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Product Bulletin

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ZINCONAL CN PROCESS

2900049
8/9/06

The **Zinconal CN** process is a treatment for aluminum and its alloys which enables many different electrodeposits to be applied directly without intermediate brass or copper plating. The process is simple and economical to operate and has the advantage of improved adhesion and corrosion resistance over conventional zincate processes.

The **Zinconal CN** dip treatment produces a film on aluminum which may be plated directly with semi-bright, full bright or electroless nickel, cyanide or pyrophosphate copper, brass, silver, chromium, acid tin, zinc or cadmium.

These metals can be plated onto a wide range of allows, including those containing up to 5% copper, 9% magnesium, 1% manganese, 13% silicon or 6% tin.

Some alloys, especially those freshly heat treated, may require modification to the process sequence as indicated on the following page in order to obtain adherent nickel deposits. It may not be possible to obtain satisfactory deposits of all the other metals listed above directly on some aluminum alloys, but these can be deposited over a nickel undercoat.

STANDARD PROCESS SEQUENCE

The basic single dip cycle consists of the following steps:

1. Preclean to remove major soils
2. Etch clean
3. Rinse
4. Remove smut and activate
5. Rinse
6. Zinconal CN
7. Rinse
8. Rinse

Plate as required for finish.

A double dip cycle, applicable to many cast alloys, wrought alloys which contain little or no magnesium, and unknown alloys, produces a very desirable thin zincate film. It consists of Step 1 thru 8 above, followed by:

9. Remove Zinconal CN deposit in 50% by volume nitric acid
10. Rinse
11. Zinconal CN
12. Rinse
13. Rinse
14. Plate as required to finish

The high magnesium alloys, particularly 5052, 6061, and 6063, use an additional step prior to Step 4 in the basic cycle:

3A. Etch in hot 180 deg F (82 deg C) 15% by volume sulfuric acid, 2-5 minutes
3B. Rinse

This should be followed by the single dip zincate cycle using 50% by volume nitric acid in Step 4.

PRECLEANING

Using a non-etch alkaline soak cleaner such as Hubbard-Hall Almet B, 6-8 oz/gal (54-60 g/1), 170-200 deg F (75-93 deg C), or where low temperature application is desired: Hubbard-Hall's Aquaease SL187NE, 100-140° (38-60C). Hubbard-Hall's Aquaease SL80 may be used when a liquid cleaner is preferred. 10% by volume, 180-200°F.

ETCH CLEANING

This should be done in Etch Clean 6LF, 4 oz/gal. (30 g/1) 140-160 deg F., (60-71 deg C), time as required to produce the desired etch or Extend Etch 4-6 oz/gal, (30-45 g/l) 140-160 deg F., (60-71 deg C) 3-5 minutes, depending upon type of etch required.

SMUT REMOVAL AND ACTIVATION

Simple alloys (1100, 3003) frequently respond well to 25-30% by volume Deoxidizer 13L non-fuming desmutter.

Of more general use is a mixture of 65% by volume nitric acid, 25% water, to which is added 1 lb/gal (120 g/l) of Descaler D. This is particularly effective on silicon containing casting alloys.

An acid mixture which is almost universally applicable and is especially effective on magnesium containing alloys, consists of 50% by volume nitric acid, 25% sulfuric acid, 25% water, to which is added 1 lb/gal Descaler D. A less active dip consists of 60% nitric acid, 15% sulfuric acid and 25% water, to which is added 8 oz/gal (60 g/1) of Descaler D.

All acid dips are used at room temperature and for a time sufficient to produce a white, smut-free surface.

Your local Technical Sales Representative will advise you of the best surface preparation for your particular application.

ZINCONAL CN – ZINCATE

Zinconal CN is supplied ready to use and it is only necessary to pump the liquid into the tank, which should be of steel, plastic or steel lined with rubber or plastic. It is an immersion process with no electric current needed. Provisions for heating up to 104 deg F (40 deg C) should be made in cases of some tin containing aluminum alloys. Heating may also be necessary to keep the solution to its minimum temperature of 60 deg F (15 deg C) during the winter months.

The Zinconal CN must be kept well mixed. The tank may be fitted with air agitation pipes or, alternatively, the solution could be stirred manually, daily, before use. This stirring will prevent stratification of the solution. For the maintenance of this solution see the analytical section.

OPERATING CONDITIONS

Immersion in Zinconal CN should produce a uniform film all over the aluminum. If a patchy film forms, this is indicative of either over-cleaning or under-cleaning and these preliminary operations should be checked. Temperature should be within the range 60-85 deg F (15 – 30 deg C) and the immersion time is from 20 seconds to 2 minutes.

The time of immersion in Zinconal CN Dip can be varied according to the alloy composition. As a rule, the immersion deposit on commercial purity aluminum and alloys containing silicon and copper takes about 2 minutes to develop fully, whereas other alloys, e.g. those containing magnesium, will require shorter immersion times.

MODIFICATIONS TO THE STANDARD PROCESS

For Alloys

On certain magnesium alloys a double Zinconal CN Dip treatment is advised, as this gives better adhesion of the nickel plate.

Some alloys are best treated in acids other than straight 50% nitric acid (step 4 see section on smut removal and activation page 2).

ARTICLES LIKELY TO CARRY-OVER SOLUTION

On articles which tend to trap liquids, whether having poor surface or a particular shape, the use of 0.5% by volume sulfuric acid dip following the rinse after Zinconal CN to prevent carry-over of the Zinconal CN dip solution into a nickel plating solution is recommended.

ARTICLES HAVING UNPOLISHED AREAS

On aluminum spinnings or pressings which have some portion that is not polished, it is advisable to etch in Hubbard-Hall's Extend Etch before polishing.

RACKING

It is advisable to use racks or wires made from aluminum alloy or, alternatively, plastic coated racks with aluminum or stainless steel tips. For many applications copper wire can be used; there is, however, a possibility that the bimetallic effect between the copper and the aluminum may affect the adhesion of the plate applied around the contact area. The use of copper wire should therefore be tried out on a few articles before proceeding with large scale production. It should be noted that the life of the copper wire contacts may be reduced due to immersion in nitric acid, especially in the case of "double dip" cycles.

DEPOSITION OF METALS OTHER THAN NICKEL

Hard Chromium Plating on Aluminum

Hard chromium can be deposited onto aluminum and most of its alloys after the standard Zinconal CN process sequence. Solution containing sulfates only, as catalysts, must be used. When depositing chromium directly, the work must go into the chromium plating solution "live." It is also sometimes advisable to "strike" for a few seconds at approximately double the current density normally used before the voltage is lowered.

For parts of large bulk, it is recommended that rinse 13 in the standard process sequence is used warm, so that the parts enter the chromium solutions pre-heated.

COPPER AND BRASS

These metals can be deposited from the normal cyanide or pyro-phosphate type solutions, using the standard Zinconal CN sequence on the majority of alloys. Acid copper solutions cannot be plated directly on the Zinconal CN treated part; a cyanide copper flash is therefore recommended.

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TIN

Deposition from sodium stannate solutions directly over Zinconal is not possible, but acid tin solutions based on stannous sulfate/sulfuric acid or fluoborate tin can be used successfully.

SILVER

Silver has been deposited satisfactorily from standard cyanide solutions directly onto aluminum after the standard Zinconal sequence without "striking." On alloys where this is not possible, an undercoat of nickel or copper should be used.

CADIUM AND ZINC

Both these metals have been plated successfully from normal bright cyanide solutions directly onto aluminum treated by the standard Zinconal process sequence.

GOLD

It is recommended that an undercoat of nickel be used prior to deposition of gold.

ELECTROLESS DEPOSITION

Electroless nickel can be deposited directly over the Zinconal CN layer after rinsing.

CORROSION PROTECTION

The protection afforded by nickel and chromium coatings on Zinconal CN processed aluminum has been shown in many corrosion tests to be similar to that given on other metals. This may be used as a guide to the thicknesses to be used for specific applications.

Service Application	Minimum Thickness Nickel	Chromium
For severe service	Duplex 30 microns 0.0012 in.	Regular 0.25 microns 0.00001 in.
- Alternatively		
	Bright 30 microns 0.0012 in.	Microcracked 0.8 microns 0.00003 in.
For moderate service	Bright 20 microns 0.0008 in.	Regular 0.25 microns 0.00001 in.
For mild service	Bright 10 microns 0.0004 in.	Regular 0.25 microns 0.00001 in.

It is strongly recommended that a topcoat of 0.8 microns *0.00003 in) of microcracked chromium be used on all aluminum parts to be exposed to outdoor conditions, as this will greatly improve their corrosion resistance.

A Duplex nickel deposit provides greater benefit when deposited on aluminum than onto other basis metals. It is therefore worth considering the use of such a system as the undercoat for severe outdoor applications, such as automobiles, even if microcracked chromium is being used.

MAINTENANCE OF THE ZINCONAL CN DIP

Where drag out is high due to the shape of the articles being processed, the Zinconal CN bath solution level should be maintained with Zinconal rather than water.

Zinconal has a long life. It may be used to exhaustion and then discarded and a fresh solution prepared, or the strength of the solution may be maintained by the addition of special powder mixtures. Where the Zinconal CN solution is used without maintenance additions, it will generally

be possible to treat 100 ft. sq of surface per gallon before exhaustion when a 2-minute immersion time is used, and greater areas if the immersion time is shorter.

Where the strength of the Zinconal CN solution is maintained by continuous additions, these may be made on the basis of the area of aluminum treated or from analytical results, as described in Sections (a) and (b) below.

(a) Maintenance of Zinconal CN Dip Based on Area Processed

For every 50 ft sq/gal aluminum processed in a 2-minute Immersion Double Dip Cycle add to the Zinconal CN Dip the following:

Zinconal CN Liquid Additive	48 fl.oz/gal….37.5 cc / liter
Zinconal CN Activator	3 oz/gal … 22.5 g/1

These additions can be made once weekly, or if more convenient, on a proportional basis. This method is suggested for Zinconal CN tank with a volume greater than 75 gallons.

Zinconal CN Liquid Additive is a 5 lb/gal (80 oz/gal or 600 grams/liter) concentrate in water. Use Zinconal CN Liquid Additive at a rate of 1 gallon of liquid additive for every 5 lbs. of Zinconal CN Additive Powder. The liquid may be added direct to the bath slowly with vigorous agitation.

When all the Zinconal CN Liquid Additive has completely dissolved, the required weight of Zinconal CN Activator should be added directly to the Zinconal CN bath in the powder form, with vigorous stirring. It is best to add the Zonconal CN Activator at the end of the working day so that the Zinconal CN solution will have had the time to cool down before it is used again.

(b) Maintenance of Zinconal CN from Analytical Results

The solution should be analyzed as given in paragraph 2. Additions should then be made to keep the solution to the following standards:

Zinconal CN Liquid Additive	16 fl.oz/gal…125 cc / liter
Zinconal CN Activator	13.3 oz/gal … 100 g/1

The same procedure should be used for making the required additions as described above.

2. METHODS OF ANALYSIS

(a) ZINCONAL CN LIQUID ADDITIVE

Reagents required:

0.02 Molar EDTA Solution

EDTA Buffer made as follows:

40g Ammonium Chloride

200 ml Ammonium Hydroxide

Dilute with distilled water, to 1 liter

5% Potassium Cyanide Solution

Formaldehyde Solution (4% by volume)

CFR Indicator – Available from the CLEPO Laboratories

Method

The estimation is carried out in duplicate, the first sample being used for the initial approximate titration and as a color matching sample for the accurate second titration.

1. Using a safety pipette transfer 2 ml of Zinconal CN solution into each of the two 350 ml conical beakers and add 25 ml of distilled water.

2. Add to each beaker 4 to 5 ml potassium cyanide solution, 5 ml of Buffer solution, and then 5 drops of CFR Indicator.

3. To one beaker add 8 to 10 ml of 4% formaldehyde solution from a burette, when a red color will develop.

4. Titrate with standard EDTA solution until the color is approximately equal to that of the second sample (yellow). Note this titration and then add 1 ml excess to give a color standard for the second estimation.

5. To the second sample add formaldehyde at paragraph 3 and then titrate with standard EDTA solution until the color matches that of the color standard. Note this titration value.

b) ZINCONAL CN ACTIVATOR

Regents Required:

1.0N Sulfuric Acid Standard solution

Phenolphthalein Indicator

Method

Measure out, using a safety pipette, 5 ml of the Zinconal CN solution into a 250 ml conical flask, dilute with water, add phenolphthalein indicator and titrate with normal sulfuric acid until the red color is just discharged.

Titration value (ml) x 9.0 = g/l Zinconal CN Activator

Titration value (ml) x 1.2 = oz/gal Zinconal CN Activator

HAZARDS

Zinconal CN and Zinconal CN Activator contains cyanide which on contact with acids will product hydrocyanic acid gas (hydrogen cyanide – HCN) – a deadly poison.

A cyanide antidote kit should be available wherever cyanides are used.

Cyanide poisoning can be caused by ingestion, inhalation or by skin absorption.

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STORAGE AND HANDL

ING

Zinconal CN materials should be kept in an appropriate location, away from acids and foodstuffs. Skin contact with the solution or salts must be avoided. When measuring out salts or powders, a suitable chemical cartridge respirator and appropriate protective clothing should be worn and washed before re-use. Personnel should wash thoroughly after handling these materials.

TREATMENT IN THE EVENT OF SKIN CONTACT

Poisoning by cyanide can be caused by skin absorption, as well as ingestion and inhalation; therefore, any solution splashed onto the skin should be immediately washed off with copious volumes of water and then washed with buffered phosphate solution, a boric (boracid) acid solution or a 5% acetic acid or vinegar solution. Any affected areas of clothing should be flooded thoroughly with water before attempting removal.

Buffered Phosphate Solution Concentrate

Monobasic Sodium Phosphate	70 g	
Dibasic Sodium Phosphate	180 g	
Brilliant Green Dye for Identification	0.15 g	
Distilled Water		880 ml

Mix 1 part with 1 part water before use

TREATMENT IN THE EVENT OF POISONING

Summon medical attention immediately. Remove to fresh air and lay patient down. Remove affected clothing and wash with copious quantities of water. Carry out procedure indicated in the Cyanide Poisoning Antidote Kit until medical help arrives.

DISPOSAL

Appropriate provisions should be made for the treatment of cyanide containing rinse waters in accordance with local authority requirements. Any spillage of solution should be dilated and washed into the effluent treatment plant. Empty containers should be washed out into the effluent treatment plant or treated with sodium hypochlorite.

After cyanide destruction the heavy metals contained in the Zinconal CN solution should be precipitated as a hydroxides by pH adjustment and settled or filtered out of solution to meet local restrictions. The final effluent pH must be adjusted to that range required by the local authority and the metal sludge disposed of in an approved suitable landfill.

The information presented herein was prepared by technically knowledgeable personnel, and to the best of our knowledge is true and accurate. It is not intended to be all-inclusive, and the manner and conditions of use and handling may involve other or additional considerations.