ANODAL® EE LIQUID

Anodal EE Liquid is an additive for sulfuric acid anodizing that reduces the dissolution of the oxide film under adverse anodizing conditions. It can be used for the production of hardcoat, decorative and other forms of anodizing to improve quality, reduce defects and lower operating costs.

- The addition of Anodal EE Liquid to the conventional sulfuric acid electrolyte enables the production of Type III (hard) anodic coatings in accordance with paragraph 3.4.3 of Military Specification *MIL A-8625-F*.
- Since Anodal EE mitigates the effects of poor anodizing conditions the uniformity of the film is substantially improved. The effects of normal variations in current density, temperature and solution agitation around a part or within a load are reduced, thus achieving more consistent quality and fewer defects.
- Anodal EE lessens the increase in RMS surface roughness normally associated with hard coat anodizing. Thus the honing that is frequently required for hard coat surfaces is reduced or in many cases, eliminated.
- Dyeable hard coat, lighter colored hard coat, low voltage hard coat or decorative architectural quality coatings as hard as integral color anodize are all examples of what can be produced using this versatile product.

HARD ANODIZING

The hard coat properties are a function of current density, temperature and processing time. It can be produced within a current density range of 24 to 48 amperes per square foot and within the temperature range of 50°F to 60°F. The addition of Anodal EE allows some compromise of the ideal conditions, i.e. higher temperatures or insufficient agitation, thereby reducing the problem of burning. Hard coat produced at these elevated temperatures will be clearer in color and more easily dyed, producing brighter colors. Alloys 2014, 2024, 7075 and 7178 being more difficult to anodize, require a lower temperature for high quality hard coat.

PHYSICAL PROPERTIES

Specific gravity:	1.26 (10.5 lbs/gallon)

APPLICATION DETAILS

Concentration:	2-4% vol (4% recommended for hard coat)
Sulfuric acid:	Typically 150-250 g/l (higher for hard coat)

TANK MAINTENANCE

In addition to drag-out loss, the major consumption of Anodal EE is due to the decants required to maintain an acceptable aluminum concentration. In most applications the buildup of dissolved aluminum is significantly reduced when using Anodal EE. In addition, some applications using Anodal EE tolerate higher dissolved aluminum. Ion exchange type acid recovery equipment typically recovers about half of the Anodal EE content and will therefore reduce the consumption accordingly.

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Electrolyte concentration may be maintained by making additions in proportion to those of sulfuric acid. A premixed electrolyte addition of sulfuric acid, water and Anodal EE may be formulated to maintain the anodize bath composition at a constant value.

ANALYSIS PROCEDURE

Step 1 - Preparation & standardization of ferrous ammonium sulfate (FAS) solution:

1. Prepare 0.1N FAS by: Dissolving 39.2 grams of ferrous ammonium sulfate hexahydrate in DI water, adding 2 ml of 50% sulfuric acid and diluting to 1 liter.
2. Store in an opaque container.
3. Pipette 25 ml of 0.lN cerric sulfate into a 400 ml beaker.
4. Add 25 ml of 50% sulfuric acid and a few drops of ferroin indicator.
5. Titrate with FAS solution to an orange endpoint.

Calculate: **FAS Factor (F) = 25/(ml of FAS)**

Step 2 – Bath Analysis

1. Pipette 25 ml of the anodizing solution into a 1 liter volumetric flask
2. Add DI water to the 1000 ml mark and mix well.
3. Pipette 25 ml aliquot of the diluted solution into a 400 ml beaker
4. Add 25 ml of 50% sulfuric acid
5. Pipette 25 ml of 0.1N cerric sulfate into the mixture
6. Add a few glass beads and boil for 10 - 15 minutes
7. Cool and add DI water to the 200 ml mark
8. Add a few drops of ferroin indicator
9. Titrate to a red end point with 0.1N FAS*

Calculate: **Anodal EE (% vol) = [25 - (mls FAS x F)] /2.67**

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