



# Lab Manual

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Chapter 1.11

## ***Miscellaneous Plating Solutions***

### **Copper Displacement Plating Solution (W. G. Oldham)**

- ▶ 50 ml Al<sub>2</sub>O<sub>3</sub>
- 50 ml CuCl
- 50 ml CuSO<sub>4</sub>
- 50 ml HF
- 500 ml H<sub>2</sub>O

Plate one minute. (Pits silicon but removes Al<sub>2</sub>O<sub>3</sub>.)

### **Gold Electroplating using E-55 Engelhard Salts**

- ▶ Clean surface well before plating. Combine:
  - 4 g salts
  - 100 ml DI H<sub>2</sub>O
  - Warm to dissolve.

Add 1.63 g E-55 gold cyanide.

Use stainless steel anode. Warm to 150°C. Current density: 35 Ma/in<sup>2</sup>. Plating rate at above current: 0.0001"/7min.

### **Nickel Plating (Electrodeless) for Ohmic Contacts (W. G. Oldham)**

JECS 1957, p 226.

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Nickel Chloride	30 g/L
Sodium Hypophosphite	30 g/L
Ammonium Citrate	65 g/L
Ammonium Chloride	50 g/L

Filter solution. Warm to 90°C. Give sample aluminum wand treatment. Ad NH<sub>4</sub>OH until solution turns from green to blue (pH 8-10).

### **Nickel Plating of Brass (Wheeler)**

- ▶ Start with clean degreased (trichlor) surface. Plating will only be as good and shiny as original surface. Dip and etch in **clean acid\*** and **bright acid\*\*** for less than 1 minute (until bubbles appear). Wash well with DI water and carry to **plating solution\*\*\*** wet. Plating rate: ~1 mil/10 min. For brightest surface, buff with rough afterwards.

#### **\* Wheeler's Clean Dip**

H <sub>2</sub> SO <sub>4</sub>	136 oz
HNO <sub>3</sub>	26 oz
HCl	2 oz
Water	Sufficient to bring volume to 1 gal.

**\*\* Wheeler's Bright Dip**

H<sub>2</sub>SO<sub>4</sub>: HNO<sub>3</sub> 1 : 1  
 Mix in ice bath

**\*\*\* Nickel Plating Solution**

Nickel ammonium sulfate	8 oz
Nickel sulfate	4 oz
Boric acid	2 oz
Sodium chloride	2 oz
Water	Sufficient to bring volume to 1 gal.
pH	5.8
Voltage	21.5 V
Current Density	6.8 amp/ft
Anode	Pure nickel
Anode/Cathode ratio	1.1 : 1

**\*\*\* White's Nickel Plating Solution****Ni Stock**

NiSO <sub>4</sub>	350 g dissolved in one liter water
H <sub>3</sub> BO <sub>3</sub>	32.2 g
NaCl	13.4 g
Sodium lauryl sulfate	0.4 g
H <sub>2</sub> SO <sub>4</sub> conc.	17.5 ml

Heat if necessary to dissolve. Adjust pH to 3 with pH stock.

**pH Stock**

40 g NaOH  
 300 ml DI water

**Plating Solution**

Pure Ni Stock	200 ml
CoCl (0.74M) (1.8g/10ml)	1.5 ml
Sodium salt of naphthalene disulfonic acid (2.7M) (11.8 g to 150 ml DI water)	8 drops

**Plating**

Current density	20 mA/in <sup>2</sup>
Plating rate	1000 Å/min.