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Structural Funds
2007-2013



ECOSOLDER

Romania - Republic of Serbia IPA Cross-border Cooperation Programme

Promoting new ecologic filler alloys
for soldering, based on the non-ferrous ore of
the Romanian-Serbian cross-border area

ECOSOLDER



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Common borders. Common solutions.



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Romania - Republic of Serbia IPA Cross-border Cooperation Programme

ECO-SOLDER ALLOYS FOR MULTIFUNCTIONAL APPLICATION

Dr A.Kostov, Dr A.Milosavljevic, Eng R.Todorovic
Mining and Metallurgy Institute Bor

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Soldering and solder types

- - electronic components (PCB)
- - plumbing systems
- - joints in sheet metal objects
- - jewelry
- - small mechanical parts



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ECOSOLDER

Soldering and solder types

- Some examples of solders:
 - - Sn-Pb wide application
 - - Sn-Zn for joining aluminium
 - - Cd-Ag for strength at higher temperature
 - - Sn-Ag and Sn-Bi in electronics



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ECOSOLDER

Eco-solders

- WEEE AND ROHS
- FIND A SUBSTITUTE FOR COMMON SOLDERS
- LEAD-FREE
- CADMIUM FREE



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REQUIREMENTS

- No toxicity
- Availability
- Temperature requirements
- Compatibility with parts and process
- Other process conditions



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Binary eco-solders

- 48Sn52In - the lowest melting point (118° C)
- 42Sn58Bi - poor wetting
- 96.5Sn3.5Ag - high melting temperature
- 99.3Sn0.7Cu - too high melting point
- 95Sn5Sb - high temperature application only



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Binary eco-solders

- Binary solder alloys do not satisfy some features, so multicomponent alloys based on tin with addition of silver, copper, bismuth, indium, antimony, etc. may be the proper solution for replacement lead solders



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Ternary eco-solders

- SAC alloys are the most promising group of eco-solder alloys (Sn-Ag-Cu)
- $93.6\text{Sn}4.7\text{Ag}1.7\text{Cu}$ - eutectic composition at 217°C
- $95.4\text{Sn}3.1\text{Ag}1.5\text{Cu}$ - optimal



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ECOSOLDER

Ternary eco-solders

- Sn-In-Ag - promising, because indium decrease melting point
- $77.2\text{Sn}20\text{In}2.8\text{Ag}$ - melting point 186°C
- Economic issue?
- Indium content has to be less than 20%



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Multicomponent eco-solders

- Solution!
- The most promising are Sn-Ag-Cu and Sn-In-Ag solder alloys with certain conditions. Concerning this, we can combine these two systems to determine alloy with better properties



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ECOSOLDER

Multicomponent eco-solders

- SIAC (Sn-In-Ag-Cu) alloys have an advance among SAC alloys - lower melting temperature (about 200° C) which is optimal for PCB assemblies
- Indium content must be less than 20% !



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Summary

- There is a large diapason of solders
- Constitutive elements: Sn, Pb, Ag, Cd, In, Cu, Zn, Sb, Bi, Au, Ga, Hg
- Eco-solder alloys are multicomponent, based on tin, without **Pb**, **Cd** and **Hg**



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THANK YOU FOR YOUR ATTENTION!



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