
Technical Article

"Lead Free or Not - Why is that the Question?"

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APEX 2004 was a good show this year. Many folks said they had good attendance at their booth, while others stated it was not as good as it should have been. This is definitely better than last year when everyone was stating the show was awful.

The big buzz of the show was of course the topic of "Lead Free". Many folks are very concerned about this push for a lead free process and rightly so.

There are many issues that we have discovered with this "lead free" push and our stance on the issues has not changed. We believe that this does not make sense for our industry and the hidden costs with going lead free are going to be the demise of our electronic industry in the United States.

Don't get me wrong here, as an M.E. I have always supported a "Green and Clean" process; however, my approach was to recycle 100% of our waste. In fact we were actually able to generate a significant income from recycling while eliminating our hazardous waste bill, which netted a \$28K savings per year.

Let us look at the lead free formulas that some are proposing to mandate that we switch too. Several of the formulas contain copper. Let us think about this logically. As I recall copper is considered a contaminant. Remember an intermetallic compound contains copper, and you do not want an intermetallic in a solder connection as it is brittle and it will greatly affect your reliability. I have also experienced wetting issues on HASL coated PCB's and after further root cause analysis we discovered that the issue was coming from too much copper content in the HASL solder bath. So, does putting copper into your raw solder materials make sense to you? I think not.

There are many other issues with the copper solder formulas as well since they are non-eutectic formulas. Non-eutectic means the solder has a pasty range from 217°C to 219°C. A non-eutectic solder formula is never going to have as tight of a grain structure in your solder connection, which is going to have a huge affect on your overall reliability. Remember the tighter the grain structure, the more reliable your solder connection. In addition there is absolutely no reliable reliability data available on these copper solder formulas.

Wait, there's more. The copper content formulas also require a very active flux in order to get the solder to wet. More active flux you say? What about BGA solder connections? As you will recall the more active the flux the more prone to voiding issues in a BGA solder connection; however, none of this will matter anyway since the copper content formulas are prone to 25% voiding even without the more active flux. 25%?! Boy, is this going to reek havoc on our high

speed BGA designs. Can you say "waiver"?

In addition to all of these issues there is also a separation issue. The copper tends to separate out from the solder easily upon freezing. In fact none of the copper solder formula solder bars can be extruded because of this issue. The copper content formulas can only be cast and even then the copper tends to separate out. Wonder how this will affect your solder joint upon freezing? Does anyone even know? As of yet there is no data on this so it is hard to say.

If you are being mandated to switch to a Lead Free formula I am sure you are saying to yourself by now "but I have no choice". Awe but you do. There are several other *Lead Free* formulas you can choose from. All of which have well over 20 years worth of reliable reliability data. They are eutectic and have a melting point of 221°C. These formulas are Sn95.5Ag3.5 or Sn96Ag4. As a matter of fact there is local Orange County, California company that has been successfully using these lead free formulas for well over 20 years with great success.

Now one must ask. Does switching to a lead free formula really solve the problem? Think about it. If the assemblies still go into a land fill isn't there still a chance of contaminants causing issues? Copper can be just as harmful as lead, and silver is far more harmful to our health than lead could ever be. Doesn't a recycling programming make more sense? Weren't we successful at recycling 100% of the lead battery's? What is the difference? Why aren't we capable of recycling 100% of electronic assemblies and CRT monitors?

Folks in the solder industry have a theory on all of this ubba-baloo on these copper content solder formulas. You see, they could not patent the Sn95.5Ag3.5 or Sn96Ag4 formulas; however they could patent their copper content formulas, and we all know what this means. Someone stands to make a lot of money by mandating the use of these copper content formulas.

The buzz in Europe is that they are going to refuse to use any copper content formulas. In addition many industries have been able to obtain "waivers" on the Lead Free mandate (due to reliability issues). These folks are all typically high reliability industries such as Automotive, Military, Aerospace, Medical Instrumentation, etc. So once again I must ask, "what's the Point?" If it is not 100%, have we really addressed the issue of electronic assemblies and CRT monitors ending up in our land fills?

We must ask ourselves, are we sheep or are we technologically leaders? Should we just follow along and go with what ever is being mandated? Or do we get off our duff and prove our stance that recycling is the key, and it always has been and always will be. Think about it. The added costs for lead free will be past on and the only folks who are going to pay are us the consumers.
