



Standard Practice for Preparation of Nickel Alloys for Electroplating¹

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1. Scope

1.1 This practice is intended to serve as a guide for producing adherent electrodeposits of nickel on nickel alloys. Only those methods that are well known and generally practiced are included. Methods that have been used successfully but not on a broad scale are not included. Once nickel is applied, other metals may be electroplated on the product.

1.2 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Cleaning

2.1 The following cleaning treatments may be used. The choice of the procedure will be governed largely by the condition of the surface.

2.1.1 Degreasing is used to remove the bulk of grease, oil, and finishing compounds that may be present on the surface. The cleaning may be vapor degreasing, solvent wash, emulsion cleaning, or soak cleaning.

2.1.2 *Electrolytic Alkaline Cleaning*—Removal of final traces of dirt, grease, and oil is accomplished best with electrolytic alkaline cleaning. The solution may be either a proprietary cleaner or a formulated one.

3. Activation

3.1 The procedure used for activating the nickel alloy surface usually determines the soundness of the adhesion. The choice of treatment is governed by the condition of the surface and the type of alloy. A mild etching treatment should be used on polished surfaces if a highly finished surface is required. Too mild a treatment may result in a sacrifice of maximum adhesion.

3.2 *Anodic-Cathodic Sulfuric Acid*—A 25 mass % sulfuric acid solution, containing 166 mL of concentrated, 93 mass % sulfuric acid (density 1.83 g/mL) diluted to 1 L is used for this etching treatment in which the alloy is first etched anodically at

a low-current density of 2 A/dm² for 10 min and then made passive at 20 A/dm² for 2 min and finally cathodic for 2 or 3 s at 20 A/dm². (**Warning**—Slowly add the sulfuric acid with rapid stirring to the approximate amount of water required.) When the initial mixture cools, dilute to exact volume. The temperature of the solution should be in the range from 20 to 25°C (70 to 80°F). Chemical lead may be used for the electrodes. Rinsing should be used before electroplating.

NOTE 1—This activation is not suitable for barrel operation.

3.3 *Acid-Nickel Chloride Treatment*—This procedure uses an anodic treatment followed by a cathodic treatment in a low-pH nickel chloride solution. The composition of the solution is 240 g/L of nickel chloride (NiCl₂·6H₂O) and 31 mL of concentrated 31.45 mass % hydrochloric acid (density 1.16 g/mL). The normal procedure is to make the alloy anodic for 2 min at 3 A/dm² and then cathodic for 6 min at the same current density. The temperature of the solution should be in the range from 20 to 25°C. Nickel may be used for the electrodes. Separate tanks are recommended for the anodic and cathodic steps to avoid contamination of solution but a single tank may be used. Rinsing should be used before electroplating except where indicated in Table X1.1.

NOTE 2—Nickel anode materials containing greater than 0.01 % sulfur are not recommended for use in acid nickel strike baths operating at pH 0.5, or lower, to avoid oxidation of sulfides by hydrochloric acid.

3.4 *Anodic Etching in a Low pH Watts Bath*—The composition of the low pH Watts Bath is 360 g/L of nickel sulfate (NiSO₄·7H₂O), 45 g/L of nickel chloride (NiCl₂·6H₂O), and 37.5 g/L of boric acid (H₃BO₃). This procedure uses an anodic treatment in a low-pH (2.0) bath for 10 min at 2 A/dm². The current is then reversed and the nickel is electroplated under normal conditions. Electrolytic nickel may be used as the opposing electrode material. No rinsing is needed if the alloy is transferred to a chloride-containing electroplating bath.

3.5 *Hydrofluoric Acid Etch*—This procedure consists of a 10-s dip in a solution containing 500 mL of 47 mass % hydrofluoric acid diluted to 1 L at room temperature. Rinsing should precede electroplating.

4. Alloys

4.1 Recommended activating treatments for specific nickel alloys are listed in the Appendix, Table X1.1.

¹ This practice is under the jurisdiction of ASTM Committee B08 on Metallic and Inorganic Coatings and is the direct responsibility of Subcommittee B08.02 on Pre Treatment.

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APPENDIX
(Nonmandatory Information)
X1. RECOMMENDED ACTIVATION TREATMENTS FOR NICKEL ALLOYS
TABLE X1.1 Activation Treatments for Nickel Alloys

Alloy	Activation	Comment
Permanickel 300	3.2	...
Duranickel 301	3.2	...
Incoloy 801	3.3	no rinsing before electroplating
Incoloy 901	3.5	...
Inconel 600	3.3	...
Inconel 722	3.3	anodic step only 15 s
Inconel 750	3.3	...
Invar Regular	3.2	3 min after onset of passivity
Invar 36	3.3	...
42 % nickel-iron	3.2	3 min after onset of passivity
46 to 50 % nickel-iron	3.2	3 min after onset of passivity
Monel 400	3.2	5 min after onset of passivity
Monel K-500	3.2	5 min after onset of passivity
Monel R-405	3.2	5 min after onset of passivity
Monel 501	3.2	5 min after onset of passivity
Nickel 205	3.4	...
Nickel 211	3.4	...
Nimonic 75	3.3	...
Nimonic 80A	3.3	...
Ni-Span C902	3.2	...
Ni-Resist Type 1	3.2	...
Ni-Resist Type 2-5	3.2	...

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