Introduction to Optical Module Dispensing Process



Overview

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Key Takeaways

The optical module dispensing process involves precise application of adhesives to secure optical components, often using automated systems to ensure alignment, repeatability, and high-quality performance. Overview of the ProcessThe dispensing process is a critical step in optical module assembly, ensuring that lenses, sensors, and other optical components are accurately positioned and permanently fixed. In modern optical modules, such as those using the COB (Chip-on-Board) process, dispensing is used to apply adhesives for die bonding, wire bonding, and optical coupling.

Proper dispensing directly affects module performance, including optical power, receiver sensitivity, and alignment accuracy.

Key Steps in Optical Module Dispensing

Die Bonding: Adhesive, often conductive silver or UV-curable, is applied to the PCB at designated positions. Optical and electrical chips are placed on the adhesive, and high-temperature baking secures them permanently. Wire Bonding: Gold wires are bonded between chips and PCB pads.

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Adhesive may be used to encapsulate and protect the wires, ensuring mechanical stability and electrical integrity. Optical Coupling: Precision lenses are mounted to align with light-emitting components like VCSELs.

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V adhesive is first used for temporary fixation, followed by permanent curing with black adhesive and high-temperature baking. Misalignment or improper adhesive application can reduce optical efficiency and module reliability.

Automation and Precision

Manual dispensing often leads to variability in adhesive volume and placement, which can compromise module quality. Automated dispensing systems, often based on machine vision, improve accuracy and repeatability. These systems use image processing to identify dispensing areas, calculate optimal paths, and control adhesive volume precisely.

Tolerances can be as low as 0. 02 mm, and efficiency improvements of 20–30% are achievable. Closed-loop control ensures consistent adhesive application, critical for high-resolution optical modules.

Adhesive Considerations

Volume Control: Excess adhesive can cause overflow or misalignment, while insufficient adhesive may lead to weak bonding. Curing: UV or thermal curing ensures the adhesive sets correctly, maintaining optical alignment and mechanical stability. Material Selection: Adhesives must be compatible with optical components and withstand thermal and mechanical stresses during module operation.

Summary

The optical module dispensing process is a combination of precise adhesive application, component alignment, and curing. Automation and machine vision technologies are increasingly used to enhance accuracy, reduce variability, and improve production efficiency. Proper execution of this process is essential for achieving high-performance optical modules with reliable optical power and receiver sensitivity.

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