



Lead-free Technology

ingun®

Lead-free Technology

Status: 11/2006

Summary of the most important Information
from:

- internal and external Investigations
- Customer questionnaires
- Seminars
- Internet Searches
- etc.

INGUN Prüfmittelbau GmbH

11/2006

R & D

1

Kontaktstifte

Prüfadapter

Testsysteme



Lead-free Technology



Internal and external Investigations from INGUN Prüfmittelbau GmbH

- The subject of „lead-free“ and the accompanying influences at our customers in regard to testing PC Boards, has been a subject at INGUN for a long time.
- To guaranty that we are up-to-date with the most recent market demands we are working closely with our customers to ensure a reliable contact.
- Our global customer network enables us to collect and apply information from a large number of application areas.
- Only internal practical tests and field-tests carried out on our customer's sites supply results, which will enable our customers to work successfully with this new technology.



Lead-free Technology



Summary for ICT:

- Those test-points with solder can still be contacted without any problems. When changing to lead-free PC-Boards, however, the spectrum of testing demands has increased considerably.
- Apart from the past standard hot-tinning there are numerous new PC-Board coatings of which their test points are not necessarily covered with solder. Due to the very thin layer thickness, the correct combination of tip-style and spring force is therefore decisive for the testing result.
- Thanks to our almost endless variety of variants we can supply the matching individual solution for every user.

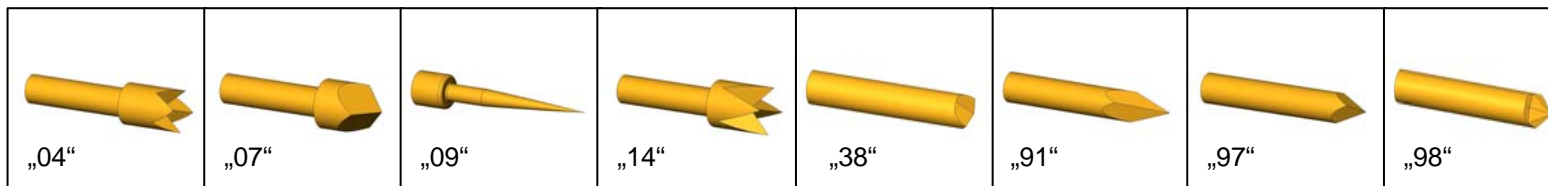


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INGUN recommendations:

ingun®	Pad / Test Points	Via	Component Pins	General Remarks
Solder lead-free SnAgCu-Alloys	91	07, 91, 97, 98	04, 14, 09	
HAL	91	07, 91, 97, 98, 38	14, 09	Aggressive Tip-Styles with self-cleaning; by "contaminated" Vias, flatter angle
Chem. Sn	91, 97	07, 91, 97, 98		possibly higher Spring Force with tip-style 97
Chem. NiAu	91, 97	07, 91, 97, 98		possibly higher Spring Force with tip-style 97
OSP	91, E-Type, Rotating Test-Probe (DKS)	91, 97, 98, E-Type		Warning: combination of aggressive tip-style and high spring force, at too thin copper layer; Rotating Test Probe can lead to penetration and damage of the PCB surface
Chem. Ag	91	07, 91, 97, 98, 38		Aggressive Tip-Styles with self-cleaning; by "contaminated" Vias, flatter angle
<p>* These are recommendations, which are based on numerous internal and external investigations. The stated recommendations are not vital and can be varied depending on the customer demands!</p>				





Lead-free Technology



New Laws and Regulations

- EU
 - WEEE (Waste Electrical and Electronic Equipment)
 - Taking back “Electronic Scrap”
 - RoHS (Restriction of Hazardous Substances)
 - Forbidding restrictions of “Electronic Scrap”

→ **Introduction Date: 1.Juli.2006**
- China

→ **Starting Date: 1.March.2007 (“China-RoHS”)**
- Japan

→ **Starting Date: Date for complete change is still pending, but change-over is already underway!**
- USA

→ **Starting Date: is presently delayed, but due to the size of the European and Chinese markets the US must follow this demand!**





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- Restriction of Hazardous Substances (RoHS)
 - Lead
 - Mercury
 - Cadmium
 - 6-valence Chrome
 - Flame protection medium
 - PBB (polybromated Biphenyl)
 - PBDE (polybromated Diphenyl Ether)



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- Actual preferred lead-free solder materials:
 - **US:** NEMI & SMTA
 - Sn3.9Ag0.6Cu
 - **Europe:**
 - Sn(3.4-3.9)Ag(0.5-0.9)Cu
 - **JEIDA:**
 - Sn3.0Ag0.5Cu

Range of Alloy Compositions:

→ Sn-(3.0-4.0)Ag-(0.5-1.0)Cu

Melting Point ~ 217 °C (Normal SnPb: ~ 183 °C)

Sn = Tin
Ag = Silver
Cu = Copper
Stated values in weight percent



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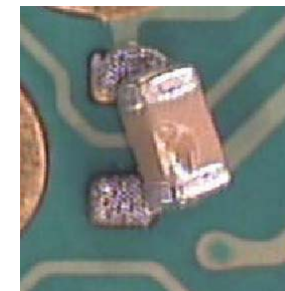
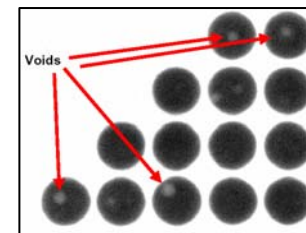
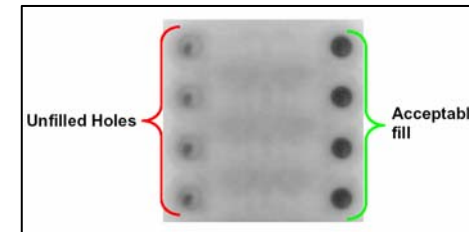


Wetting:

The Wetting characteristic of melted solder on the surfaces has an influence on how well the solder spreads out on and coalesces with the pads!
 The Wetting Force of Sn/Ag/Cu lead-free solder materials is not as great as by Sn/Pb solder! This fact has a definite influence on the solder process.

Prognosis for Solder Failures

<u>Failure</u>	<u>Comparison</u>
Opens)	Lead-free > Sn0Pb
Shorts	Lead-free > SnPb
Voids	Lead-free > SnPb
Miss-positioning	Lead-free > SnPb
Not accessible Solder Joints	approx. the same
Surplus Solder	approx. the same





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- **Finishes:**

- **HAL / HASL:**

- Very suitable for ICT
- Good to solder
- Good storage capability
- Limited for Fine-Pitch

- **Chem. Sn:**

- Suitable for ICT
- Suitable to solder
- Limited storage capability

- **Chem. NiAu:**

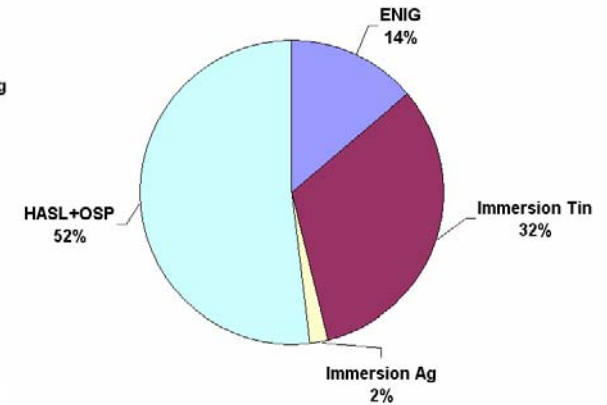
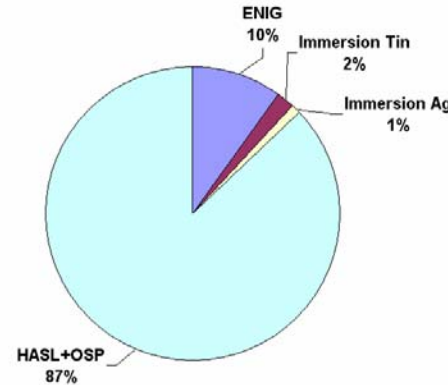
- Suitable for ICT
- Good to solder
- Good storage capability
- Expensive (approx. 5x HASL)
- Finish is brittle and prone to mech. Stress

- **OSP:**

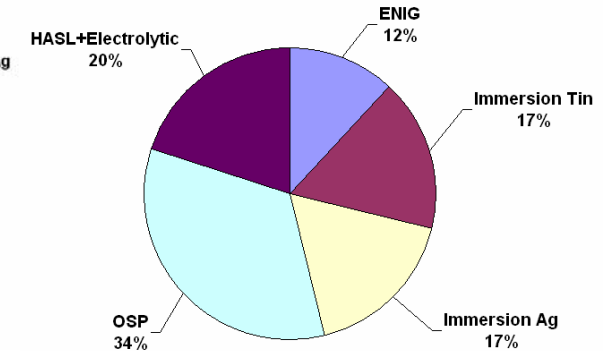
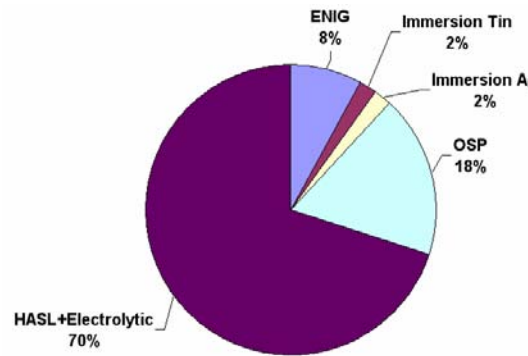
- Limited usage for ICT
- Good to solder (one-time)
- Limited storage capability
- Is often used for small grids
- Cheap!

- **Chem. Ag:**

- Ideal for ICT
- Good for HF-Applications
- Usage still limited, because relatively new!



Trend estimation Europe End Surfaces for PC-Boards 2003 and 2007



Trend estimation Europe End Surfaces for PC-Boards 2003 and 2007



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Suitability for ICT	++	+	o	-	-
Layer thickness	0.5 - 25 µm	0.6 - 1.0 µm	3 - 8 µm, 0.04 - 0.1 µm Au	0.2 - 0.5 µm	0.1 - 0.3 µm
Solder Capability	++	++	+	+ (one time)	o
Storage Capability	+	-	++	-	-
	(6-12 Months)	(<= 6 Months)	(12 Months)	(<= 6 Months)	(<= 6 Months)
Costs	+	+	-	++	o
Coating quality	-	+	+	+	+
SMD Pitch	>= 0,5 mm	< 0,5 mm	< 0,5 mm	< 0,5 mm	
Other	Very good for ICT; Limited for Fine Pitch area due to poor planarity and homogeny characteristic	Very thin and hard Coating	Very hard coating; Coating is brittle and prone to mech. Stress	Limited suitability for ICT; Low conductivity of the Coating, Contamination of Probe Tips. Very thin layer thickness in conjunction with greater hardness after oxidation.	Usage still limited, because very new. Good for ICT; good for HF-Applications (skin effect)



Lead-free Technology



- OSP (Organic Solder Preservative)

General Information:

OSP: Organic Solderability Preservative;
organic passivation of Copper surfaces on
the basis of Imidiasols and Triasols

Typical layer thickness of the conductor
tracks on the outer surface of the
PC Board: **10 – 50 µm**

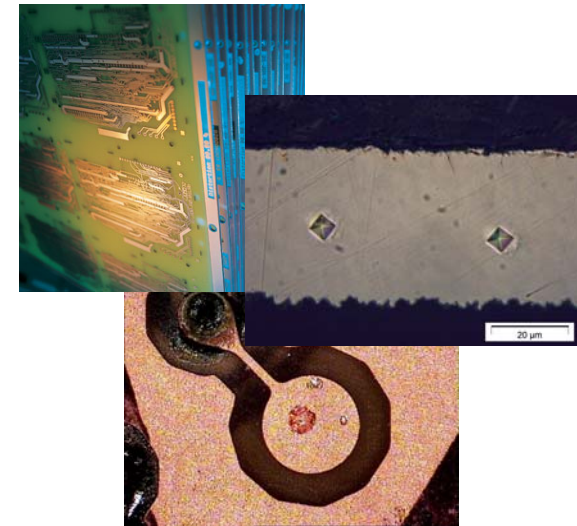
Layer thickness of OSP: **0,2 – 0,5 µm**

Main brands:

EntekPlus
Gliccoat
Mecseal
Schercoat

Summary Statement of diverse ICT Guidelines from the Surface Mount
Technology Association (SMTA: www.smta.org (TP-101C 2002)):

**→ If possible, OSP-Finishes should never be contacted
directly. The Test Points should be covered with solder first!**





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Summary:

Due to our many years of experience and our continuous contact to the market, we are able to offer you a tailor-made solution for every testing demand.

With **INGUN Prüfmittelbau GmbH** as your partner in regard to testing of PC-Boards and Units you are always **“Ready for Lead-free”**.