Proposal Ultrafast Soldering of the BGA package for Carbon Neutrality

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Carbon neutrality in the manufacturing of electronics requires the net zero commitment by 2050. Green peace warns that the semiconductor industry's power consumption will more than double by 2030. According to Mackensey report, the share of CO2 gas in the semiconductor industry consists of 20% of law materials, 35% of gas and 45% of electrical power. Semiconductor industry equipment has very high standby current compared to other industries. The convection reflow process is a typical soldering technique, but it is known that soldering SAC 305 consumes 29.5 kWh of energy.

For example, the mobile phone is assembled by more than 1000 elements such as actives devices and passive devices. In addition, electronic packages are becoming more compact for higher density and performance, making reliable interconnection between different devices a major problem.

In general, the assembly process between different devices for electronics has been applied to a reflow process by using IR base energy.

Also, carbon neutral policies have begun to require minimization of the energy used by electronic products. For example, minimizing the energy required for manufacturing electronic products can be attempted in various ways such as recycling of used materials, reducing the number of manufacturing processes, reducing the process temperature, etc.

However, conventional IR base reflow processes require process temperatures higher than the melting point and long process times of at least 300 seconds. Also, the reflow process cause problems with advanced package such as chip delamination and warpage problems in soldering interconnections. On the other hand, Laser-assisted bonding (LAB) has been highlighted as an advanced soldering interconnection process because of an ultrafast bonding process and thermal selectivity. However, the laser energy can be applied to solder process for local joint or point soldering. Because the IPL soldering process is 1/10th shorter than reflow soldering, the IPL soldering process reduces warpage issues in packaged components and thermal damage to polymer components.

Reliability of package was evaluated by using shear test method and drop impact test method.

Furthermore, the thickness of intermetallic compound (IMC) formed at the interface of the COG package by IPL soldering was 4-5 times thinner than that of conventional reflow process. As a whole, bonding strength of the BGA package by IPL soldering was 3 times higher that of reflow process. Drop impact strength of the BGA package by IPL soldering was 4 times higher than conventional reflow. The Crack of the BGA component assembled on OSP surface finished PCB substrate were mainly propagated along the layer of Cu6Sn5.

Reference

1. *Eun Ha and S. B. Jung et al ; Advanced Engineering Materials, No.5, Vol. 25, page* 2201635, *2023.*

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