The EPIG Process:

Electroless Palladium, Immersion Gold

EPIG nickel-free PCB finish has opened up a wide, new design avenue for high frequency applications and designs with reduced spacing.

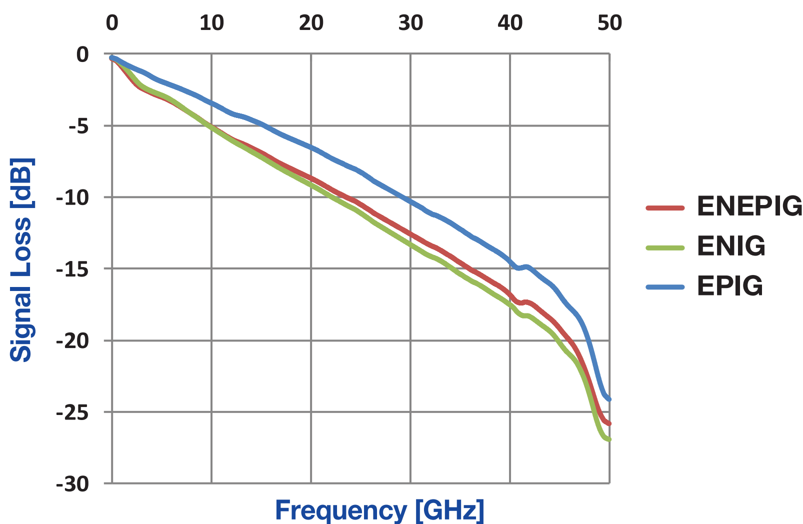
The EPIG process deposits palladium directly onto copper. Eliminating the nickel means there's less build-up on circuits, and circuits can be controlled with smaller geometries. It's a perfect fit for applications that demand smaller features and better clearances.

EPIG offers unique and significant advantages for microwave applications, flex circuits, and end users requiring high purity levels. Specialty applications include ceramic electronics, thermo compression bonding, pogo pin connectors, and medical applications requiring the biocompatibility of a nickel-free finish.

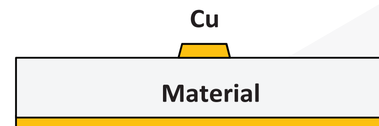
Advantages include:

- No skin effect on low current, HF applications
- Non-magnetic
- Thickness 4 - 40 u" (0.1 – 1.0 µm) palladium allowing for very fine lines and spaces of 1 – 2 mils (25 – 50 µm)
- Wire bondable to Au, Cu-Pd, Cu, Al, Ag wires
- Planar surface for soldering, forming a Cu/Sn IMC
- No hyper-corrosion
- No nickel to fracture on bending for flex circuits
- Short process time
- Easy to visually inspect
- Less water consumption compared to ENEPIG due to shorter process cycle
- Low process temperature, less energy use

Comparison of High Frequency Signal Loss



- **Test board Specification:**
  Material: Megtron6
  Trace: single-end 50Ω /
  Length = 250mm w = 0.52mm
- **Measurement**
  VNA ZVA67 (ROHDE & SCHWARZ)
- Test board provided and measured by OKI Printed Circuits Co., Ltd.



Signal Loss (dB)

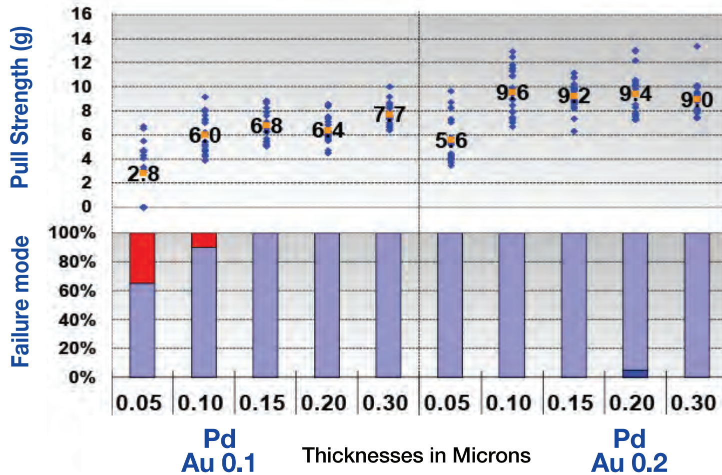
Frequency in GHz	ENIG	ENEPIG	EPIG
10 GHz	-5.1	-5.1	-3.4
20 GHz	-9.1	-8.6	-6.5
30 GHz	-13.3	-12.5	-10.3

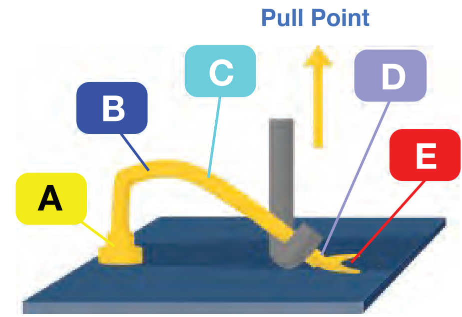
Signal loss of EPIG was lower than that of ENIG and ENEPIG due to the absence of an EN layer.

EPIG Wire Bonding Performance

Using 1 mil gold wire – wire bonding after 175° C heat treatment for 16 hours

Pull strength achievable above 9 at target thicknesses of 0.2 µm for palladium and gold





Talon 3 Electroless Palladium for EPIG

Talon 3 is groundbreaking technology in board chemistry that allows plating directly onto copper. This development paved the way for EPIG, a nickel-free alternative that becomes more consequential as lines become tighter.

Talon 3 E-Pd was developed for applications in four main categories: medical sensors, where nickel is prohibited for reasons of patient sensitivity; flexible circuits, where there's a risk of nickel fracturing creating gaps in the circuits; electronic products with issues related to magnetics and frequency, and high frequency circuitry where nickel can compromise signaling.

Talon 3 deposits an electroless / autocatalytic palladium that is solderable and gold wire bondable. The bath has low palladium metal content and is highly stable. Deposition rate and quality are exceptionally consistent; EPIG with Talon 3 solders perfectly after eight hours of steam aging.

Talon 3 allows ENIG, ENEPIG and EPIG to be processed on the same line

Clean	**007 mild acid – 5 to 7 min @ 140F (60C)**
Etch	MGE-9 – 2 min @ 75F (24C)
Activate	MFD-5 – 2 to 4 min @ 75F (24C)
Electroless Palladium	Talon 3 – to thickness @ 120F (49C)
Immersion Gold	TAM 55 – 30 minutes @ 185F (85C) or TWX 40 – to thickness @ 180F (82C) *(TWX 40 is reduction assisted immersion gold)*

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Corporate Headquarters: 3990 Concours, #425 • Ontario, CA 91764 • ph: (909) 466-5635

Tech Center: 240 Town Line Road • Southington, CT 06489 • ph: (860) 793-4011

uyemura.com