

钨电极
Tungsten electrode

钨电极是TIG焊中常用的易耗材料。钨电极具有电子逸出功能低,再结晶温度高,机械切削性能好,耐高温,强大的电子发射能力等特点。由于钨的熔点高达3410℃、沸点高达5900℃,能耐高温,导电性好,强度高(σ_b 可达850~1100MPa),钨的纯度约为99.5%(质量分数),其电子逸出功为4.54eV(1eV=1.602 $\times 10^{-19}$ J,下同),当在钨中加入微量逸出功较小的稀土元素,如钍(Th)、铈(Ce)、锆(Zr)等,或它们的氧化物,如氧化钍(ThO₂)、氧化铈(CeO₂)等,则能显著提高电子发射能力。其应用范围:适用于惰性气体保护电弧焊和等离子焊接、切割、喷涂、熔炼电极。

Tungsten electrode is the consumable material commonly used in TIG. The features are low electron work function, high recrystallization temperature, good mechanical cutting performance, high temperature resistance, strong ability of electron emission etc., since the melting point of tungsten up to 3410℃ and boiling point up to 5900℃, it can stand high temperature resistance and conduct electricity, and it also has high strength. The purity of tungsten is about 99.5% (mass fraction), and its electron work is 4.54eV. When adding a little of rare earth elements into the tungsten material, such as thorium(Th), cerium(Ce), zirconium(Zr) ect., or their oxides, such as thorium oxide, cerium oxide, zirconium oxide etc., the ability of electron emission can be improved significantly. It can be applied into inert gas shielded arc welding, plasma arc welding, cutting, painting and melting electrode.

钨电极规格尺寸表
Tungsten electrode specifications

直径 Diameter		直径偏差 Diameter tolerance	长度 Length	长度偏差 Length tolerance
mm	inch	mm	mm	mm
1.0	1/25	(+/-)0.01	50,75,150,175	(+/-)1.0
1.2	6/125	(+/-)0.01	50,75,150,175	(+/-)1.0
1.6	1/16	(+/-)0.01	50,75,150,175	(+/-)1.0
2.0	2/25	(+/-)0.02	50,75,150,175	(+/-)1.0
2.4	3/32	(+/-)0.02	50,75,150,175	(+/-)1.0
3.0	3/25	(+/-)0.02	50,75,150,175	(+/-)1.0
3.2	1/8	(+/-)0.03	50,75,150,175	(+/-)1.0
4.0	5/32	(+/-)0.04	50,75,150,175	(+/-)1.0
4.8	3/16	(+/-)0.04	50,75,150,175	(+/-)1.0
5.0	1/5	(+/-)0.04	50,75,150,175	(+/-)1.0
6.0	15/64	(+/-)0.04	50,75,150,175	(+/-)1.0
6.4	1/4	(+/-)0.04	50,75,150,175	(+/-)1.0
8.0	5/16	(+/-)0.04	50,75,150,175	(+/-)1.0
10.0	2/5	(+/-)0.04	50,75,150,175	(+/-)1.0

根据客户要求可提供特殊规格钨电极 Special length and diameter are also available upon your request.

钍钨电极成分表
Thoriated tungsten electrode composition

牌号 Model	氧化物 Oxide addition		杂质含量% Impurites	钨含量% Tungsten	色标 Color	标准 Standard
	种类 Principal oxide	含量% Contents				
WT10	ThO ₂	0.8–1.2	≤0.2	余量Balance		AWS A5.12 ISO6848 EN 26 848
WT20	ThO ₂	1.7–2.2	≤0.2	余量Balance		
WT30	ThO ₂	2.8–3.2	≤0.2	余量Balance		
WT40	ThO ₂	3.6–4.4	≤0.2	余量Balance		

钍钨电极含有0.8%—4.2%的氧化钍，电子逸出功为2.7eV，起弧更容易，电弧更稳定，即使在超负荷电流下也能表现良好，因而广泛应用于各种TIG、PAW焊接领域。氧化钍具有超强的载流能力，再结晶温度高，导电率更好，机械切削性能更强，使用寿命更长。焊接时，钍钨电极尖端保持磨尖，这样在焊接中能更大程度的保证钨电极尖端的球状不易开裂。

Our company is the only legal manufacturer accredited "Radiation Safety License" to produce thoriated tungsten in China. Thoriated tungsten electrode contains 0.8%-4.2% thorium oxide, and its electron work function is 2.7eV. So it can be widely used in various TIG and PAW for its easy and stable arcing. Thorium oxide has strong current-carrying capacity, high recrystallization temperature, better conductivity, stronger mechanical cutting performance and longer service life. When welding, the tip of thoriated tungsten electrode keeps sharpening so that the ball on the tip of tungsten electrode can be not easy to crack at a greater degree of assurance.



铈钨电极成分表

Ceriated tungsten electrode composition

牌号 Model	氧化物 Oxide addition		杂质含量% Impurities	钨含量% Tungsten	色标 Color	标准 Standard
	种类 Principal oxide	含量% Contents				
WC20	CeO ₂	1.8-2.2	≤0.2	余量Balance		AWS A5.12 ISO6848 EN 26 848

我公司是国内最早生产铈钨电极的生产厂家，产品曾获省级科技进步奖，铈钨电极含有1.8%–2.2%的氧化铈，电子逸出功为2.4eV，在低电流条件下有优良的起弧和稳弧性能，维弧电流较小。因此，铈钨电极经常用于管道、不锈钢制品和细小精密部件的焊接，在低电流直流条件下或钨电极直径要求2.0mm以下的焊接一般首选铈钨电极。

氧化铈具有很高的迁移率，因此铈钨并不适合高电流条件下的应用，因为高电流下，氧化物会快速的移动到高热区，即钨电极焊接处的顶端，这样对氧化物的均匀度造成破坏，因而因为氧化钨均匀所带来的好处将不复存在。

Our company is the earliest manufacturer of cerium tungsten electrodes, and our products have obtained the provincial science and technology progress prize. Ceriated tungsten electrode contains 1.8%-2.2% ceria, electron work function is 2.4eV, and plays a good performance on starting arc and stabilizing arc at low current. Therefore, ceriated tungsten electrode are commonly used in pipeline, stainless steel and small precision parts welding. It's the first choice in the low current and diameter below 2.0mm.

The high-mobility cerium oxide is not suitable for the application in the high current. If it's used in the high current, the oxide may accelerate to the high hot area, the top of the tungsten electrode, Which damages the uniformity of oxide. The benefit brought by cerium oxide will disappear.



镧钨电极成分表

Lanthanated tungsten electrode composition

牌号 Model	氧化物 Oxide addition		杂质含量% Impurities	钨含量% Tungsten	色标 Color	标准 Standard
	种类 Principal oxide	含量% Contents				
WL10	La ₂ O ₃	0.8-1.2	≤0.2	余量Balance		AWS A5.12 ISO6848 EN 26 848
WL15	La ₂ O ₃	1.3-1.7	≤0.2	余量Balance		
WL20	La ₂ O ₃	1.8-2.2	≤0.2	余量Balance		

镧钨电极含有0.8%–2.2%的三氧化二镧，电子逸出功为2.8eV–3.0eV。镧钨电极低电流下容易起弧，并且能稳定低电流下的电弧。主要用于直流焊接，用于交流焊接时也表现良好。三氧化二镧抗蠕变性能更好，延展性强，搅拌率小，因而镧钨电极的尖端温度更低，这样有助于阻止晶粒长大，提升电极使用寿命。如果无过载电流，镧钨电极寿命比钍钨长，尤其擅长防止热冲击，短周期焊接中重复点火的情况下，焊接良好，避免污染。在焊接管道时，焊工对这种镧钨电极尤其满意，因为使用寿命长而减少停机时间。

Lanthanated tungsten electrode contains 0.8%-2.2% lanthana, the electron work function is 2.8eV-3.0eV. It's easy to start arc and sustain the stability at low current, it is mainly used in DC, performances well in AC welding. Lanthana has better of creep resistance, strong ductility, lower stirring rate, therefore the tip temperature of lanthanated is lower, which helps to prevent grain from becoming larger, the service life of electrode can be increased substantially. The lifetime of lanthanated tungsten electrode is longer than thoriated tungsten electrode without overload current. It is particularly good at preventing thermal shock. When you ignite repeatedly in the welding of short cycle, it can be welded well and prevents from pollution. When welding the pipeline, welders are quite satisfied with this lanthanated tungsten, because the service time is long to reduce the downtime.



钨钨电极成分表

Zirconiated tungsten electrode composition

牌号 Model	氧化物 Oxide addition		杂质含量% Impurities	钨含量% Tungsten	色标 Color	标准 Standard
	种类 Principal oxide	含量% Contents				
WZr3	ZrO ₂	0.2-0.4	≤0.2	余量Balance	■	AWS A5.12 ISO6848 EN 26 848
WZr8	ZrO ₂	0.7-0.9	≤0.2	余量Balance	□	

在交流焊接中，钨钨电极是最常用的，钨钨电极含少量的氧化钨。电子逸出功为2.5eV-3.0eV。钨钨电极焊接性能良好，在焊接时比纯钨容易起弧，而且弧束稳定，也能很好的防治污染，载流能力也不错。该电极最大的特点是在高负载电流的情况下，其端部能保持成圆球状而减少渗钨现象，并具有良好的抗腐蚀性。钨钨电极表现出来的优越性能，是其他电极不可替代的。

Zirconiated tungsten electrode is the most commonly used in alternating current welding, which contains little zirconium oxide. Its electron work function is 2.5eV - 3.0eV. Zirconiated tungsten electrode performs well, and it is easier to start arc than pure tungsten. Arc is stable as well. It can also prevent and control pollution well. Current-carrying capacity is quite good as well. The biggest characteristic of this electrode is that its top can keep globular to reduce the seepage of tungsten in the high load current and it also has good corrosion resistance. The superior of zirconiated tungsten electron cannot be replaced by other electrode.

纯钨电极成分表

Pure Tungsten products composition

牌号 Model	氧化物 Oxide addition		杂质含量% Impurities	钨含量% Tungsten	色标 Color	标准 Standard
	种类 Principal oxide	含量% Contents				
WP	—	—	≤0.2	余量Balance	■	AWS A5.12 ISO6848 EN 26 848

纯钨电极是氩弧焊接最早使用的电极，也被广泛使用在各个特定的焊接行业。纯钨电极含钨量最低99.5%，没有合金元素。纯钨电极仅作为交流条件下的焊接电极或作为电阻焊电极，它能提供清洁母材表面，加热时焊球变尖，这种形状提供一个平衡的波形交流焊接电弧稳定，是特别良好的。纯钨具有非常高的电子逸出功能，蒸汽压力低，电阻小，导电性好，热膨胀小，弹性模量高。所以在低电流时电弧稳定，低于5A时能够很好地焊接铝、镁及其合金，但发射电子要求电压较高，要求焊机空载电压高，长时间大电流工作时钨极烧损较明显，端部熔化后落入熔池会使焊缝夹钨，因此只作为某些黑色金属焊接用，或焊接不重要部位。

Pure tungsten electrode is the earliest to be used in tig welding. It contains tungsten content minimum 99.5%, without other impurities. Pure tungsten electrode is only as welding electrode under the condition of AC or resistance welding electrode, It can clean surface of base matel .welded ball became tapering when heating. This shape provides a good and balanced wave form for AC welding. pure tungsten electrode has a very high electron output, low vapor pressure, low resistance. good conductivity, thermal expansion, high elastic modulus bright. Therefore, the arc is stable at low current,and Aluminum,Magnesium and other metals can be welded at the current below 5A. But the emission of electron demands high voltage and high no-load voltage of welding machine.The tungsten electrode is burned apparently if it works in the high current for a long time. The end may drop into molten pool after melting, which will bring the tungsten into the welding gap.So, it's just used for welding some black metal or welding the unimportant parts.



钇钨电极成分表

Yttrium tungsten electrode composition

牌号 Model	氧化物 Oxide addition		杂质含量% Impurities	钨含量% Tungsten	色标 Color	标准 Standard
	种类 Principal oxide	含量% Contents				
WY	YO ₂	1.8-2.2	≤0.2	余量Balance		AWS A5.12 ISO6848 EN 26 848

钇钨电极含有1.8%–2.2%的氧化钇，电子逸出功为2.8eV–3.2eV。钇钨电极在焊接时，弧束细长，压缩程度大，在中、大电流时其熔深最大。在焊接高强度钛合金承力构件，以及喷气发动机高温部件采用的单晶或粗晶材料，金属间化合物，陶瓷或金属基复合材料等新型材料时，性能优越。所以，主要应用于军事工业和航空、航天工业。

Yttrium tungsten electrode contains 1.8%-2.2% yttria, its electron work function is 2.8eV-3.2eV. When used in welding, yttriated Tungsten is primarily used in military and aviation industry with narrow arc beam, high compressing strength, highest welding penetration at medium and high current. Its superior performance also recommends use in the welding of high strength titanium bearing components, as well as high-temperature jet engine components using a single crystal or coarse-grained materials, intermetallic compounds, ceramic or metal matrix composites and other new materials. Therefore they are mainly applied to military industry and the aerospace industry.

复合钨电极成分表

Compound tungsten electrode composition

牌号 Model	氧化物 Oxide addition		杂质含量% Impurities	钨含量% Tungsten	色标 Color	标准 Standard
	种类 Principal oxide	含量% Contents				
WS2	La ₂ O ₃ YO ₂ ZrO ₂	1.8-2.2	≤0.2	余量Balance		AWS A5.12 ISO6848 EN 26 848

复合钨电极又称三元复合稀土钨电极，含有1.2%的氧化镧，0.5%的氧化锆，0.5%的氧化钇三种元素，其本身不具有放射性，复合目的就是为了平衡内部电子的迁移率和蒸发率，使得钨电极性能发挥到极致，而且降低电子的电子逸出功。复合钨电极起弧和重复起弧很容易。如果焊接周期在大于15分钟的情况下，它的使用寿命会更长。复合钨电极尖端烧损明显优于其它钨电极。由于三种氧化物在电极中掺杂混合，对生产工艺有极为严格的要求，因此生产成本较高。

Compound tungsten electrode is also known as three elements of rare earth containing 1.2% lanthana , 0.5% zirconia, and 0.5% yttria. It is a non-radiation material. It is good to balance the electron mobility and evaporation rates, make tungsten electrodes to maximize their performances. For compound tungsten electrode, it's easy to start and restart arc. If the welding cycle is more than 15 minutes, its life will be longer. Compound tungsten electrode is better than others in tip burning. As the mixture of three kinds of oxides in electrode. It's strict with the production process and the cost of production is more expensive.

