

# Mold Culls for Die Attach Adhesive Filler

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**Abstract**— Cost initiatives were required in the semiconductor field in order to be cost effective. Reprocessing of different by-products across the manufacturing process have gained opportunity to become cost effective. The paper discusses the introduction of fillers present on the mold culls from the molding process to salvage for die attach adhesive filler. The innovative process solution involves crushing of the culls, sieving the fillers and prepare it to mix with epoxy adhesive material; then will be filled into the syringe. The process will also reinforced the epoxy adhesive to increase mechanical strength of the package.

**Keywords**— Molding; Culls; Die attach adhesive fillers; planetary mixing; semiconductor package; process solutions.

## I. INTRODUCTION

Nowadays, Semiconductor packaging requires cost effective and innovative solutions. Several initiatives such as cost effective material, extension of life of several tools and materials; and reduction of non-value-added activities were introduced in order to lessen packaging costs. The paper introduces an innovative process solution to use a by-product of a process in order to be used as a component of another bill of material. The two critical bill of materials involved on the innovative solution were molding compound and die attach epoxy adhesive, which are used on molding and die attach process, respectively.

Die Attach process is the process, which involves binding the silicon die into the carrier via an epoxy adhesive. Epoxy adhesive is one of the mostly used polymer matrices in the composite industry due to its high adhesion strength [1]. In order to further modifying the behavior of thermoset epoxy, reinforcing with fillers. Bond line thickness or the adhesive thickness is critical for semiconductor package mechanical strength. The filler also offers significant thickness assurance during die attach process. Figure 1 shows the epoxy adhesive configuration with fillers and its bind with silicon die and the package carrier, substrate or lead frame.



Fig. 1. Die Attach Epoxy Adhesive

On the other hand, molding process involves encapsulating the carrier with wire bonded silicon die to ensure the semiconductor package to withstand environmental factors at application level. During the molding process [2-3], the pellet

is liquefied in order to flow towards the carrier. In order to ensure the target-molded unit is fully covered, the volume of the liquefied pellet is being increased, which results to a mold cull (Figure 2). Mold pellets and so with culls; also have fillers in order to increase the package strength of the integrated circuit.

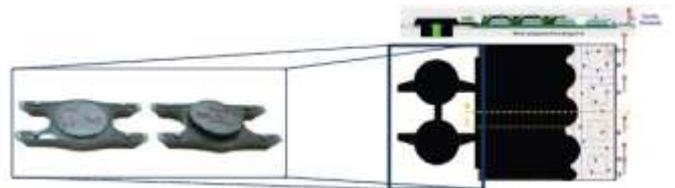


Fig. 2. Mold Culls

The paper will discuss the introduction of a new regenerative process of using the fillers present in the mold cull. The filler will be prepared in order to be mixed and filled into the epoxy adhesive syringe.

## II. PROCESS SOLUTION

The innovative process solution, shown in Figure 3, offers cost reduction initiative. Mold culls as by-product of molding process have been gathered and crushed into micron level to ensure that the fillers were separated from the cull. The fillers were been sieved in order to get the required diameters that will be used on die attach process, typically, from 20 to 50um. The size is also critical thus; this will defined the desired bond line thickness of the semiconductor package. The fillers washed with a special cleaning agent to ensure the molding compound polymers removed from the filler that can affect the binding quality of the epoxy adhesive and fillers. In order to have a good interfacial adhesion, pre-baking process performed to remove any moisture present during the washing process. Baking at different temperature will increase the package reliability compared to constant temperature [4]. Baking with different temperature will also remove the concentration of moisture across the filler area. After removing the molding polymer and moisture during the washing process, the next critical process is to ensure that the filler have effectively mixed on the epoxy adhesive. Mixing process such as Planetary Mixer, which combines rotation and revolution motions inside a cylindrical vessel. The planetary mixing will ensure that the filler is completely blend into the epoxy adhesive. Finally after the mixing, the epoxy adhesive will mold filler will be filled into the syringe to prepare for its application on the die attach process.



Fig. 3. Mold Cull Spacer replenishment Process for Die Attach Adhesive

### III. CONCLUSION

The innovative solution offers the use of the mold cull fillers in order to be used on epoxy adhesives. Several problems have been solved like the conversion of the standard adhesive epoxy into epoxy with fillers, that could act as spacers will help easily to gain consistent bond line thickness requirements and more control on epoxy bleeding during dispense and cost reduction of epoxy adhesive with fillers or spacers due to the in-house filling of standard adhesive epoxies. Finally, the process will change the horizon of cost reduction initiatives of the semiconductor package with the advantage of good manufacturability and cost avoidance.

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