Peelable Mask, Unpeelable Residues

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In this case study, we examine the effects of temporary processing materials, in this case a peelable latex temporary solder mask. The assembler in this study was a low volume contract assembler, using a no-clean flux technology. The assemblies in question were standard FR-4 boards (primarily through-hole technology). Components were inserted, clinched, and wave soldered with a no-clean flux. A peelable latex solder mask was applied to the wave solder side of the board prior to wave soldering to keep holes open for the insertion of add-on components. Following wave soldering, the mask was peeled off of the assembly surface. The add-on components were inserted and soldered in place using a solder fountain and no-clean fluxes. No cleaning operation followed either reflow operation. Figures 1 and 2 illustrate the situation.

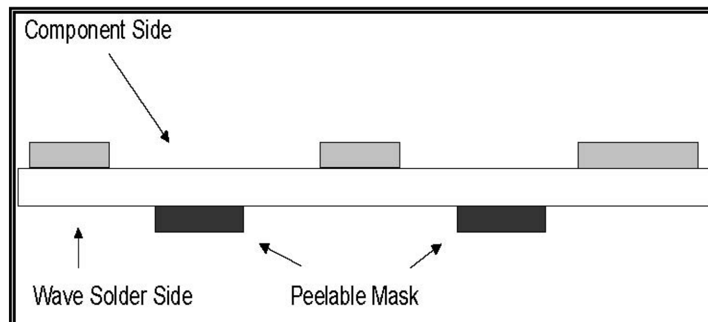


Figure 1

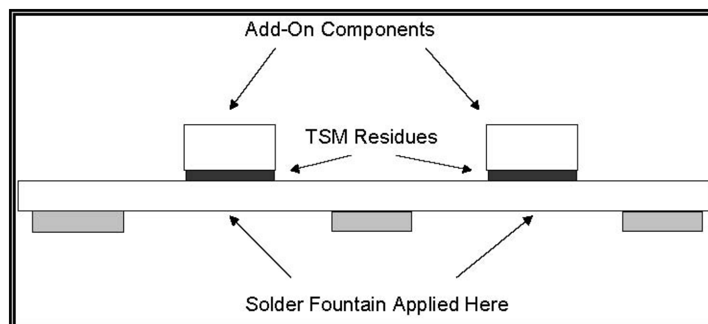


Figure 2

The assembler was experiencing high levels of electrical leakage between the pins of the add-on components. One field failure (one as-manufactured assembly) and a sample of temporary solder mask (TSM) taken from the processed board were analyzed. Charts 1 and 2 illustrate the residue levels found by ion chromatography. High levels of weak organic acids (WOAs) were found in all cases. This was to be expected due to the no-clean flux that used WOA activators. The WOAs on the TSM sample were the result of residual flux, rather than as an inherent component of the mask. We concluded that the WOAs were not the problem in this case. Chart 2 shows a close-up view of the more detrimental anions present. The analysis of the TSM material showed it to contain high levels of chloride, bromide, and sulfate elements. On both the failed assembly and on the newly manufactured assembly, the chloride levels were dramatically higher in areas where the TSM was applied and removed. Higher levels of bromide and sulfate were noted in the TSM areas. No sulfate was found in reference areas on the assemblies that did not have contact with the TSM material.

Chart 1 - Residue levels by Ion Chromatography

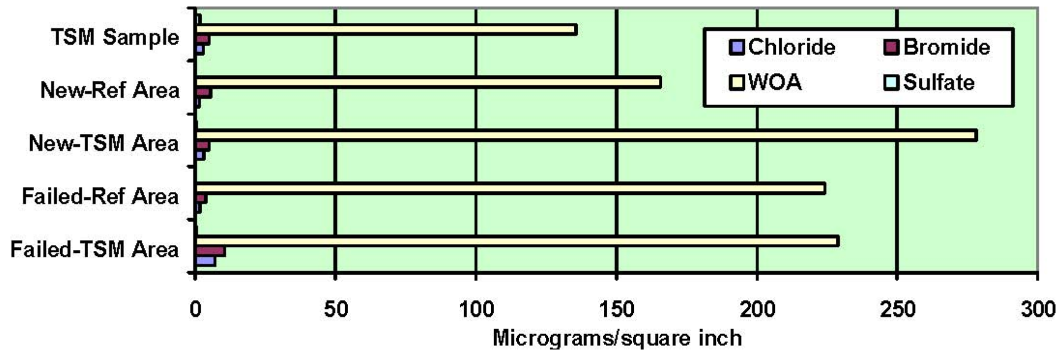
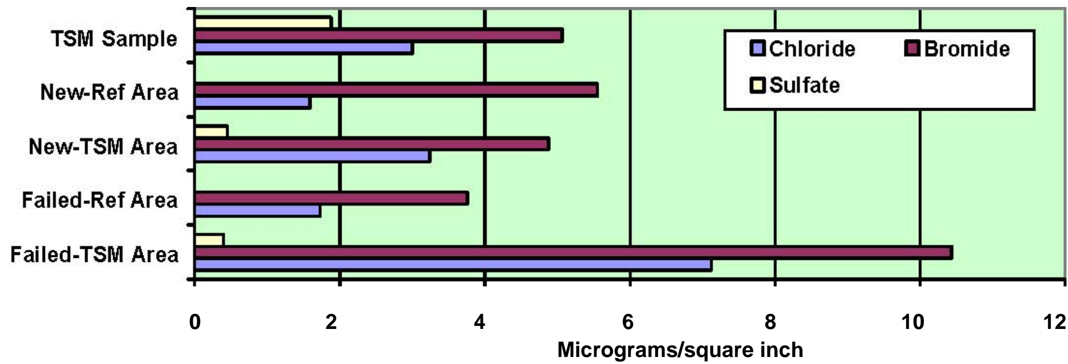


Chart 2 - Residue levels by Ion Chromatography



This case is an illustration of how sensitive a no-clean assembly operation is to every material that comes in contact with the assembly. During the reflow operations, the halides were transferred from the temporary mask to the board surface. The outer surface of the mask protected the holes and board surface from the wave solder as it was designed to do, but left the halides on the board when it was peeled off. Since the board was then soldered from the side opposite the TSM, there was little opportunity for the molten solder to burn off the halides. Consequently, they became entrapped under the add-on parts, resulting in electrical leakage.

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