

CATALOG OF PURE TUNGSTEN PRODUCTS

Tungsten Products

Revision No.2

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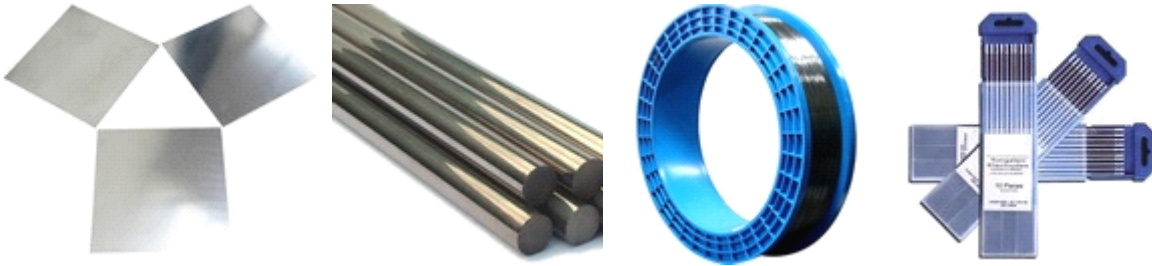
Reason For Issue: Updated Format

Chemical Name: Tungsten metal

Chemical Family: Refractory Metal (non-ferrous metal)

Chemical Formula: W

Manufacturer: Bango Alloy Technologies Co.,Ltd.



COMPANY INFORMATION

Name: Bango Alloy Technologies Co., Ltd.

704 Tianhu Building, No.150,Binglangxili, Siming District, Xiamen, China 361000

Tel: 0086-592-5977282

Fax: 0086-592-3992527

Email: maya@chtungsten.com

Website: <http://www.tungstenalloy.net>

PRODUCTS CONTENTS

1. TUNGSTEN MATERIAL.....	3
2. TUNGSTEN PLATES / SHEET / FOIL.....	4
3. TUNGSTEN ROUND ROD / BAR.....	5
4. TUNGSTEN TUBE / PIPE.....	5
5. TUNGSTEN WIRE / HEATER.....	6
6. TUNGSTEN TARGETS / SPUTTERING TARGETS.....	7
7. TUNGSTEN CRUCIBLE.....	8
8. TUNGSTEN ELECTRODE.....	9
9. TUNGSTEN PARTS.....	12
COMPANY INFORMATION.....	12

1. TUNGSTEN MATERIAL

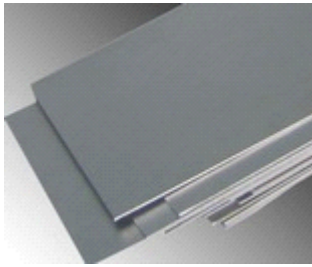
Symbol:	W
Atomic Number:	74
Atomic Weight:	183.85
Density:	19.3 gm/cc
Melting Point:	3410 °C
Boiling Point:	5900 °C
Thermal Conductivity:	1.73 W/cm/K @ 298.2 K
Electrical Resistivity:	5.65 microhm-cm @ 27 °C
Electronegativity:	1.7 Pauling
Specific Heat:	0.0317 Cal/g/K @ 25 °C
Heat of Vaporization:	185 K-Cal/gm atom @ 5660 °C
Heat of Fusion:	8.42 Cal/gm mole

The impurity content accords with GB3459-82

Grade	W-1	W-2	W-3	W-4
Pb	--	--	--	0.001
Bi	--	--	--	0.001
Sn	--	--	--	0.001
Sb	--	--	--	0.001
As	--	--	--	0.002
Fe	0.005	0.005	0.010	0.05
Ni	0.003	0.003	0.005	0.30
Al	0.002	0.002	0.005	0.005
Si	0.003	0.003	0.010	0.010
Ca	0.003	0.003	0.005	0.005
Mg	0.002	0.002	0.005	0.010
Mo	0.010	0.010	0.20	0.20
P	0.001	0.001	0.002	0.005
C	0.005	0.008	0.010	0.010
O	0.003	0.003	0.005	0.010
N	0.003	0.003	--	--

The impurity Content is not more than %

2. TUNGSTEN PLATES / SHEET / FOIL



Tungsten plates / sheet / foil

1. Grade: W1, W2, W3, W4
2. Width*Length: (2.0-500.0mm)*(2.0-500.0mm)
3. Thickness: 0.2mm-15.0mm
4. Surface: Sintering surface, Forged surface, Ground surface

Production process

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

Application of Tungsten plates

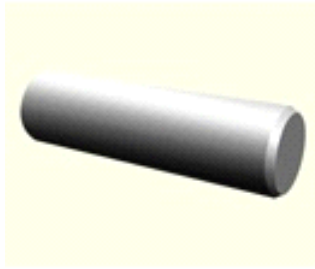
Since the melting point of tungsten has reached 3380 °C , tungsten sheet is widely used in reflection shield, cover plate applied in the sapphire growth furnace, reflection shield, heating tape, connecting pieces applied in vacuum furnace, sputtering target applied in plasma coating film, and high temperature resistance boat.

Specification of tungsten sheet

Thickness	Thickness tolerance		Width tolerance	Length tolerance
	Grade I	Grade II		
0.10-0.20	±0.02	±0.03	±3	±3
>0.20-0.30	±0.03	±0.04	±3	±3
>0.30-0.40	±0.04	±0.05	±3	±3
>0.40-0.60	±0.05	±0.07	±4	±4
>0.60-0.80	±0.07	±0.08	±4	±4
>0.80-1.0	±0.08	±0.12	±4	±4
>1.0-2.0	±0.12	±0.20	±5	±5
>2.0-3.0	±0.20	±0.30	±5	±5
>3.0-4.0	±0.30	±0.40	±5	±5
>4.0-6.0	±0.40	±0.50	±5	±5

Type	Process	Delivery condition	Size(mm)		
			Thickness	Width	Length
W1 W2 W3 W4	P/M	Cold rolled (Y)	0.10-0.20	30-250	50-500
		Stress relief annealing (m)	>0.20-0.4	50-250	50-500
		Hot rolled (R)	>0.40-4.0	50-200	50-200
		Stress relief annealing (m)	>4.0-6.0	50-200	50-200

3. TUNGSTEN ROUND ROD / BAR



Tungsten round rod / bar

1. Grade: W1, W2, W3, W4
2. Diameter: 2.0-100.0mm
3. Length: 50-1000mm
4. Density: 19.2g/cm³
5. Surface: Sintering surface, Forged surface, Ground surface

Production process

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

Application of Tungsten rod

The tungsten rod can be used in making the electricity photo source, the automobile and the tractor light bulb, make lattice side rod, framework, leading wire, electrode, heater, contact materials, X-ray collimators, Gamma radiography shields and so on.

General Specifications of tungsten rod

Type	Diameter (mm)	Dia. tolerance (mm)	Length (mm)	L tolerance (mm)	Liner rate
Sintering Rod	Φ40-100	±3	<500	±5	±5%
Forged Rod	Φ20-80	±2	<800	±5	±2%
Ground Rod	Φ2-60	±0.1	<650	±1	±0.5%

4. TUNGSTEN TUBE / PIPE



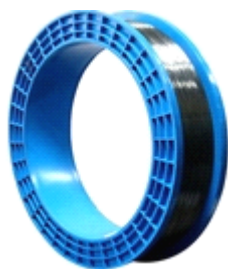
Tungsten tube / pipe

1. Diameter: 30-500mm
2. Thickness: 8-30mm
3. Length: 10-2000mm
4. Density: 19.2g/cm³
5. Purity ≥ 99.92%

Tube(mm)	Thickness (mm)	Length (mm)
φ30~100	8~15	<2000
φ100~200	10~20	
φ200~300	15~20	
φ300~500	15~30	

Mainly used for high temperature furnace components, crucible, missile rockets nozzle high temperature furnace, etc.

5. TUNGSTEN WIRE / HEATER



Tungsten wire / heater

1. Grade: W1, W2, WA1, WA2, WA3
2. Density: not less than 19.1g/cm³
3. Appearance: black surface
4. Quality standard: GB/T 4181-1997 (tungsten wire)
ASTM B760-86

Specifications of Tungsten 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

Application of Tungsten wire

Type	Purity of tungsten	Application
WA1	≥99.92	<ol style="list-style-type: none"> 1. Double – screwy filament. Filament for high colour temperature lamp and shockproof lamp etc. 2. Filament for incandescent lamp. Cathode for emitting tube. High temperature electrodes. Twisted tungsten wire etc. 3. Folded – heater for electronic tube, etc.
WA2	≥99.92	<ol style="list-style-type: none"> 1. Filament for fluorescent lamp etc. 2. Heater for electronic tube. Filament for incandescent lamp. Twisted tungsten wire etc. 3. Folded – heater for electronic tube, etc.
WA3	≥99.92	Filament for normal lamp. Spring wire for semiconductors, etc.
W1	≥99.95	Tungsten wire in twisted and heating parts etc.
W2	≥99.92	Grid side rod for electron tube. Tungsten wire in twisted etc.

6. TUNGSTEN TARGETS / SPUTTERING TARGETS



Tungsten targets / Sputtering Targets

1. Appearance: Silver white metal luster
2. Purity: $Mo \geq 99.95\%$
3. Density: not less than $19.1g/cm^3$
4. Supply state: Surface polishing, CNC machine processing
5. Quality standards: GB/T 3875-2006 (tungsten plate)

Production process

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

Application of Tungsten targets

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

7. TUNGSTEN CRUCIBLE



Tungsten crucible

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

Production process

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

Application of Tungsten crucible

Since the melting point of tungsten has reached 3380°C , tungsten 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 tungsten crucible is above 2000°C . For sapphire crystal growth furnace, high-purity, high-density, no internal-crack tungsten 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.

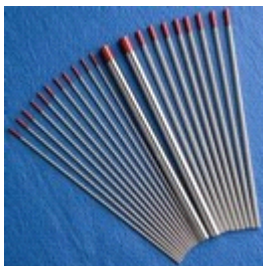
Specifications of Tungsten crucible

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

8. TUNGSTEN ELECTRODE

Tungsten electrode product is the traditional and advantages product in our Factory. In recent years, the factory began to the tungsten electrode product research and development, While unceasingly optimizes the cerium tungsten, the thorium tungsten, the pure tungsten and so on ordinary electrode production craft, our factory centralized scientific research strength, successively researches and develops the cerium tungsten electrode, lanthanum tungsten electrode, zirconium tungsten electrode, yttrium tungsten electrode and so on, receives the market widespread welcome.

Thoriated Tungsten Electrode



Thoriated Tungsten Electrode (EWTh)

1. Trade mark: WT10, WT20, WT30, WT40
2. Diameters: 1.0mm-10.0mm
3. Length: 150mm, 175mm
4. Quality of surface: Ground finish, polish finish
5. Property: Easy to get up the arc, in the welding process unceasingly arches.

Easy to get up the arc, in the welding process unceasingly arches. The electric arc is stable, not spread around and disperse the arc. The electricity saving effect is obvious, gets up the arc current relatively Drops 20 - 50%. Because welding current lower, in the use process is not easy to appear splashes, extremely not instable circle. The electrode causes Is long with the life. The thorium tungsten electrode is the traditional electrode, has the superior welding performance, but the tungsten thorium electrode slight radioactivity, caused it the application to receive certain resisting and the limit.

Trade mark	Added impurity	Impurity quantity(%)	Color sign
WT10	ThO ₂	0.90~1.20%	yellow
WT20	ThO ₂	1.8~2.2%	red
WT30	ThO ₂	2.80~3.20%	purple
WT40	ThO ₂	3.80~4.20%	orange

Cerium tungsten electrode



Cerium tungsten electrode (EWCe)

1. Trade mark: WC20
2. Diameters: 1.0mm-10.0mm
3. Length: 150mm, 175mm
4. Quality of surface: Ground finish, polish finish
5. Property: Cerium-Tungsten is the first choice for replacing thoriated tungsten electrode under the condition of low DC.

Cerium Tungsten Electrode has good starting arc performance under the condition of low current. The arc current is low; therefore the electrodes can be used for welding of pipe, stainless and fine parts. Cerium-Tungsten is the first choice for replacing thoriated tungsten electrode under the condition of low DC.

Cerium-Tungsten Electrode has the following merit compared to the thorium tungsten electrode:

- Non- radioactivity;
- Low melting rate;
- Long welding life;
- Good gets up the arc.

Trade mark	Added impurity	Impurity quantity (%)	Other impurity	Electric discharged power	Color sign
WC20	CeO ₂	1.8~2.2%	<0.2%	2.7~2.8	grey

Lanthanated tungsten electrode (EWLa)



Lanthanated tungsten electrode (EWLa)

1. Trade mark: WL10, WL15, WL20
2. Diameters: 1.0mm-10.0mm
3. Length: 150mm, 175mm
4. Quality of surface: Ground finish, polish finish
5. Property: Another advantage of Lanthanated Tungsten is being able to bear high current and having the lowest burn-loss rate.

The Lanthanated Tungsten Electrode became very popular in the circle of welding in the world soon after it was developed because of its good welding performance. The electric conductivity of Lanthanated Tungsten electrode is most closed to that of 2%Thoriated Tungsten. Welders can easily replace Thoriated Tungsten Electrode with Lanthanated Tungsten Electrode at either AC or DC and do not have to make any welding program changes. The radioactivity form Thoriated Tungsten can thus be avoided. Another advantage of Lanthanated Tungsten is being able to bear high current and having the lowest burn-loss rate.

The advantages of lanthanated tungsten electrode:

- Better Cutting Mechanical Properties
- better performance of creep resistant
- High temperature recrystallization
- Good tractility

Trade mark	Added impurity	Impurity quantity (%)	Other impurity	Electric Discharged power	Color sign
WL10	La2O3	0.8~1.2	<0.2%	2.6~2.7	black
WL15	La2O3	1.3~1.7	<0.2%	2.8~3.0	gold
WL20	La2O3	1.8~2.2	<0.2%	2.8~3.2	Sky blue

Zirconiated tungsten electrode



Zirconiated tungsten electrode (EWZr)

1. Trade mark: WZ
2. Diameters: 1.0mm-10.0mm
3. Length: 150mm, 175mm
4. Quality of surface: Ground finish, polish finish
5. Property: Zirconiated Tungsten electrode is excellent for AC welding due to favorable retention of balled end.

Zirconiated Tungsten Electrode has good performance in AC welding, especially under high load current. Zirconiated Tungsten Electrodes can not be replaced by any other electrodes in terms of its excellent performance. While welding, the end of electrode can retains globose, because of this the seep of tungsten phenomenon can be reduced.

The technical staffs in our factory have been engaged in research and testing work and succeeded in solving the conflicts between zirconium contents and processing properties.

Trade mark	Added impurity	Impurity quantity (%)	Other impurity	Electric discharged power	Color sign
WZ3	ZrO2	0.20~0.40%	<0.2%	2.5~3.0	brown
WZ8	ZrO2	0.70~0.90%	<0.2%	2.5~3.0	white

9. TUNGSTEN PARTS

Tungsten fabricated parts



Most of our tungsten 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 tungsten and molybdenum. Tungsten 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 tungsten components for their successful operation. Tungsten rod or flat sheet heating elements are used in vacuum and hydrogen furnaces. Tungsten 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 tungsten electrodes which operate within fabricated molybdenum or tungsten arc chambers.

COMPANY INFORMATION



Bango Alloy Technologies Co., Ltd.
704 Tianhu Building, No.150,Binglangxili,
Siming District, Xiamen, China 361000
Tel: 0086-592-5977282
Fax: 0086-592-3992527
maya@chtungsten.com
<http://www.tungstenalloy.net>