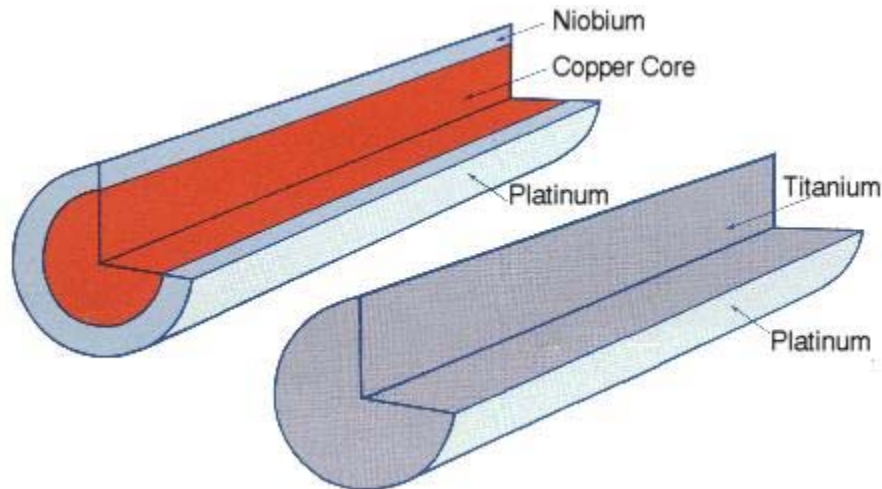


Anomet Platinum Anodes



The Leader in Platinum Anode Technology

Anomet Products has been manufacturing platinum clad anode materials since 1976, and today is the industry leader. Anomet, together with its sister company, Supercon, represents over 30 years' experience in innovative metallurgical processing. Since its inception, Anomet has been dedicated to improving product quality and to developing new products using advanced metallurgical technology to provide long lasting cost effective anode materials. Today, Anomet is recognized throughout the cathodic protection industry for its product quality and excellent service.

Anomet's commitment to platinum clad (platinized) anode materials does not stop at manufacturing, but continues on through research and development of existing and new materials. To better assist the cathodic protection industry, Anomet maintains an ongoing research effort to characterize the behavior and performance of its clad anode materials in cathodic protection environments. In addition to in-house laboratory testing, Anomet remains in close contact with its customers in order to accumulate data on existing field installations. With hundreds of thousands of anodes in service, this field data serves as a comprehensive guide to the performance of platinum clad anodes. Through extensive experience, its research and development in the metallurgical and electrochemical fields, and excellent customer relations, Anomet has developed into the leading supplier of platinum clad anode materials.

Material Selection in Platinum Clad Anodes

The materials chosen in the design of Anomet's anodes are based primarily on the technical merits of the metals utilized. While the list of possible material combinations is virtually unlimited, the current standard line of Anomet material limits itself to those materials which possess specific properties necessary in the design of an effective impressed current anode material.

Platinum is used on the surface as a primary anode material due to its excellent corrosion resistance under anodic conditions coupled with its ability to pass current in all electrolytes without forming an insulating film. The corrosion resistance of platinum manifests itself in its low consumption rate. Its major disadvantage is its high cost, thus making it clear that it is most desirable to use as little platinum as is necessary. In order to restrict

the amount of platinum used and to maintain an anode of some structural integrity, it is necessary to use some type of substrate material. Included among the properties of the substrate should be the ability to form an insulating film under anodic conditions, such that a dimensionally stable anode is obtained, good conductivity, and relatively low cost. As there are no individual materials which fully meet all of these criteria, it is necessary in most cases to use a combination of materials.

Both niobium and titanium have the ability to form insulating oxide films under anodic conditions, and both possess unique advantages and disadvantages as a substrate for platinum. The major advantage of titanium is its low cost, particularly when considering its lower density. Unfortunately, there are many applications where the disadvantages of titanium far outweigh its cost advantage. First, in environments with high chloride contents, the insulating oxide film formed by titanium tends to break down, thus undermining dimensional stability needed for complete platinum consumption. A second disadvantage of titanium is its poor conductivity; approximately 5 times less than niobium and 50 times less than copper. Low conductivity makes titanium poorly suited for long wire lengths and restricts its use to larger diameter, shorter anodes.

The use of niobium as a substrate to platinum eliminates many of the problems with titanium. The breakdown voltage of niobium oxide film is approximately 120 volts in most commonly found cathodic protection environments. Although its conductivity is higher than that of titanium, it is often still too low for use in small diameters and long lengths. The principal disadvantage of niobium, however, is its relatively high cost.

Copper is an ideal conductor at virtually any length and diameter suitable for cathodic protection. The combination of high conductivity and low cost allows copper to be an ideal candidate for use in the design of an anode material.

Material Considerations in Platinum Anode Design

- **Copper (Cu)** Good conductivity, low cost.
- **Niobium (Nb)** Passive film formation, high cost, high breakdown potential, fair conductivity.
- **Titanium (Ti)** Passive film formation, low cost, low breakdown potential, poor conductivity.
- **Platinum (Pt)** High corrosion resistance, high cost, good conductivity.

In reviewing the properties of these materials above, it becomes quite clear that if a combination of these materials was developed which exploits only the advantages, the result would be a superior anode material. The most logical combination of materials would include the use of a platinum outer layer, very thin due to cost, a layer of niobium beneath the platinum to allow for a dimensionally stable anode, and a copper core for both conductivity and economy. The niobium layer should be heavy enough to withstand normal mechanical handling.

To properly manufacture an anode material which is composed of multilayers, sophisticated metallurgical processing techniques must be employed to insure integral contact between the metal layers. The ideal method of insuring this contact is by providing a metallurgical bond. All of Anomet's clad materials are manufactured through very tightly controlled metallurgical co-processing techniques yielding complete metallurgical bonds. In obtaining this type of high integrity bonding, three materials then behave as one with no possibility of spalling or non-bonds. This method of fabrication used by Anomet insure that the corrosion engineer obtains a high quality anode material.

Anomet 40 is a standard platinized anode material, which is 40% niobium by cross-sectional area with a copper core. The use of Anomet 40 is recommended for anode diameters below 1/8". The heavier niobium allows for sufficient mechanical and electrochemical protection of the copper core at these smaller diameters. Anomet 40 is sold principally at smaller diameters usually in double platinum thicknesses. It should be noted that anode life is not related to niobium thickness.

Anomet 40 (40% Nb)				
Diameter	Nb Thickness	Resistance	Pt Thickness	
inches	inches	microhm/ft	u-in.	(2X) *
.375	.038	113	150	(300)
.250	.025	256	100	(200)
.188	.019	453	75	(150)
.125	.013	1025	50	(100)
.093	.010	1822	38	(75)
.063	.007	4102	25	(50)
.031	.0035	16,408	12.5	(25)

*Double Platinum Thickness

Complete Metallurgical Bond

- Solid or copper cored niobium and titanium substrates
- Platinum and niobium thickness can be optimized
- Mechanical strength and ductility
- Steel core (optional) for added strength
- Easy to transport and install
- Available in various sizes and lengths

Platinum clad anodes by Anomet feature all the ingredients necessary for a long-life, cost-effective anode material. They offer a low consumption rate material metallurgically bonded to a corrosion resistant inert anodic oxide forming substrate with the flexibility of high conductivity or high-strength core materials.

Available in virtually any diameter and platinum thickness, Anomet's anodes are produced under strict quality control standards for long-term, trouble-free performance. Along with a quality product comes Anomet's excellent service and quick delivery.

Information About Anomet Special Services

As a complete metal-working facility, Anomet offers a number of special services which allow for easier handling and subsequent use of materials. For copper cored anodes, a niobium end cap can be welded into the end exposed to the electrolyte. Also, Anomet provides complete machine shop services for tapping or threading anodes. Custom geometries may also be obtained by bending anodes to protect structures with complex geometries. In most instances, the cost of these services is considerably lower than can be obtained through outside sources.

Quality Control

Anomet Products prides themselves on the consistent quality of their clad anode materials. This consistency is achieved through utilizing trained personnel who draw on the 20 + years of metal working experience in the supervision of all quality control aspects of rod and wire production. At Anomet, quality starts with high grade raw materials which must meet all ASTM standards and continues with careful handling of all raw materials, work in process, and finished goods. The inspection of wire products is carried out using state of the art electronic wire inspection equipment for the detection of surface and subsurface flaws or inclusions. Anomet stands behind its quality with a guaranty that the material is received defect free and contains no less than the specified amount of raw materials.

Applications

Since their introduction, platinum clad anodes by Anomet have impacted almost all areas of impressed current cathodic protection technology. Through close contact with customers, Anomet has compiled a list of many applications well suited to their products. Platinum anodes found their original applications in seawater environments and have developed a successful track record over the past 20 + years. Among the specific applications in seawater are cathodic protection of docks, offshore structures, and ship hulls.

In power plants, where cooling waters range from seawater to brackish water, platinum clad anodes have been used extensively in protecting condenser water boxes, pumps, traveling screens, and other equipment and structures subject to corrosion. Condenser water box designs are particularly well suited to Anomet's partialclad anodes. Applications of platinum anodes in fresh water include the cathodic protection of water tanks as well as submerged fresh water structures. Platinum clad anodes are also used in cathodic protection ground beds protecting pipelines, underground storage tanks, underground hydraulic cylinders as well as many other types of underground structures. Platinum anodes have been used in both conventional and deep well groundbeds. They are usually used in conjunction with fine particle carbonaceous backfill. Their small size, light weight, and economy of design make platinum clad anodes by Anomet a clear technical and economical choice for underground cathodic protection.

In recent years, much attention has focused on cathodically protecting reinforcing bars in concrete structures, such as bridge decks and parking garages. Utilizing the high conductivity of a copper core and the low corrosion rate of platinum small diameter, platinum clad anode wire has been used in conjunction with other conductive media for long life and uniform current distribution in protection of reinforced structures.

In more unique applications, platinum clad anodes have been used for the electrochemical protection of many types of process vessels. Included among these types of applications are bleach washers in pulp and paper mills, sulfur dioxide scrubber towers, as well as a wide variety of other chemical process environments.

It is impossible to cover all the applications of platinum clad anodes. At Anomet there is, however, a wide spectrum of applications knowledge in terms of the behavior of their anode materials in many electrolytes. While Anomet is not a cathodic protection design company, they can provide useful information to engineers performing design services.

Choosing Your Platinum Anode Company

While the expertise at Anomet Products is in materials fabrication and processing, the commitment to cathodic protection technology should be clear. As a manufacturer of technically sophisticated materials, Anomet must maintain a close association with materials applications and maintain a strong research and development effort. All of this should be in addition to providing a high quality product and good service. Anomet's reputation for excellent service and response to customer needs has spread throughout the cathodic protection industry. This has been accomplished principally through the people at Anomet who can provide immediate assistance and service. People with in-depth knowledge of the product line, the capabilities of the company, and the applications are readily available to talk with customers.

When choosing a platinum anode company, there is more to consider than just a materials supplier. There should be confidence in the commitment of that company to the overall industry, a commitment such as that of Anomet Products.