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Die Attach Pre-bond Optimization for Nickel-Palladium-Gold Roughened Leadframe

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Keywords— *Die Attach; Pre-bond inspection; Roughened leadframe; insufficient Epoxy.*

I. OVERVIEW

Today, we mainly use plated leadframes. Plated leadframes can help improve adhesion of the die attach, wire bonds, and mold compound, and improve the solderability of the leadframe. Other technique to improve adhesion is to change the plating finish. One can roughen the nickel layer through a chemical etch before depositing the palladium. Figure 1 (below) shows an example of a Roughened Ni/Pd/Au preplated leadframe.

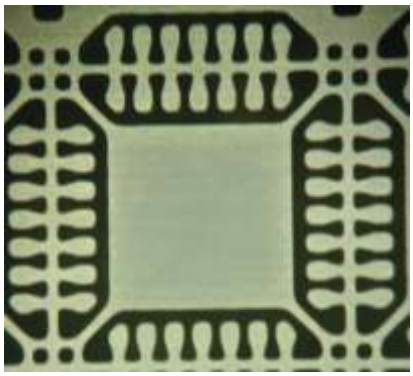

Fig. 1. Roughened Ni/Pd/Au preplated leadframe

This paper studies the challenges and behavior of epoxy material between roughened Ni/Pd/Au preplated leadframe (known as µPPF) during Die Attach process. Die bond on die attach paddle (DAP) of roughened µPPF using Silver (Ag)-based epoxy has been a challenge for its manufacturability in terms of maintaining the target epoxy volume.

II. PROBLEM IDENTIFICATION

The study on the roughened µPPF utilizing Pre-bond parameter for Ag-based epoxy on standard Ag-plated DAP Cu leadframe causing Pre Bond Inspection Machine cannot fully detect the epoxy pattern, due to dark background image cause by rough leadframe, as showed in Figure 2.

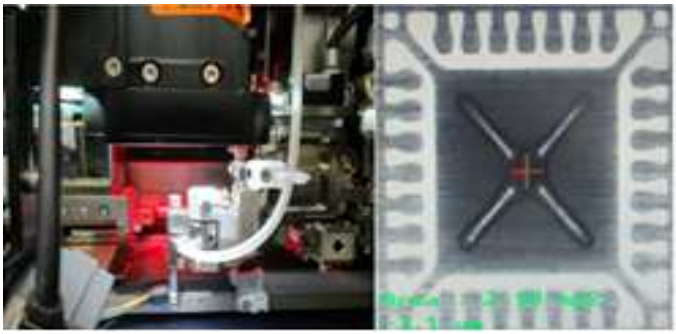

Fig. 2. Roughened leadframe causing Die Attach Pre Bond Inspection Machine cannot fully detect the epoxy pattern.

Un-even contrast of pad's, causing pre-bond inspection problem as showed in Figure 3. Hard to teach / set-up epoxy inspection due to no contrast between leadframe die pad vs. epoxy. Roughen leadframe property have different surface contrast causing Frequent "Bond Align" and epoxy inspection error on Roughen leadframe.

This occurrence leads to risks of insufficient epoxy which is detrimental on reliability (delamination on die bottom) and can cause manufacturing yield loss due to insufficient epoxy coverage.

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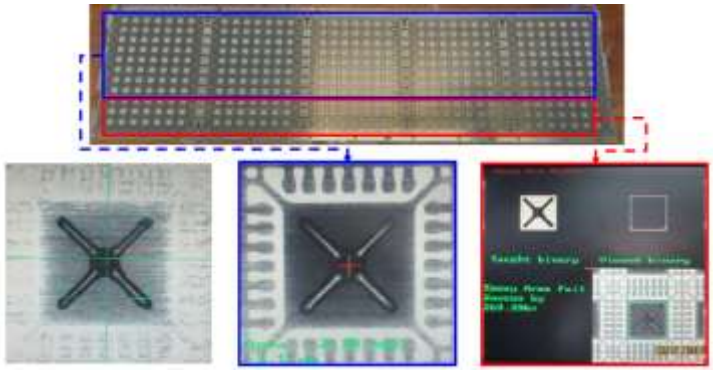

Fig. 3. Un-even contrast of pad's, causing pre-bond inspection problem

The processability of the epoxy on the surface of the roughened µPPF leadframe needs to be established due to this significant difference in contrast between leadframe die pad vs. epoxy when compared to the Ag-plated Cu leadframe which has a major impact in the quality of the chip assembly.

III. Assembly Process Improvement

Series of Evaluation where done to analyze and to find optimum solution in Die attach pre-bond inspection using roughened PPF leadframes. At Pre Bond Inspection, different Lighting Coaxial parameter setting will evaluate and test, if they can provide a result of Good judgement of pre-bond inspection. As a result, showed in figure 4, there is not significant difference on the PBI. Machine cannot fully detect the epoxy pattern; some epoxy cannot form complete boundary under strong coaxial.

Fig. 4. Evaluation result on different Lighting Coaxial parameter setting using 2-proportion test

Evaluation on different Lighting Type for Die Attach pre-bond inspection where also done as showed in figure 5. This is check if can resolve PBI problem for PPF leadframe. And the result showed, there is significant difference on the Pre-Bond Inspection result. Ultra Bright light is better compare to Red and Blue Coaxial Light, Rough pattern on pad can be completely removed. As showed in figure 5.

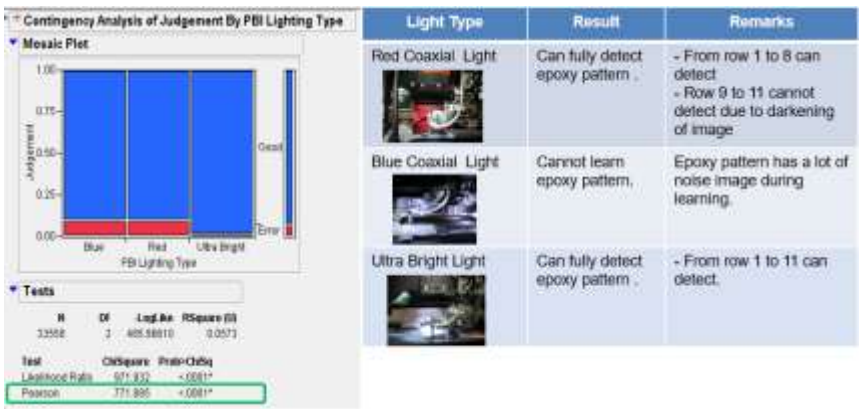

Fig. 5. Evaluation result on different Lighting Type for PBI using 2-proportion test

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Addition side where also consider and evaluate. To check whether the additional Single or Double Side light, can improve the lighting solution? As showed in figure 6, Double Side light is better PBI result. The Epoxy pattern can be clearly distinguished from the pad, remove the dark shadow.

Fig. 6. Evaluation result on different Side Lighting for PBI using 2-proportion test

Overall evaluation and statistical testing on Pre-bond inspection showed the Ultra Bright Light with double side light is the optimum solution for Un-even contrast of die pad's, causing pre-bond inspection problem as showed in figure 7.

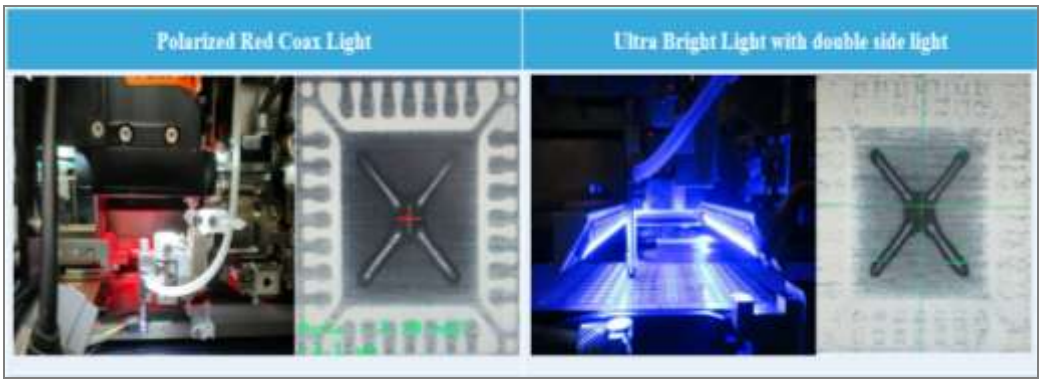

Fig. 7. Improved Die Attach Pre-bond inspection using Ultra Bright Light with double side light.

Equal contrast on die pad was attained on bond PRS lighting from pad column 1 to pad 11. Die machine PBI can fully detect the insufficient epoxy dispense pattern, as well as excessive dispense of epoxy, as showed in figure 8.

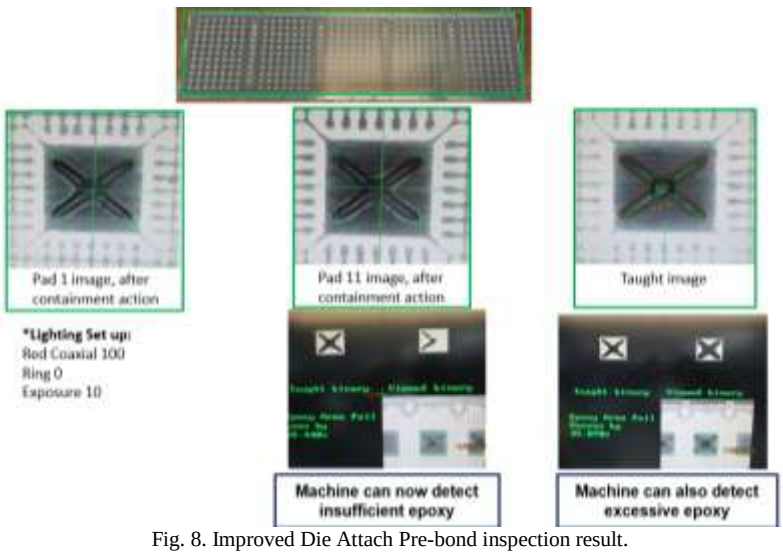

Fig. 8. Improved Die Attach Pre-bond inspection result.

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