electrodes which operates within fabricated molybdenum or molybdenum arc chambers.