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### **Halogen-free laminates for PWB application**

Elektronika (XLV), no 12/2004, p. 48

[www.Elektronika.orf.pl](http://www.Elektronika.orf.pl)

**Abstract:** Directive of the European Parliament on restriction of the use of halogenated substances as flame retardants in PCB laminates will come into force from July 2006. It will be technical challenges in substituting alternative flame retardants for PCB laminates manufactures The new halogen-free laminates will have to achieve the desired flammability resistance and at the same time maintaining the physical properties of current epoxy resin systems. This paper describes some of the chemical approaches that have been undertaken by main manufacturers of PCB laminates and the effects of those approaches on the performance of halogen-free laminates in the fabrication of circuit boards.

Keywords: PCB halogen free

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**Legal issues of lead-free solder technology implementation in the face of  
exemptions from the Directive of the European Commission**

Elektronika (XLVI), no 9/2005, p. 25

[www.Elektronika.orf.pl](http://www.Elektronika.orf.pl)

**Abstracts:** The article gives information about the present legal status of the RoHS Directive in Poland, particularly its aspects concerning the ban of several hazardous substances in electric and electronic equipment. The introduction presents the scope, requirements and important dates introduced in the Directive. The existing directive of the Ministry of Economic Affairs and Labour harmonized with RoHS Directive is described. The essential definitions concerning producers, importers, products and ban hazardous substances are presented. The existing and planned exemptions of the RoHS Directive are explained in the details. In the summary, the plan of Green Rose knowledge dissemination for the industrial companies are pointed out.

Keywords: RoHS Directive, lead-free technology, lead

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**Transfer on lead-free technology - problems with materials and assembly processes**

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**Abstract:** In the article the authors presented the basic information about problems with materials and assembly processes during transferring to lead-free technology e.g. changes of soldering materials, soldering machines and parameters of soldering processes. The recommended printed circuit boards with lead-free finishes, as well as lead-free solders were described. The examples of soldering failures which can happen during lead-free soldering were shown. The possibility of ways of transferring to lead-free technology was explained.

Keywords: lead-free technology, solder

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### **Lead free soldering in production. Recapitulation of experiments**

Elektronika (XLVI), no 12/2005, p. 42

[www.Elektronika.orf.pl](http://www.Elektronika.orf.pl)

**Abstract:** From July 2006 manufacturers of PCB assemblies have to exclude lead from electronic assembly. In the present article there have been recapitulated technological aspects and results of some experiments relating to lead free reflow soldering and lead free wave soldering in mass production.

Keywords: lead free soldering, lead free assembly, lead free alloys, reflow soldering, wave soldering

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### **Polymer stencils made by laser method for lead-free solder paste printing trials**

Elektronika (XLVI), no 12/2005, p. 45

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**Abstract:** In this article there are presented the experimental results of laser manufactured polymer stencils and the results of application these stencils in PCB manufacturing process. The experiments show that the polymer stencils enable to obtain much higher density than steel based stencils. The laser manufactured polymer stencils have very high precision and can be applied to print lead-free solder pastes. The resistance of polymer stencils is suitable for prototype and short series of PCBs manufacturing and it can withstand several thousands of printing.

Keywords: stencil, polyimide, laser, printed Circuit board

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### **Requirements of the solderable finish immersion tin or lead free soldering**

Elektronika (XLVI), no 12/2005, p. 47

[www.Elektronika.orf.pl](http://www.Elektronika.orf.pl)

**Abstract:** Substitution of lead-free solders in electronic assemblies requires changes in the conventional SnPb finishes of PCBs e.g. implementation of immersion tin. It is very important for lead-free SMD that immersion tin coating should fulfill demands of solderability. The results of the immersion tin solderability measured by wetting balance method as well as reflow method and the thickness of immersion tin finish measured using stripping coulometry will be presented. The immersion tin surface finish solderability was then correlated with coating thickness measured in several conditions: „as delivered” and after aging (4 h at 155°C and 3x reflow soldering). In this study the authors have found that thickness of immersion tin coating is critical when it comes to lead-free soldering, including higher peak temperatures during soldering. The own min-max immersion tin thickness specification for the final finish has to be established.

Keywords: immersion tin, solderability, stripping coulometry, wetting balance method

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### **Printed circuit boards lead-free solder finishes**

Elektronika (XLVI), no 12/2005, p. 52

[www.Elektronika.orf.pl](http://www.Elektronika.orf.pl)

**Abstract:** From a manufacturing perspective, the purpose of a PCB surface finish is to protect the solder pads and thus maintain their cleanness and solderability before assembly. PCB surface finish will not be allowed to contain lead since 1 July 2006. Electro less nickel/immersion gold, immersion silver, immersion tin, new developed lead-free alloys for HASL technique and organic preservatives are available on the market at the present.

Keywords: gold, immersion tin, immersion silver, OSP, lead-free soldering, wettability

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**Wave soldering machine adaptation for lead-free technology and  
VOC-free fluxes assessment**

Elektronika (XLVI), no 12/2005, p. 55

[www.Elektronika.orf.pl](http://www.Elektronika.orf.pl)

**Abstract:** From 1st July 2006 the PCB assembly producers must exclude lead and other dangerous materials from technology process according to RoHS EC Directive. The introduction of lead-free technology require therefore use new solder alloys and fluxes as well as necessity of examine all machine settings used in soldering processes. The article shows information connected with implementation of lead-free technology to wave soldering process. The modernization of wave soldering unit and assessment of VOC-free fluxes, which are recommend for lead-free technology, were presented in details.

Keywords: lead-free technology, wave soldering, VOC-free fluxes

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### **Quality laboratory for investigation of lead-free materials and processes**

Elektronika (XLVI), no 12/2005, p. 62

[www.Elektronika.orf.pl](http://www.Elektronika.orf.pl)

**Abstract:** The Quality Laboratory for investigation of lead-free materials and processes in ITR has carried out the following range of tests: quality investigation of materials and components for assembly processes, quality evaluation of soldering technologies, quality investigation of solder joints as well as climatic tests performance of soldering materials, PCBs and solder joints. ITR has designed test boards for solderability measurements of PCBs with lead-free coating, characterisation of the immersion tin coating and estimation of solder joints quality produced in reflow and wave soldering processes. The Laboratory provides some research for GreenRoSE project.

Keywords: PCB, lead-free surface finishes, quality tests, solderability, quality laboratory

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### **Switchover on lead-free technology experience from GreenRoSE project**

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[www.Elektronika.orf.pl](http://www.Elektronika.orf.pl)

**Abstract:** The aims of GreenRoSE project is to help SMEs meet European legislation in particular RoHS directive. The pilot line was installed in the Semicon company in frames of the GreenRoSE project. It makes possible research new materials and lead-free reflow soldering process. The some problems connected with lead-free technology, composition of pilot line as well as first tests results were presented in the article. The Taguchi's method and variation analyze (Anova) were used in experiments to decrease a quantity of experiences and to finding reflow oven parameters influence on soldering profiles.

Keywords: lead-free technology, pilot line, GreenRoSE, Taguchi method

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**Influence aging of PCBs with immersion tin coating on their solderability with lead-free solders**

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**Abstract:** The solderability investigations of PCB's solder pads and through holes with immersion tin finish and with lead-free solders (SnAgCu and SnAg) as well as VOC-free flux is presented in the article Investigation of PCBs was performed before and after aging processes in IR reflow oven (1\*IR and 3><IR). The measurement temperatures were: 250°C as well as 50°C after melting temperature of alloys. The solder pads met the solderability requirements for all variants of measurement. The immersion tin coating thickness in the range 1.2...1.4  $\mu\text{m}$ , assured adequate solderability of solder pads for lead-free soldering processes. The worse solderability of tinned through holes was demonstrated. The hypothesis was made that the high surface tension of lead-free alloys is responsible for worse solderability results of through holes, because the high surface tension made difficult capillary elevation of lead-free solder alloys in through holes.

Keywords: solderability, immersion tin coating, lead-free soldering

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**Lead-free PCB finishes in lead-free soldering technology - some experiences  
from GreenRoSE Project**

Elektronika (XLVII), no 8/2006, p. 30

[www.Elektronika.orf.pl](http://www.Elektronika.orf.pl)

**Abstract:** Necessity for lead elimination from electronic equipment caused that eutectic alloy SnPb so far used in soldering components on PCBs will be replaced by lead-free alloy. This change caused that PCBs and components will undergo higher temperature during assembly than now. Meeting the lead free assembly requirements, PCBs have to be made with lead free finishes. The base material of the board has to be adapted to higher temperatures and to have better mechanical resistance to distortion. The most common lead free coatings are: immersion tin, nickel -gold, silver, organic materials (OSP) and new alloys used in HASL technology. In the paper some practical information and experiments results obtained during the GreenRoSE project realization are presented. The solderability of PCB finish materials (OSP, immersion tin, immersion Ag and LF HASL) were tested by Wetting Balance method, Rotary Dip method and wettability by reflow and wave soldering processes. Lead-free coatings were tested in laboratory in state "as received" and after ageing (4 at 155°C, 1x lead-free reflow process, climatic test). Influence of fluxes activities, state of finish materials, and parameters of soldering processes on solder

joint quality is discussed. Inspection of lead-free solder joints consisted of visual inspection; cross-section data and shears strength measurement of 1206 chip capacitors were done.

Keywords: coating gold, immersion, immersion silver, organic materials, lead free soldering, wettability

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### **The chosen factors influencing on lead-free reflow soldering**

Elektronika (XLVII), no 8/2006, p. 40

[www.Elektronika.orf.pl](http://www.Elektronika.orf.pl)

**Abstract:** From 1st July 2006 the PCB assembly producers must exclude lead and other dangerous materials from technology process according to RoHS EU Directive. The introductions of lead-free technology require therefore use new materials as well as adjust all machines settings for new conditions used in soldering processes. The article shows a lot of practical information and remarks connected with implementation of lead-free technology to reflow soldering process. The information presented in the article are a result of the Tele and Radio Research Institute participation in projects concerning pro-ecological technologies for electronics supported by Polish government and the 5<sup>th</sup> and 6<sup>th</sup> FP EU.

Keywords: lead-free technology, reflow soldering

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### **Wettability of lead-free PCBs finishes after long-term natural storage**

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**Abstract:** The Directive RoHS impacts on the production of printed circuit boards. New lead-free surface finishes, compatible with lead-free soldering processes, have to be implemented. It is very important to have knowledge how long after manufacture of PCBs can be carried out the lead-free soldering process without assembly problems. The paper presents wetting properties assessment of most popular lead-free PCBs coatings (immersion tin, immersion Ag, Ni/Au, OSP and SnCu made by HASL method) after long term natural storage. The assessment is a result of the wetting tests with using lead-free solder pastes. In presented investigations were used two solder pastes with the SAC305 alloy and different activity of fluxes. The obtained results showed that the soldering results are dependent on PCB finish type and properties, solder paste flux activity and storage time of PCBs.

Keywords: lead-free soldering, PCBs coatings, wettability, natural storage