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SURFACE FINISHES

Technical Webinar

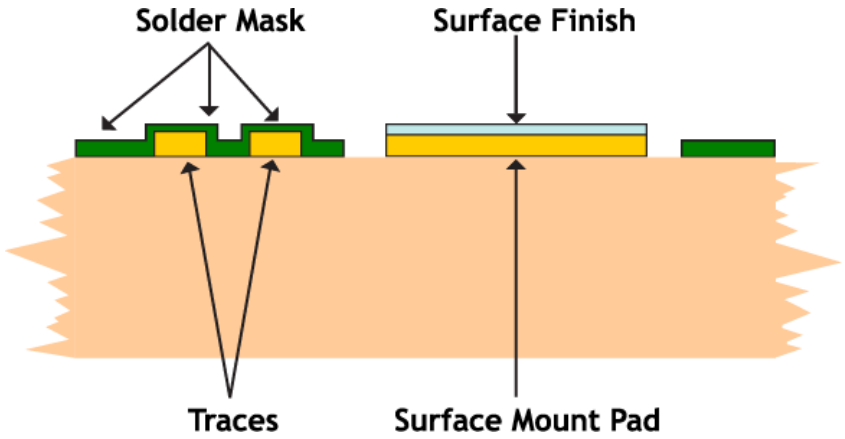
SURFACE FINISHES

- **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).



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SURFACE FINISHES

- **Factors When Choosing Finish:**
  - Cost
  - RoHS \ WEEE \ ELV
  - Assembly Method
  - Components Used
  - Durability
  - Environment
  - Shelf Life
  - Testability
  - Productivity
  - Failures

SURFACE FINISHES

- **Element Symbols:**

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

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SURFACE FINISHES

- **Surface Finishes Covered:**
  - HASL
  - Lead Free HASL
  - Immersion Tin
  - Immersion Silver
  - OSP / Entek
  - Gold
    - ENIG
    - Hard Gold
    - Wire Bondable Gold

SURFACE FINISHES

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

SURFACE FINISHES

- **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

SURFACE FINISHES

- **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

SURFACE FINISHES

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 over4 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

SURFACE FINISHES

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

SURFACE FINISHES

- **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

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Summary Matrix

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

SURFACE FINISHES

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

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The Difference is Quality and Delivery

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.

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- 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
Quotes	quoting@epectec.com
Engineering	engineering@epectec.com

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www.epectec.com

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