Method for flux spray control

Disclosed is a method for flux spray control. Benefits include improved functionality, improved performance, and improved ease of implementation.

Background

Over spray can occur in the keep-out zone (KOZ) during the spray flux process. The overspray contaminates the adjacent solder paste, interrupts the underfill (UF) flow pattern, and causes uneven flux distribution. Material waste, voiding, and electrical failure can result.

Conventionally, the problems are resolved using a cone-shaped spray nozzle. However, to ensure sufficient flux at the edge of the die, over-spraying is performed out of the substrate bump areas (see Figure 1).

Charged moving particles/droplets exert magnetic force (Lorentz force) that is vertical to the moving direction of the particles/droplets. The force is in proportion to the speed of the moving droplet (V), the charging quantity (Q), and the magnetic strength (B). Conventionally, the spray flux droplet is not charged during spraying (see Figure 2).

General description

The disclosed method is flux spray control. Charged droplet/particles exert a Lorentz force in a magnetic field, enabling control of the flux spray pattern to solve the over-spray issue.

The key elements of the disclosed method include:

- Spray flux nozzle connected to a positive electrode to charge the flux droplet during spray
- Specifically designed magnetic field to control the flux droplet during spray
- Deionization of the substrate after flux spraying to remove the positive charges

The disclosed method can solve the over-spray issue without compromising the even flux distribution on the die-attach area.

Advantages

The disclosed method provides advantages, including:

- Improved functionality due to providing flux spray control
- Improved performance due to providing a magnetic-field frame to contain the spray area
- Improved ease of implementation due to requiring a small upgrade/modification to the spray nozzle and charging system

Detailed description

The disclosed method is flux spray control. A magnetic-field frame is established at over-spray areas so that over-sprayed flux is pulled back by the Lorentz force (F) to the bump areas. The frame is created by an electronic coil attached to the spray nozzle (see Figure 3).

A positive electrode is attached to the spray nozzle so that every flux droplet from the charged nozzle is charged with a positive charge (Q+) (see Figure 4).

The preceding over-sprayed flux droplet follows a hyperbolic track and lands within the substrate bump areas. The path is created by controlling the following factors (see Figure 5):

- Flux droplet electronic charge (Q)
- Spray speed (V)
- Frame magnetic movement (m)
- Flux droplet size

To avoid the electronic charge impact to the die during chip attachment, the sprayed flux must go through a deionization process to remove the positive charge. The process step is performed using an electrostatic discharge (ESD) machine, such as a deionization machine (see Figure 6).

After deionization, the conventional chip-attach process is performed.

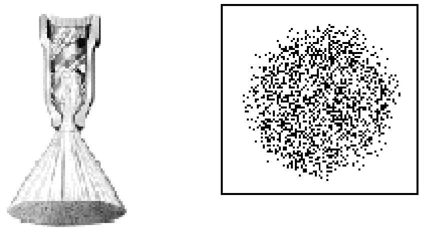

Fig. 1

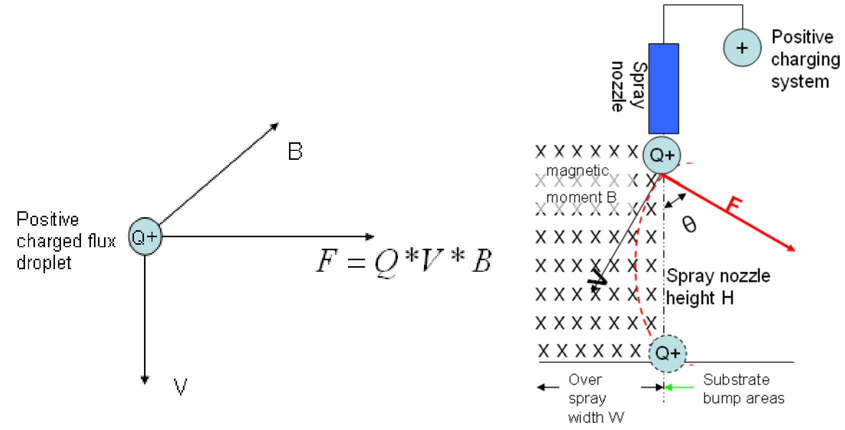

Fig. 2

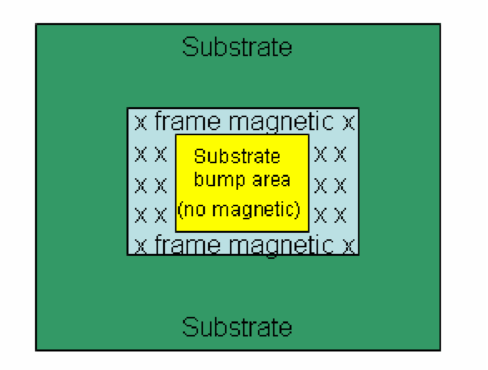

Fig. 3

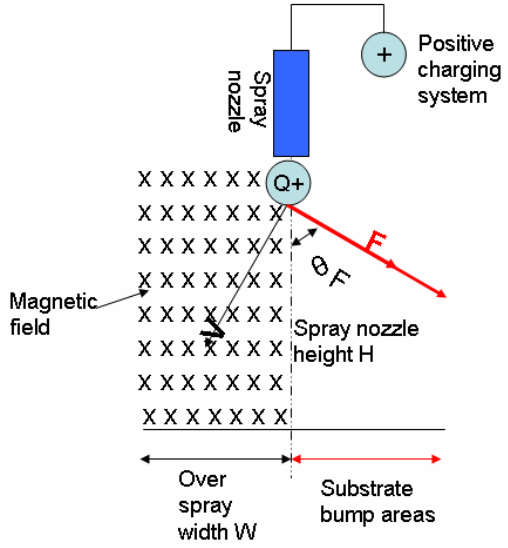

Fig. 4

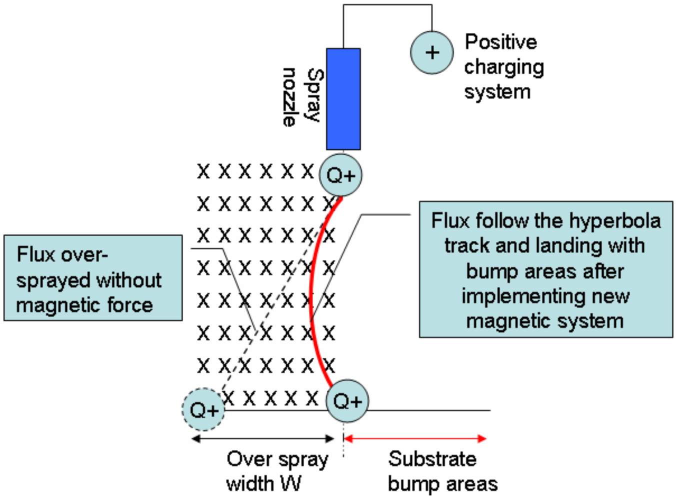

Fig. 5

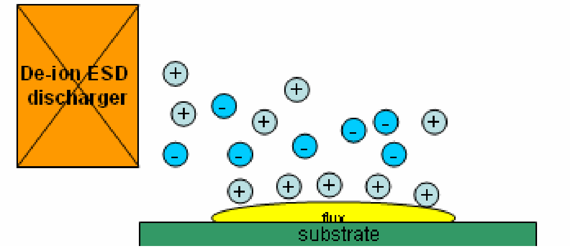

Fig. 6

Disclosed anonymously