enthone

Technical Data Sheet

ALUMON®

Zincate process for plating on aluminum

ALUMON powder is dissolved in water to make a solution to activate aluminum alloys by applying a thin, adherent zinc alloy film by immersion. The ALUMON process can be used prior to electroless nickel plating of aluminum with excellent results. This film can also be electroplated with copper, nickel, or other deposits. READ ENTIRE TECHNICAL DATA SHEET BEFORE USING THIS PRODUCT.

The ALUMON process does not materially affect the surface finish of the aluminum and the subsequent deposits reproduce the condition of the aluminum surface. Brilliant finishes can be obtained by plating on buffed surfaces. The ALUMON process is suitable for almost all aluminum alloys.

HOW TO USE ALUMON

OPERATING CONDITIONS

Concentration	4.5 lb. per gallon (540 g/L)
Specific gravity	41.5º Baumè (Sp. Gr. 1.407)
Temperature	60 to 75 ºF (16 to 24 ºC)
Time	5 seconds to 2 minutes

MAKE-UP

Fill the tank one-half to two-thirds with cold water. Slowly add the ALUMON powder with constant stirring. There will be considerable heat librated on dissolving the powder and the solution should be allowed to cool to room temperature before using. Fill the tank to the proper level with water.

TEMPERATURE

The best temperature range for the ALUMON process is 60 to 75 ºF (16 to 24 ºC). Higher temperatures tend to accelerate the formation of the zinc film and it may become porous or spongy especially on the more active alloys. It is advisable to have a cooling coil available for use during hot weather or for cooling the solution after making a large addition of ALUMON powder.

IMMERSION TIME

Immersion time depends on the temperature, the alloy, and the passivity of the aluminum surfaces. Excessive immersion times will result in a spongy, poorly adherent zinc coating which may cause blistering of the subsequent plate. If the alloy reacts vigorously with the ALUMON solution, the immersion time must be short. If there is no visible reaction, the immersion time must be from 30 seconds to two minutes. A uniform light gray coating should be deposited. If the coating is spotty or bare in certain areas, the preparation of the aluminum surface was incomplete. Occasionally a consistently dark coating occurs on certain alloys. This film is satisfactory for plating and provides excellent adhesion.

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DOUBLE ZINCATING

a double zincate may be used for better adhesion on difficult-to-plate alloys. This consists of a two minute dip in ALUMON stripping of the zinc coating in nitric acid, and then re-immersion in ALUMON for 5 to 15 seconds. The same nitric acid dip should not be used for both smut removal prior to the first dip in the ALUMON and for stripping zinc; use a separate nitric acid bath for zinc removal prior to the second ALUMON immersion. The double dip method is especially useful when two or more aluminum alloys are bring processed through the same line on an automatic machine and the immersion time will be the same for all alloys.

RACKING

Racking should be done by means of stainless steel or aluminum spring contacts. Because aluminum is not heavy enough to make a secure contact by simple hanging, there should be tight contact between the work and rack and between the rack and the bus bar. Exposed rack areas other than the contacts should be coated with a suitable insulating rack coating.

OPERATION

In general, castings are somewhat porous and tend to hold the viscous ALUMON solution even when well rinsed. Therefore, a dilute acid rinse of ½ to 1 percent sulfuric acid for not more than two seconds and a second water rinse should follow the water rinse after the ALUMON treatment. This is especially advisable when nickel is to be plated directly over the ALUMON coating.

Silicon alloys are either very reactive, requiring short immersion periods of 10 seconds or less, or very unreactive and require immersion of two minutes or more. Aluminum alloys 1100 and 5052, frequently cause difficult in plating due to their chemical activity. A double zincate operation in the ALUMON solution will permit these alloys to be plated either with copper or directly with nickel.

Aluminum plated with nobler metals such as nickel, gold, silver, tin, copper and chromium should not be exposed to severely corrosive conditions such as salt atmosphere, high humidity or continuous exposure to water. Nickel-plated aluminum to be used outdoors should have a minimum thickness of 750 millionths of an inch (2 microns) of nickel and should be chromium plated. Nickel plated aluminum with 10 millionths of an inch (0.0254 microns) or more of decorative chromium appears to withstand corrosion better than nickel-plated aluminum without a chromium deposit. The best plate to apply to aluminum for outdoor weathering or protection against salt for corrosion is cadmium.

The best metal to deposit on aluminum for soldering is electroless nickel. A minimum coating of 100 millionths of an inch (0.254 microns) must be applied. For high temperature resistance, direct electrolytic nickel plating upon the ALUMON coating is best. Copper can be used as a base for soldering but a much heavier coating must be plated, usually at least 300 millionths of an inch (0.762 microns).

Zinc will tend to protect aluminum against corrosion under severely corrosive conditions but under mildly corrosive conditions such as general weathering, aluminum is slightly anodic to zinc.

The properly cleaned and acid-dipped work is simply immersed in the ALUMON solution for the proper length of time. When the work enters the solution it should be agitated to insure that all of the water on the surface is replaced with the ALUMON solution and that all air bubbles are expelled. Since the solution is fairly viscous, the initial agitation should be vigorous. Likewise, the work must be thoroughly agitated during the first few seconds of the subsequent rinse to replace the ALUMON with water.

The specific plating cycle varies slightly with the aluminum alloy and the metal to be deposited. The services of the Enthone laboratory are available to plate sample parts and to recommend a specific plating cycle.

CLEANING

Three types of alkaline cleaning may be employed on aluminum alloys.

Non-etch cleaning – for brightly buffed surfaces where no etching is desired and ENBOND® non-etching cleaner at 8 oz/gal. (60 g/L), 180 to 200 ºF, (82 to 93 ºC) for 1 to 5 minutes should be used.

Non-silicated mild-etch cleaning – for use where no etching or very mild etching is desired and where silicated films, produced by non-etch cleaners, are undesirable. Recommended for general work. Use an ENBOND non-silicated cleaner at 2 to 6 oz/gal. (15 to 45 g/L), 120 to 150 ºF (49 to 66 ºC) for no etching, or at y to 8 oz/gal (45 to 60 g/L) 160 to 180 ºF, (71 to 82 ºC) for mild etching. Cleaning times range from 1 to 4 minutes.

Etch Cleaning – for use where etching of the aluminum is desired for appearance or for superior adhesion where brightness of plate is not essential. Use an EN ENBOND etch cleaner at 6 to 8 oz./gal (45 to 60 g/L), 140 to 160 ºF (60 to 70 ºC) for 5 to 120 seconds.

Detailed operating instructions on all of the Enthone alkaline cleaners are available from your Enthone representative.

ACID DIPPING

Following non-etch cleaning – a 5 to 10 second dip in a 2 oz/gal (15 g/L) solution of ACTANE 70 is sufficient to remove the siliceous film remaining from ENBOND non-etch cleaners. The work should be removed as soon as passing covers the entire surface to avoid dulling the luster of the buffed aluminum.

Following mild-etch or etch cleaning – If the aluminum alloy contains only copper as an alloying element, a nitric acid dip will remove the copper smut. If the alloy contains both copper and silicon, a nitric acid-ACTANE 70 dip or a nitric-sulfuric – ACTANE 70 dip is required to completely remove the smut. If the alloy contains magnesium, a nitric-sulfuric ACTANE 70 dip is required to completely remove the smut.

Nitric Acid Dip

Concentration	
Nitric Acid, 36º Bé (Sp. Gr. 1.33)	2 parts by volume
Water	1 part by volume
Temperature	Room temperature
Time	about 15 seconds

Nitric-ACTANE 70 Dip

Concentration	
Nitric Acid, 36º Bé (Sp. Gr. 1.33)	3 parts by volume
Water	1 part by volume
ACTANE 70	1 lb/gal (120 g/L)
Temperature	Room temperature (exhaust ventilation)
Time	5 to 15 seconds

Nitric-Sulfuric – ACTANE 70 DIP

Concentration	
Nitric Acid, 36º Bé (Sp. Gr. 1.33)	2 parts by volume
Sulfuric Acid, 66 º Bé (Sp. Gr. 1.84)	1 part by volume
Water	1 part by volume
ACTANE 70	1 lb/gal (120 g/L)
Temperature	Room temperature (with exhaust ventilation)
Time	5 to 15 seconds

Complete operating instructions for ACTANE 70 are available from your Enthone representative.

NICKEL PLATING

In many cases, it is possible to nickel plate directly upon the ALUMON coating and obtain adherent, bright electrodeposits. Generally, a non-etching cleaning process is used. Most commercial bright nickel solutions are satisfactory for this purpose providing contact is made either before entering the solution or by placing the rack rapidly onto a live cathode bar. The nickel solution should be operated near the high limit of the pH range. If there is a build-up of zinc in the nickel solution, it can be removed by low current density electrolysis.

When a dull nickel plate is desired prior to buffing or soldering, the following solution has proven very satisfactory.

Concentration	
Nickel Sulfate	16 oz/gal (120 g/L)
Ammonium chloride	4 oz/al (30 g/L)
Boric Acid	3 oz/gal (23 g/L)
Sodium sulfate	16 oz/gal (120 g/L)
Anodes	Rolled depolarized
Current density	5 to 15 A/ft^2 (0.5 to 1.5 A/dm^2)
Temperature	70 to 90 ºF (21 to 32 ºC)

A dull Watt's nickel solution is not recommended because of the low tolerance of the solution for zinc.

COPPER PLATING

A cyanide copper strike solution can be used providing the pH is not above 10.5 High pH such as is present with the high speed copper plating solutions, results in attack upon the base aluminum, and adherent copper deposits are usually not obtained. The special low pH, low free-cyanide copper strike solution recommended for use with the ALUMON process is as follows:

Concentration	
Copper cyanide	3.5 oz/gal (28 g/L
Sodium cyanide	4.5 oz/gal (32 g/L)
Free cyanide	0.2 to 0.4 oz/gal (1.5 to 3 g/L)
Sodium carbonate	4 oz/gal (30 g/L)
Rochelle salts	4 oz/gal (30 g/L)
Temperature	120 ºF (49 ºC)
pH	10.5 maximum
Current density	20 to 30 A/ft^2 (2 to 3 A/dm^2)
Time	3 to 5 minutes

Other deposits such as copper from high speed solutions, nickel zinc, silver, etc. can then be plated over the initial copper deposit.

CHROMIUM PLATING

Direct chromium plating on the ALUMON film is possible if careful attention is given to the application of the plating current BEFORE the piece is introduced into the chromium solution. However, for most applications it is generally advisable to deposit the chromium over a previous applied copper or nickel-deposit. Since nickel is harder than the aluminum alloys, the benefits of a hard chrome deposit are not reduced by the thin undercoat of nickel.

SILVER PLATING

Silver has been directly deposited upon ALUMON coatings using the customary silver strike followed by a silver plating solution. However, it is recommended that nickel plate be applied as an undercoat to secure most adherent deposits and particularly deposits that will withstand aging and high temperatures.

TIN PLATING

Tin cannot be plated satisfactorily upon the ALUMON coating. It is best to apply a copper or nickel plate and then tin plate using either the fluoborate or stannate type solutions. When fusion of the tin is to be done, a copper undercoat is preferred.

CADMIUM PLATING

Sometimes it is possible to cadmium plate directly upon the ALUMON coating by using half-strength cadmium strike. However, cadmium solutions are very alkaline and there may be attack upon the base aluminum and the cadmium deposits may blister after standing. Therefore, first apply a nickel flash to the aluminum and then cadmium plate over the nickel coating using a nickel sulfate-sodium sulfate solution. A nickel thickness of 50 to 100 millionths of an inch (0.127 to 0.254 microns) should be applied. A copper undercoat in place of nickel is recommended for barrel plating.

GOLD PLATING

Gold should not be deposited directly over the ALUMON coating because rapid diffusion will occur; Nickel is the best base for the gold plating.

EQUIPMENT

ALUMON solution can be contained in steel, stainless steel, plastic or plastic-lined tanks. The use of a steel or stainless steel cooling coil is suggested especially during the summer months, and to cool the solution after make-up or after a large addition of salts.

Exhaust ventilation is recommended to remove dust or fumes that may be generated during make-up and operation.

CONTROL

ALUMON solution is controlled by means of density or specific gravity. There is sufficient reservoir of salts present so that chemical analysis is not required. The density of the solution should be 41.5º Baumé or specific gravity 1.407 at 70 ºF (21 ºC). If the density is less, add salts; and if the density if more, add water to dilute the solution to the proper density. It is recommended that additions of ALUMON salts be made at the close of the day to allow complete dissolution overnight and to allow the solution to cool to room temperature in cases where large amounts of salts are required.

SAFETY AND HANDLING INFORMATION

DANGER! CONTAINS SODIUM CYANIDE/SODIUM HYDROXIDE

POISON, CORROSIVE: May be fatal if inhaled, ingested or absorbed through the skin. Contact with acid liberates poisonous gas. Contact may also cause irritation or severe burns of skin or eyes, blindness. Inhalation of dust may also cause respiratory tract and lung irritation or buns. Ingestion may also cause gastro-intestinal irritation or burns. Do not get in eyes, on skin or on clothing. Do not take internally.

FIRST AID: If inhaled or ingested, give EMERGENCY FIRST AID TREATMENT for CYANIDE POISONING. GET IMMEDITE MEDICAL ATTENTION. In case of contact, immediately flush skin or eyes with plenty of water for at least 15 minutes; for eyes, get immediate medical attention. Remove contaminated clothing, treat to destroy cyanide, and wash before reuse.

HANDLING INFORMATION: Use with adequate ventilation, Always wear chemical safety goggles, face shield, rubber gloves, respirator, and protective clothing when handling. Avoid contact with acids, oxidizers or any other foreign matter. Exhaust ventilation is recommended to remove dust or vapors that may be generated during make-up and operation. Wash thoroughly after handling.

CONTAINER INFORMATION: Keep container tightly closed. Store indoors in a cool dry area away from acids, salts, or oxidizers. Loosen closure cautiously when opening. Do not reuse container. Triple rinse before disposal. Improper disposal or reuse of container may be dangerous and illegal.

REFER TO MSDS FOR FURTHER SAFETY AND HANDLING INFORMATION.

MATERIAL SAFETY DATA SHEETS

For more detailed information on the toxicological properties of the products described herein, reference can be made to the Material Safety Data Sheet (MSDS) for each product. If you do not have the proper MSDS, it can be requested from: Enthone Inc., attention: Regulatory Affairs Department, 350 Frontage Road, West Haven, CT 06516. For emergency assistance call CHEMTREC (800) 424-9300.

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