

are exposed to a rapid change in ambient temperature. Any absorbed moisture is quickly turned into superheated steam. This sudden change in vapour pressure can cause the package to swell. If the pressure exerted exceeds the flexural strength of the plastic mould compound, then it is possible to crack the package.

Even if the package does not crack, interfacial delamination can occur. These defects often go undetected during normal assembly and test process, and will result in early life failure of the finished electronic products. The only effective method to detect such internal defects during assembly is to use a tool called scanning acoustic microscope. This is what the IC suppliers use to qualify each new component they offer.

The best-known failure mode of MSDs is the dramatic cracking of the package, sometimes accompanied by an audible "pop" during reflow, which explains the commonly-used designation "pop corn". Despite the common knowledge of this situation, it is very difficult to actually see and recognise this defect since the cracks and the characteristic bubble in the plastic are quite small, difficult to see without proper lighting and magnification, and they are located underneath the package which is obviously not accessible for inspection after reflow.

The proposed move to lead-free technology will have a direct and major impact on MSDs since the replacement alloys require higher reflow temperatures, resulting in higher levels of moisture sensitivity. As a result, existing components must be re-qualified and typically downgraded to one of two levels. Clearly, as the lead-free example demonstrates, the challenge of properly controlling MSDs is constantly increasing. Existing MSD control procedures and systems must be regularly updated to keep up with changes in product mix and the most recent industry guidelines.

Since 1999, a joint industry standard, published by IPC and JEDEC, provides guidelines that must

be followed by assemblers to prevent moisture-induced defects. This standard has recently been revised, and includes many significant changes and improvements. These changes provide a wider process window but also increase the complexity of the resulting procedures and systems.

Traditionally, MSD control systems were based on manual procedures, including paper logs to track exposure time. In most cases, important simplifications to the guidelines were made to provide a usable procedure for production operators. This simplification has a significant impact since manufacturing engineers would prefer to err on the safe side, resulting in a large number of unnecessary bake cycles. This created non-value added cycle time and costs, while reducing the solderability of components.



Cogiscan Dry Bag

It was also a major obstacle to achieve efficient material flow and on-time deliveries. In addition, even the simplest MSD procedure can be challenging to implement on the production floor.

Recognising the importance of this issue, Celestica has implemented a fully automated MSD control system at its U.K. assembly facility. Celestica selected the MSD control system from

Cogiscan Inc. It features re-usable radio frequency (RF) tags attached directly to the trays and reels containing MSDs. These tags are programmed with all the relevant material identification and process information, including MS level and expiration date/time.

The system also features local control units, to read/write RF tags and to provide real-time information to production operators, including warnings and alarms when components come near the limit of their specified floor life. The application software takes into account applicable parameters, including moisture sensitivity level, body thickness, ambient conditions and dry storage. This ensures that components are only baked when absolutely necessary and for the shortest possible duration while ensuring zero moisture-related defects.

As discussed in previous articles within EM&T's outsourcing supplements, OEMs partner with EMS providers to reduce costs and increase efficiencies within their organisations. Process improvements, such as those achievable through MSD control, can have a positive impact on final product reliability, customer satisfaction and overall manufacturing cost. Like other quality standards, demonstrating compliance with the newly revised J-STD-033A for MSD control, is becoming a prerequisite for OEMs

when selecting their EMS partner.

*Andy Wycherley is technical director of Celestica's Europe North operations.*

*Steve Kinloch is an engineering manager within Celestica's UK operation.*

#### **Celestica**

**Tel: +44 (0) 1782 771000**

**Web: [www.celestica.com](http://www.celestica.com)**