

TECHNICAL REFERENCE

TOPIC: Electrode Material Selection Guide

When designing a Membrane Electrode Cell, it is important to select the proper Electrode material. Generally, materials with the following characteristics can be considered for use: readily available; insoluble in a dilute solution of common organic acids and amines; and no components that can foul the ED paint. In cathodic ED paints, another desirable quality is the ability to resist the oxidation that results from hydrolysis of water at the anode's surface under an elevated voltage. A lifetime of two years or more is desirable.

In anodic ED paints, the cathode does not suffer from oxidation and so has a very long life. While the cathode could be made from black iron typically it is made from 304 and 316 stainless steel.

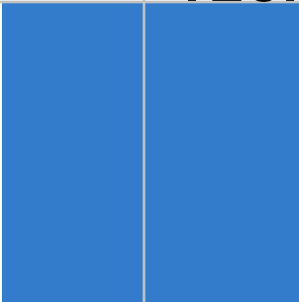
For cathodic ED systems (where the Electrode is an anode), 316L grade stainless steel is the material of choice – any lesser grade will dissolve in a matter of months and create a tremendous amount of iron contamination & iron sludge. 316L stainless is appropriate for most epoxy-based ED paints. Its dissolution by-products form an excellent conductive layer around the Electrode and serve to lessen the overall oxidation process. However, 316L stainless steel is sacrificial and typically needs to be replaced every 2 to 5 years. For the smaller diameter TECTRAN Cells Sch 40 wall thickness is common and for the larger diameter TECTRAN Cells Sch 10 is used..

For acrylic-based cathodic ED paints, precious metal oxide-coated titanium anodes are an excellent choice. This material does not contain iron and cannot contaminate the ED paint bath with solubilized iron. The Precious Metal Electrode has a hybrid composition. Its substrate is a titanium thin wall tube. The function of the tube is to serve as a form factor for the precious metal oxide coating. The precious metal oxide coating is applied over the titanium tube and then is oven-cured. Whereas precious metal is **less soluble** than 316L stainless steel, it too can suffer from corrosion & pitting if certain conditions are present in the e-coat tank.

There are two commonly used precious metals: ruthenium & iridium. Ruthenium is about 20% less and is selected by price sensitive clients. Iridium is a much better material and should be used in high painted through put E-coat tanks like appliance and automotive where more durability is required.

The chart on the next page provides additional information concerning the choice of Electrode material.

Note: Since anodes are sacrificial and can suffer fast corrosion they are not warranted and no performance guarantees can be offered.



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	Stainless Alloy	Precious Metal Oxides
Type	316L	Ruthenium or Iridium
Composition	Homogeneous	Oxide-coating
Cost Factor	1	> 5 - 8 times
Availability	OK	Adequate
Fabrication	OK	Adequate
Substrate Materials	None	Ti,Ta,Zr,Nb
Physical Properties	Strong	Brittle
Quick Failure ?	Yes	Yes
Dissolution Products	Fe -> Fe+2 & Fe +3	TiO ₂ -> Ti +4 & O ₂
Dissolution Voltage	< 2	> 8 - 12
Design Basis, Amps/SM (Amps/SF)	55 (5)	55 (5)
Measure Wear ?	Readily	No
Resistance to X-Factor	Poor	Good
Usage	No Corrosion Factor Epoxy ED Paints	Low Corrosion Factor Light colors/Acrylic Only ED Cathodic Paints
Application	Industrial price sensi- tive markets	High thru-put systems requiring more durability such as appliance & automotive.
Typical Wear Rates (No Corrosion Factor)	Generally < 10 - 50 mgrams/C	Hard to predict or meas- ure without x-ray equip- ment
Detect Wear Thru Visual Inspection ?	Yes	Limited
Life Expectancy, Hours	~20k	> 20k