

# ▶ **SURFACE FINISHES**

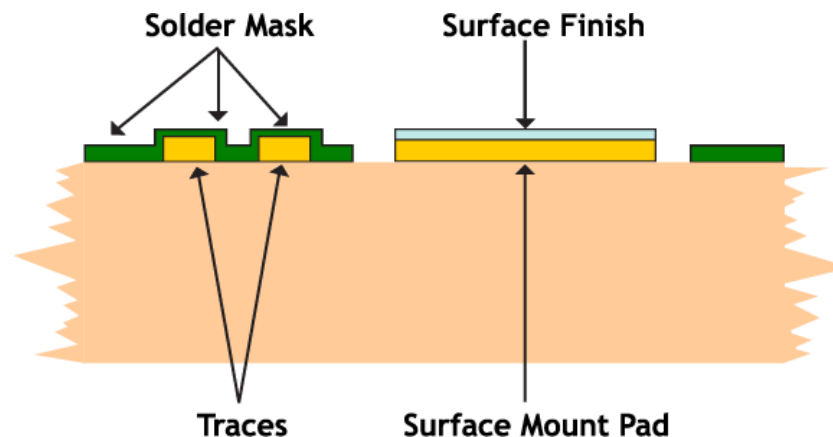
## **Technical Webinar**

## ► Overview:

The printed circuit board surface finish forms a critical interface between the component to be assembled and the bare PCB. The surface finish has two essential functions:

- To protect the exposed copper circuitry.
- To provide a solderable surface when assembling (soldering) the components to the PCB.

Most surface finishes are considered SMOBC (Solder Mask Over Bare Copper).



▶ **Factors When Choosing Finish:**

- Cost
- RoHS \ WEEE \ ELV
- Assembly Method
- Components Used
- Durability
- Environment
- Shelf Life
- Testability
- Productivity
- Failures

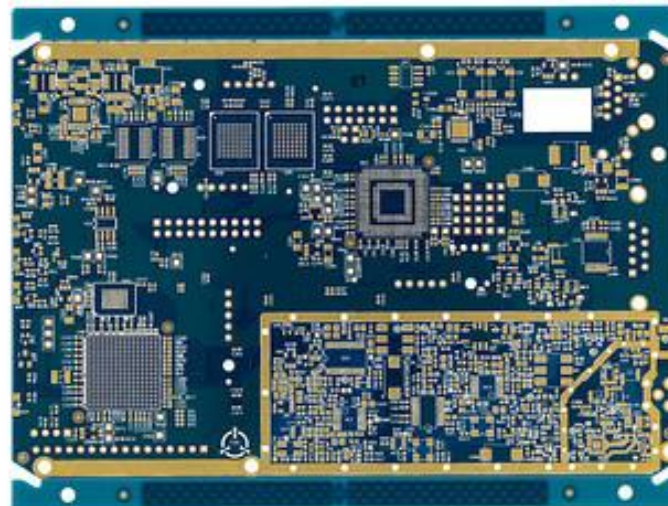


▶ **Element Symbols:**

<b>Copper</b>	Cu
<b>Gold</b>	Au
<b>Silver</b>	Ag
<b>Tin</b>	Sn
<b>Nickel</b>	Ni
<b>Lead</b>	Pb
<b>Carbon</b>	C
<b>Germanium</b>	Ge
<b>Palladium</b>	Pd

▶ **Surface Finishes Covered:**

- HASL
- Lead Free HASL
- Immersion Tin
- Immersion Silver
- OSP / Entek
- Gold
  - ENIG
  - Hard Gold
  - Wire Bondable Gold



## ▶ HASL / Lead Free HASL:

### Two Different Metals – Same Finish

- HASL (Standard): Typically Tin-Lead
- HASL (Lead Free): Typically Tin-Copper, Tin-Copper-Nickel, or Tin-Copper-Nickel Germanium.

Typical thickness: 70 micro inch – 200 micro inch, however IPC spec calls for only complete coverage of copper pads.

#### Advantages:

- ▶ Low cost
- ▶ Widely Available
- ▶ Reworkable

#### Disadvantages:

- ▶ Uneven surfaces
- ▶ Not good for fine pitch
- ▶ Pb
- ▶ Thermal shock
- ▶ Solder Bridging
- ▶ Plugged or reduced PTH's

#### Process Flow

Clean	Microetch	Apply Flux	Solder Dip	Air Knife Leveling	Rinsing
-------	-----------	------------	------------	--------------------	---------

Typically Processed in Production Panel Form

## ▶ Immersion Tin:

Typical thickness: 20 micro inch –50 micro inch.

### Advantages:

- ▶ Flat Surface
- ▶ No Pb
- ▶ Reworkable

### Disadvantages:

- ▶ Easy to cause handling damage
- ▶ Process uses a carcinogen (Thiourea)
- ▶ Exposed tin on final assembly can corrode
- ▶ Tin Whiskers
- ▶ Not good for multiple reflow/assembly processes
- ▶ Difficult to measure thickness

### Process Flow

Clean	Microetch	Predip	Apply Tin	Postdip
-------	-----------	--------	-----------	---------

Typically Processed in Production Panel Form

## ▶ OSP / Entek

Organic Solderability Preservative

Typical thickness: 4 micro inch – 24 micro inch; however not usually specified.

### Advantages:

- ▶ Flat Surface
- ▶ No Pb
- ▶ Simple Process
- ▶ Reworkable

### Disadvantages:

- ▶ No Way to Measure Thickness
- ▶ Not Good for PTH
- ▶ Short Shelf Life
- ▶ Can Cause ICT Issues
- ▶ Exposed Cu on Final Assembly
- ▶ Handling Sensitive

### Process Flow

Clean	Microetch	Predip	Flood OSP
-------	-----------	--------	-----------

Typically Processed In 1-up or Array Form



## ▶ Gold – ENIG

Electroless Nickel Immersion Gold

**\*IMPORTANT** - The gold serves as a barrier and protectant to the nickel. The gold will dissolve into the solder during assembly. Gold thicknesses over 4 micro inches can cause solderability issues.

Typical thickness:

- Nickel: 100 micro inch – 200 micro inch
- Gold: 2 micro inch – 4 micro inch

### Advantages:

- ▶ Flat Surface
- ▶ No Pb
- ▶ Good for PTH
- ▶ Long Shelf Life

### Disadvantages:

- ▶ Expensive
- ▶ Not Reworkable
- ▶ Black Pad/ Black Nickel
- ▶ Damage from ET
- ▶ Signal Loss (RF)
- ▶ Complicated Process

### Process Flow

Clean	Microetch	Catalyst	Electroless Nickel	Rinse	Immersion Gold	Rinse
-------	-----------	----------	--------------------	-------	----------------	-------

Typically Processed In 1-up or Array Form

## ▶ Gold – Hard Gold

A.K.A: Flash Gold, Electrolytic Gold, Full body Hard Gold, Tab Gold, Selective Gold

**\*IMPORTANT** - Electrolytic process, all copper surfaces to be plated must be electrically connected to a rectifier (power supply), unless “gold as etch resist” process is used. Unplated copper must be covered by mask or resist. Gold has grain stiffeners and brighteners added.

Typical thickness:

- Nickel: 125 micro inch – 150 micro inch
- Gold: 25 micro inch – 40 micro inch

### Advantages:

- ▶ Hard, Durable Surface
- ▶ No Pb
- ▶ Long shelf life

### Disadvantages:

- ▶ Very Expensive
- ▶ Extra Processing / Labor Intensive
- ▶ Use of Resist / Tape
- ▶ Plating / Bus Bars
- ▶ Demarcation
- ▶ Difficulty with other Surface Finishes

### Process Flow

Apply Resist/Tape	Clean	Micoretch	Electroless Nickel	Rinse	Electrolytic Gold	Rinse	Strip Resist/Tape	Clean
-------------------	-------	-----------	--------------------	-------	-------------------	-------	-------------------	-------

Typically Processed in Production Panel Form

## ▶ **Gold – Wire Bondable Gold**

Typically uses Electrolytic Nickel / Gold processing; however gold must not have added grain stiffeners or brighteners. Nickel hardness is important.

Two Types of Wire Bonding: Aluminum Wedge and Ultrasonic (Thermal)

### **Welding Aluminum Wedge:**

Typical thickness:

- Nickel: 100 micro inch – 200 micro inch
- Gold: 5 micro inch – 15 micro inch

### **Ultrasonic (Thermal) Welding:**

Typical thickness:

- Nickel: 100 micro inch – 200 micro inch
- Gold: 45 micro inch – 60 micro inch

▶ **Summary Matrix**

	<b>Cost</b>	<b>RoHS</b>	<b>Typical Thickness</b>	<b>Processing</b>
<b>HASL</b>	\$	No	Pad Coverage	Panel
<b>Lead Free HASL</b>	\$	Yes	Pad Coverage	Panel
<b>Immersion Tin</b>	\$	Yes	20-50 ui	Panel
<b>Immersion Silver</b>	\$\$	Yes	4-12 ui	1-up / Array
<b>OSP/Entek</b>	\$\$	Yes	4-24 ui	1-up / Array
<b>Immersion Gold</b>	\$\$\$	Yes	Nickel: 100-200 ui Gold: 2-4 ui	1-up / Array
<b>Hard Gold</b>	\$\$\$\$	Yes	Nickel: 125-150 ui Gold: 25-40 ui	Panel

**For More Information Please Contact  
Christopher Perry at 508.995.5171 Ext. 202  
cperry@epectec.com**

1. **Quicker Delivery** - Epec's technology infrastructure and people, including the Asian and US based operations and engineering teams, enable jobs to get started the same day the order data is electronically received by our factory.
2. **Accurate Information** - Epec's on-site personnel provide accurate daily Work In Process reports so customers can receive immediate order status information, along with in person verification of all daily reports by Epec staff.
3. **Better Quality** - Epec ensures higher levels of quality through three key additional processes. On-site QA inspectors at each facility provide an additional audit before it leaves Asia, Epec maintains dual UL approval at each facility with quarterly audits, and perform QA audits at our headquarters in Boston, MA.
4. **Flexibility** - Each of our manufacturing facilities have been selected for their best-in-class niche product and delivery solutions, ensuring our optimal facility is building every order.



TS-16949  
Certified

ISO9001  
Certified

ISO14001  
Certified

- ▶ If you require additional information please contact us with any questions or requests.

### **North American Headquarters**

174 Duchaine Blvd.  
New Bedford, MA 02745  
Tel: (508) 995-5171  
Fax: (508) 998-8694

### **Contact Us By Email:**

Sales [sales@epectec.com](mailto:sales@epectec.com)  
Quotes [quoting@epectec.com](mailto:quoting@epectec.com)  
Engineering [engineering@epectec.com](mailto:engineering@epectec.com)

### **Visit Our Website For More Information**

[www.epectec.com](http://www.epectec.com)



### **Stay Connected with Epec Engineered Technologies**

Join our Social Community and keep in touch with all our latest technology investments, current news, upcoming events, and promotions. Visit our Social Media Websites for more information.

