



Mixed Metal Oxide Anode

For many years “High Silicon Iron Anode” being used in impress current Systems that has a lot of deficiencies and weak points which caused many difficulties for the Cathodic Protection System Designers such as (high weight, fragility, short life time). Metal oxide (MMO) Anodes; The majority of such problems have been solved through their obvious distinctive capabilities such as low consumption rate, dimensional stability, and high current density. Furthermore, their central core is generally made of Titanium and coated with a layer of active metal oxide ($\text{IrO}_2 \text{ Ta}_2 \text{ O}_5$), which is suitable to be used for soil, cock backfill, fresh water, sea water, saline water and concrete.

Considering the above mentioned facts and other economical and functional advantages of aforesaid new Anodes, The PG PARS Electronic company, while having an experience of more than a quarter century in designing, producing, equipment sourcing and execution of Cathodic Protection Projects, has took an action for development and renovation of its manufacturing plants through providing and producing different types of MMO Anodes as an outstanding achievement of a new product, to meet industrial demands in wide variety of applications as followings:

Durability and stability of MMO Anodes:

MMO anodes have been designed in such a way to be stable and durable in simultaneous sense of chlorine and oxidized environment. In another words, by applying Mixed metal oxide (MMO) coating as an activation agent, the over potential for anodic chlorine and anodic oxygen evolution would be remarkably reduced, because the covering catalyst of MMO Anodes provides a small electrical resistance for each Anode, which be resulted in lower consumption rate with regard to its life time. Thus MMO Anodes have the low consumption rate nearly between 4.0 – 5.0 mg/A. Year, depending on environment condition and application. MMO coated Anodes specifications for different operation condition.

Operation condition	Max current density (mA/mm ²)	Service life (Year)
Carbon backfill	50	20
calcine petroleum coke	100	20
Fresh water	100	20
saline water	100-300	20
Sea water	600	20

The Titanium substrate meets ASTM B 265 & 338 & 348 grad 1 or 2 standards and the MMO coating consists of mainly IrO_2 and Ta_2O_5 catalyst. The MMO coating can be increased or decreased depending on particular life/current density requirements. The titanium substrate remains constant throughout the design life of the anode.



Types of MMO Anodes

MMO Tube Anode

The anodes are made using tubular titanium substrates, which are coated with a mixed metal oxide catalyst. The titanium hollow tubes conform to ASTM B338 grade 1 standard. The tubular configuration provides a larger surface area, which in turn permits greater current output and lower anode to earth resistance. The tubular style also means lead wire connections can be made in the center of the anodes.

MMO tubular anodes are epoxy resin filled & helium leakage tested for an effective seal of the connection cable end of Anode which is tested for resistance that is less than .001 ohms, variety of cable types and sizes are available.

Environment	Anode Size(Diameter x Length)	Current Output (A)	Lifetime (Years)
Coke, Soil & Freshwater	25mm x 500mm (1" x 19.7")	4	20
	25mm x 1000mm (1" x 39.4")	8	20
	31.75mm x 1220mm (1.25" x 48")	12	20
Seawater	25mm x 500mm (1" x 19.7")	25	20
	25mm x 1000mm (1" x 39.4")	50	20
	31.75mm x 1220mm (1.25" x 48")	75	20





MMO Ribbon Anode

Mixed metal oxide ribbon anodes are designed for use on both newly constructed & existing above ground storage tanks. These Anodes are composed of a Titanium conductor bar is connected to the MMO Anodes by spot welds applied at point of crossover. MMO ribbon anodes are manufactured using titanium substrate which meets ASTM B265 Grade 1 standard. The spacing between the MMO Anodes strips can be adjusted to achieve various design life requirements.

Advantages

- Adjustable to achieve various design life requirements by varying spaces between strips
- Ability to place under all areas of the tank (because it can be easily cut)
- Availability of multiple paths for current flow (electrically continuous strips)

They can be applied in sands with various levels of moisture and salt contents without carbon backfill. Which can also be utilized in concrete bridges, decks and piers as well as in evolution O₂, Cl₂ or a combination of both.

Nominal Dimension of Solid Ribbon	
Width	6.35mm (0.25")
Thickness	0.635mm (0.025")
Standard coil length	100 m
Standard coil weight	~1.5 Kgs
Surface are of Ribbon	0.014m ² Per/m

Titanium Conductor Bar	
width	12.7mm (0.50")
Thickness	0.9mm (0.035")
Standard coil length	100m
Standard coil weight	~ 5 Kgs

Operation Characteristics		
Environment	Maximum Current Density	Estimate Design Life
Fine sand	42mA/m (12.8mA/ft)	~50 Years
Concrete	1.5mA/m (0.45mA/ft)	~100 Years

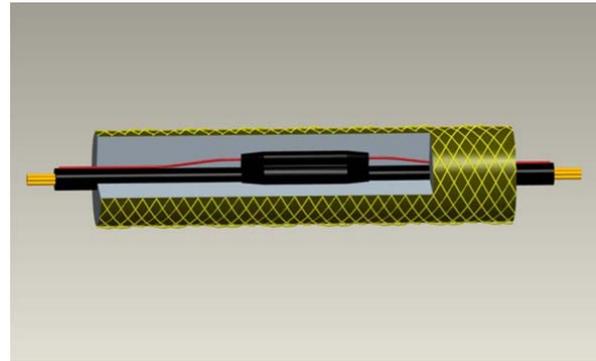




MMO Wire Anodes

The anodes are composed of a copper core which is surrounded by a titanium metallurgically bond coating. The titanium is inherently resilient and stable, allowing the wire anode to be extremely flexible.

Wire anodes are designed suitable for many application requiring long slender anode material. Linear anodes are for installing in a trench parallel to the pipe to optimize current distribution and minimize operating costs. Also suitable for installation inside pipe for internal protection. Anodes are available in two (1.5mm dia and 3.0 mm dia) standard sizes, and current ratings.



Applications:

MMO Wire is applicable for impressed current Cathodic Protection of:

- Above Ground Storage Tanks
- Underground Storage Tanks
- Water Treatment Equipment
- Electrical Cable Shielding
- Buried pipelines and other Structures.

Wire Dia. mm	Current Output (Amps/m) With Backfill			Electrical Resistance (ohm/m)
	Sea Water (SW)	Fresh Water (FW)	Soil (ST) With Backfill	
3	6	1	1	0.083
2	4	0.66	0.66	0.18
1.5	3	0.5	0.5	0.33

We have developed two new products PG PARS Piggy Back Anode & Borflex Anode; utilizing MMO Wire for replacement of conventional existing types (deep well equipped with tubular MMO or Cast Iron Anode, Shallow Vertical Ground-beds - Continuous Horizontal Ground-beds, Canister Anodes) Wire material is normally titanium, however it could be Niobium and both of them could be activated with Platinized coating, upon request.



Best Solution for the Potential Problem along a Pipeline

PG-Pars Anode:

For high output impressed-current Cathodic Protection and without any under or over protection. It's provide the optimize Cathodic Protection on every point of buried pipelines & bottom of storage tanks.

PG Pars manufacturing process assures that the anode assembly is centered in the carbon backfill. The outer jacket of the PG Pars package is porous fabric with chlorine, UV, and pH resistant that is covered with a protective cross braid for excellent abrasion and damage resistances. The overall nominal diameter of the PG Pars flexible Anode is 35mm and lengths is upon request.

Product Benefits:

- Distributed Current Uniformly
- Easy to install (follows pipeline right-of-way)
- Optimized Power Efficiency
- Up to 50 years Anode Design Life
- Cost Effective
- Assembled In the Factory
- High Quality and QC on all individual Connections
- Low Consumption Rate

Product Basic Elements:

- High Performance Coke Breeze
- Titanium MMO wire Anode in three Alternatives
- 1.5, 2 or 3mm² Diameter
- Single Core Cable, with variety of insulation (Kynar, HMWPE, XLPE/PVC, PVC/PVC) regarding to the environmental condition and different copper cross section.
- Protective Fabric & Braid, with following

Specification:

- Chlorine
- High bursting strength
- UV Resistance
- Fluid resistance
- Abrasion Resistance
- Accessories: End seal kit, Tee splicing kit, In-line splicing kit