Lead-free Soldering Trials – Soldering Results

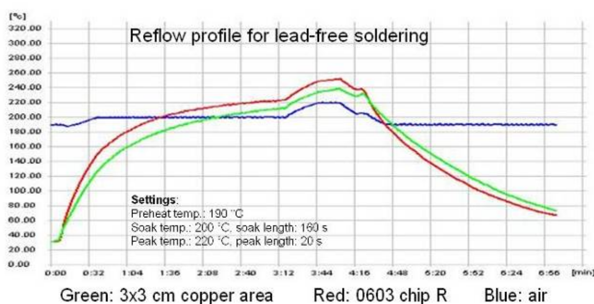
In the work package of “Lead-free Technology Industrial Implementation” (WP3) of the LEADOUT Project, soldering trials were performed at industrial sites by the RTD and the SMEs of the same country in order to have a close contact and to improve the transfer of the know-how of the RTD. Three circuits were selected by BME, the Budapest University of Technology and Economics in collaboration with SZEM and Elszetron Ltd’s (the Hungarian RTD and SMEs, respectively) for fabrication using both leaded and lead-free soldering technologies.

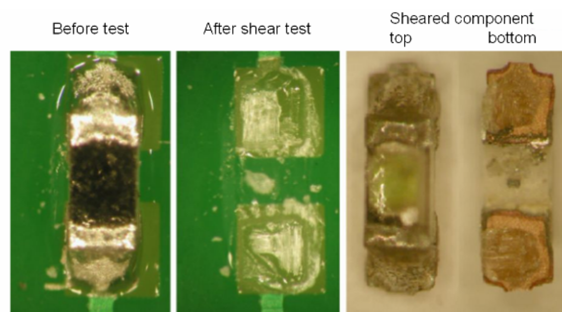
BME's LEADOUT board, see in the figure on the left, and two frequently manufactured boards of the SMEs were fabricated at each site using the leaded technology on 15 samples and the new lead-free technology, which was developed in the frame of WP2, on another 15 samples. The fabrication of the boards was monitored by electrical tests as well as optical inspection, and reliability tests were completed on them.

Quality evaluation of solder joints was carried out as the function of different aspects like applied materials and processing technology. The activity of BME focused on the following items:

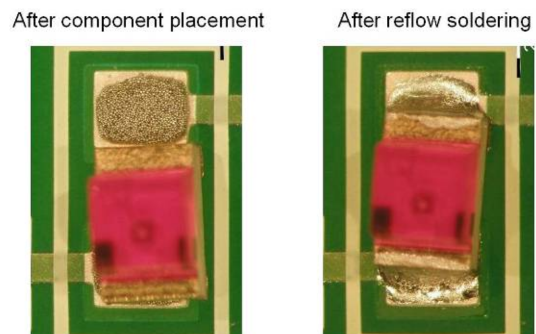
- process monitoring strategy based on optical inspection was developed and applied;
- shear test equipment was developed and implemented, shear force tests were carried out;
- test board was developed to study the effect of stencil type and quality on solder paste printing process and the quality of the solder joints;
- life-time test methods were studied.

Soldering trials resulted in the main conclusion that when optimized temperature profile (left figure) was applied, the lead-free soldered joints were strong, many cases, especially at the small (0402) component sizes, the pads were torn from the board, the joints survived (right figure).





It was found that the self-aligning property of lead-free soldering is much better than it was reported by some technical papers. The higher surface tension and lower wettability of lead-free solders even help to push the component into the correct position, as it is illustrated in the figure on the right. When the solder paste melts, at first it forms a liquid bump on the pad under the terminal, the bump lifts the end of the component and it slides towards the correct position.



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