UFS Corporation
330 North 400 East
Valparaiso, IN 46383-9704 USA
PH: 219-464-2027 FAX: 219-464-8646
www.ufsc.com
email: service@ufsc.com

Technical Reference

Topic: Electrode Material Selection

When designing a Membrane Electrode Cell, it is important to select the proper Electrode material. Generally, for a material to be considered for use, it must have the following characteristics: readily available; insoluble in a dilute solution of common organic acids and amines; and no components that count 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. 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. Typical cathode materials include 304 and 316 stainless steels.

For ED systems (where the Electrode is an anode), 316L grade stainless steel is very common – any lower grade will dissolve in a matter of months and crate a tremendous amount of iron contamination & iron sludge. 316L stainless is a good choice 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. Other, more premium grades of stainless steels have been tested. Some have higher performance. But when cost and delivery are also included in the decision making process, these higher grades are not worth the extra cost and wait to obtain.

For acrylic-based cathodic ED paints, precious metal oxide-coated titanium anodes is an excellent choices. This material does not contain iron and cannot contaminate the ED paint bath with soluble 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 fired to cure it. While precious metal is **less soluble** than 316L stainless steel, it too can suffer from corrosion & pitting corrosion if the conditions in the Cell are conducive to such an issue.

Please see the table below for more information on the three general materials used for Electrodes. The chart on the next page provides additional information concerning the choice of Electrode material.

Think and act in a safe manner. Always disconnect power and use a lockout before you work on the E-coat system. Observe any confined space conditions. Use the appropriate safety equipment & clothing for the task.

	Stainless Alloy	**Precious Metal Oxides**
Type	316L	Proprietary types
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
Application	No Corrosion Factor Epoxy ED Paints	Low Corrosion Factor Light colors/Acrylic **Only ED Cathodic Paints**
Typical Wear Rates (No Corrosion Factor)	Generally < 10 - 50 μgrams/C	Hard to predict or measure without x-ray equipment
Detect Wear Thru Visual Inspection ?	Yes	Limited
Life Expectancy, Hours	~20k	> 20k