Copper Displacement Plating Solution (W. G. Oldham)

- 50 ml Al₂O₃
- 50 ml CuCl
- 50 ml CuSO₄
- 50 ml HF
- 500 ml H₂O

Plate one minute. (Pits silicon but removes Al₂O₃.)

Gold Electroplating using E-55 Engelhard Salts

- Clean surface well before plating. Combine:
  - 4 g salts
  - 100 ml DI H₂O
  - Warm to dissolve.

Add 1.63 g E-55 gold cyanide.

Use stainless steel anode. Warm to 150°C. Current density: 35 Ma/in². Plating rate at above current: 0.0001"/7min.

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

JECS 1957, p 226.

- 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. Add NH₄OH 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
  - H₂SO₄ 136 oz
  - HNO₃ 26 oz
  - HCl 2 oz
  - Water Sufficient to bring volume to 1 gal.
**Wheeler's Bright Dip**

\[ \text{H}_2\text{SO}_4 : \text{HNO}_3 = 1 : 1 \]

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\(_4\): 350 g dissolved in one liter water
- H\(_3\)BO\(_3\): 32.2 g
- NaCl: 13.4 g
- Sodium lauryl sulfate: 0.4 g
- H\(_2\)SO\(_4\) 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\((0.74\text{M}) (1.8g/10\text{ml})\): 1.5 ml
- Sodium salt of naphthalene disulfonic acid\((2.7\text{M}) (11.8 \text{~g~to~} 150 \text{~ml~DI~water})\): 8 drops

**Plating**

- Current density: 20 mA/in\(^2\)
- Plating rate: 1000 Å/min.