

## *Hot Air Levelling Technology Lead-free (SnCuNi und SnAgCu)!*

**T**he nearer the deadline draws to the compulsory implementation of lead-free regulations (ROHS), the greater the attempts to achieve lead-free solutions that are comparable to the “all-purpose answer” SnPb in terms of technology and cost. Two systems are particularly predominant: tin/silver/copper (SnAgCu) and, more recently, stabilised tin/copper (SnCuNi). Although the level of efficiency of both systems is not yet completely clear, the following presents the latest information:

### SnAgCu

**T**here is more experience in the field of silver systems. Here, differentiation is made between the Sn-3.5Ag-0.7Cu, Sn-4Ag-0.5Cu and Sn-3Ag-0.5Cu systems which vary in use from continent to continent.

**H**owever, the agreed expert opinion (IPC/Soldertech-Conference Brussels 2003) is that the technological differences between the three systems are negligible. Sn-3.5Ag-0.7Cu is the most common alloy in Europe.

### SnCuNi

**A**lthough there are even fewer field results for the stabilised tin/copper system Sn-0.7Cu-0.1Ni, it shows a lot of potential. It is called “stabilised” because the addition of nickel is said to show an improved hardening reaction in soldering.

**T**he creation of needle-structured crystals is said to alter to rounder structures, achieving an improved soldering flow for wave soldering of PCBs (reduction in torn soldering, less electrical bridging).

**T**his alloy was developed in Japan and is supplied in Germany by the license holder, Balver Zinn.

### The Printed Circuit Board Manufacturer

**T**he SnCuNi system is particularly interesting for the PCB manufacturer as the investment needed to convert from conventional lead-tin techniques to tin/copper is far lower than for facilities providing the processing technology for chemically produced surfaces.

**B**ecause, this is also a melting pot procedure. And only the solder’s tolerance with the dipping-container needs to be further researched.

**O**ur company is already working on solutions with mechanical engineering manufacturers. From May 2004, we plan to offer our customers SnCuNi in series production.

### Soldering Trials

**A**s already mentioned, there has been insufficient field research. Therefore direct comparison of soldering characteristics has been undertaken in diverse trial campaigns by expert and work groups (BDF Germany, Boeing USA).

**B**oth systems enable smooth, shining surfaces and reliable soldering joints, using wave soldering as well as reflow.

**T**he tin-copper system promises advantages in terms of the copper’s peeling reactions (leaching) on the circuit boards. The effect on the copper surface is halved.

	SnAgCu - Systems	Sn-0.7Cu-0.1Ni (SnCuNi)
Melting point (eutectical point)	217	227
Procedure characteristic reflow/convect	Tpeak = 230 C°	Tpeak 240 C°
Procedure characteristics Wave	Bath temp.: 255 – 265 C	Bath temp.: 255 - 260
Ecolog. disadvantages	Silver content	00
Metal Price	12 – 13 €	7 – 8 €
Leaching (CU peeling)	Agressiv, high Leaching - Rate	Leaching Rate 0,5 of SnAgCu
Soldering error rate compared with SnPB	Equal solder bridging, more non-soldering	Equal solder bridging, more non-soldering

**C**osts must be kept in mind. The silver system is approximately 40% more expensive than SnCuNi due to the use of precious metal; also, there is the ecological disadvantage.

### Lead Sensitivity

**T**he problem of lead sensitivity during the lead-free conversion phase in 2006 remains unsolved. Structural changes in lead-free soldering caused by remains of lead (even below 0.1% weight) in processing containers have been observed.

**S**tructural coarseness occurs in SnAgCu if there are stressful temperature changes even well below 96 C° (degradation acceleration).

**L**ead secretion occurs in bordeline grains in SnCuNi systems which, under mechanical tension, can create weak spots. Splitting is possible when soldering heat cools.

### Conclusion

**T**here is no doubt that the “good old” lead/tin still provides the best soldering results.

**H**owever, the two procedures presented above can be improved upon.

**T**he temperature and processing profiles in wave and reflow soldering are two points where this could happen, so that almost the same quality could be achieved.

**I**n spite of the limited experience in the field, in our opinion, the SnCuNi system offers definite advantages over the silver systems both in cost and quality.