

'There Are Changes Every Day'

Three EMS providers discuss challenges and opportunities of adopting lead-free practices.

One major challenge facing EMS providers is adequately addressing impending regulations related to elimination of lead and other contaminants from manufacturing processes. The best-known driver: the RoHS (Restriction on the Use of Certain Hazardous Substances) directive by the European Union, which becomes effective July 1, 2006. However, many Japanese OEMs have also implemented schedules for eliminating lead from manufacturing processes and components as part of internal initiatives to adopt more environmentally friendly practices. The issue is not simply elimination of lead; the EU directive also bans cadmium, mercury hexavalent chromium, polybrominated bi-phenyls and polychlorinated diphenyl ethers. Finally, specifics of the EU directive are a work in process, further complicating efforts to develop a viable compliance strategy.

Among U.S. regional mid-tier EMS providers, many are taking a wait-and-see approach, actively researching the issues and defining a likely path, but not making substantial investment until the European standards are better defined. But margins do not allow for wrong technology adoption choices. Many experienced engineering teams remember similar challenges in surface-mount technology process definition, elimination of CFCs and direct chip attach processes and are concerned about the risks of being early adopters in an area where opinions on best practices differ.

This column looks at a few companies who are taking the early adopter path. The common characteristic: all these companies have valid business reasons for early adoption. For Epic Technologies, equipment choices related to its lean manufacturing processes also provided a path for developing a lower temperature lead-free soldering processes. And for two Singapore-based EMS providers, Beyonics Technology and CEI, Japanese influence in the region has been driving earlier compliance deadlines.

The participants: Jochen Lipp, VP of manufacturing operations, Epic Technologies in Juarez, Mexico; C.P. Goh, CEO, Beyonics Technology in Singapore; and K.H. Tan, managing director, CEI Contract Manufacturing Ltd. in Singapore.

Susan Mucha: Describe your lead-free manufacturing capability.

Epic: We have been producing surface-mount assemblies with lead-free solder since January. We have the capability to do common lead-free alloys (tin/silver, tin/silver/copper and tin/silver/bismuth) using vapor phase reflow, which does not require higher temperature components. We use lead-free solder in our vapor phase oven at 230°C; current lead solder processes operate at 250°C. We have full capability for the wave process, but have no customer requirements.

Beyonics: Our lead-free capability covers 1) for surface-mount technology, a seven-to-10 zone curing reflow oven to achieve the curing temperature profile. Process control is made possible with a 16-channel temperature profiler to ensure more even temperature distribution on the PCB; 2) for through-hole and manually inserted assembly, a wave that can stand lead-free material corrosiveness as well as being able to achieve a specific temperature profile for solderability. We also use an impurity checker to control and ensure lead contamination levels below specified limit; 3) for touchup and final assembly, a hand soldering tool that meets specifications for higher soldering temperature at a fast recovery rate.

CEI: We are ready to implement a lead-free process. With the help of materials suppliers such as Tamura, we researched and evaluated several lead-free tin pastes. We have qualified two types with 3% silver-filled tin-based pastes, installed a dedicated reflow oven, characterized the process and established the parameters. Due to the absence of lead, the eutectic temperature is now higher, around 215°C.

SM: When did you start looking at the issue?

Epic: We have worked with EPM/IBL since the beginning of 2002. We put a wave solder machine with lead-free capability in place in 2002.

Beyonics: We've used lead-free processes in volume production since October 2002.

CEI: We first started looking at it about two years ago upon getting indication from our Japanese and European customers. The European market will likely

Susan Mucha is president of Powell-Mucha Consulting Inc. (powell-muchaconsulting.com), a management consulting firm focused on EMS strategy development, marketing positioning and training.



be the prime target for this process. But certain Japanese companies have run ahead with regards to implementation.

SM: What was the primary reason your company started focusing on lead-free processing?

Epic: Upcoming requirements in European and Asian markets and customer demand.

Beyonics: The requirement from our main customer, a Japanese consumer electronics firm, that specifies all of its products to be lead free. Also, the well-being of a good environment for our globe.

CEI: CEI's *modus operandi* has always been customer-centered, so the motivation was to support customer requirement when it is due. The indication then was that the need would come in the 2005-06 timeframe. The Japanese were particularly keen. In fact, in Vietnam one of our prospects, a Japanese company, is asking us to quote based on a lead-free PCBA process.

SM: What initial challenges has your company overcome in developing a workable lead-free processing strategy?

Epic: Development of solder pastes to optimize

lead-free process including the vapor phase process, development of segregated lead-free rework process, and past and future customer approval processes.

Beyonics: A key initial challenge is the cost factor, as the price of lead-free material is either double or triple that of lead soldering materials. Additional capital investment is required for processing machines and process control equipment. Finally, initial process development involved costs to arrive at suitable process parameters for processing equipment and metal mask design to achieve good solderability.

CEI: Selection of materials was the key factor and it took us quite a while to go through this process working with several materials suppliers.

SM: Have you identified any specific supply-chain issues related to lead-free components?

Epic: None so far. Our processes are compatible with lower temperature components. One challenge will be the availability of lead-free terminations on individual components. This is typically handled on a case-by-case basis either starting at the design stage or through an intensive ECN process.

Beyonics: We need to enforce that our components suppliers are following our policy of using lead-free

FOR INDIVIDUAL USE ONLY. NOT FOR COMMERCIAL
DUPLICATION AND DISTRIBUTION

processes. A major shift of suppliers could occur or the supply chain could be changed totally.

CEI: One key question is the semiconductor components' and IC leads' finishes. We believe the IC components assembly, the PCBA and other downstream processes need to stay in sync, meaning that they all need to be lead-free. The product will not be truly green if the IC components have solder finishes while the assembly undergoes a lead-free process. In this respect, some kind of industry-wide coordination is needed to reflect an effective movement in this direction. Again, we note that a couple of Japanese components suppliers have converted to lead-free finish.

SM: Are you comfortable with the degree of definition of requirements related to EU regulations? In what areas would you like to see greater definition?

Epic: I am very familiar with the requirements, but changes are made every day. While working with European customers and equipment suppliers, I got a lot of information. In different segments (like medical), different requirements exist for every product. It is very difficult to keep up.

Beyonics: We are not sure of this yet as our major customers are Japanese and U.S. companies.

CEI: So far we have no issue with EU regulations and will be keen to receive information and relevant materials.

SM: Are you encountering any conflicting customer requirements related to their processing preferences? If so, how do you address this?

Epic: We have received ambiguous customer demands to validate the processes or help define components. We have taken a proactive approach by using third-party testing facilities to verify cleanliness levels using ion chromatography and SIR testing. We have also validated all profiles as being within component tolerance specifications.

Beyonics: None so far.

CEI: Not at the moment. But we will be managing this topic cautiously going forward and working closely with our customers and prospects. ■

FOR INDIVIDUAL USE ONLY. COMMERCIAL
CIRCUITS ASSEMBLY PROHIBITS DUPLICATION AND DISTRIBUTION