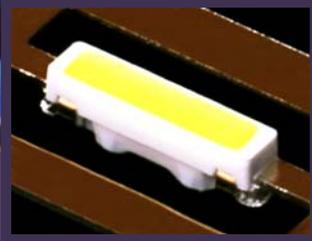


LED Dispensing Solutions: Small scale to high volume



LED assembly includes dispensing of various materials, such as yellow phosphor filled silicone. Typical dispensing applications are:

- Cavity Encapsulation
- Phosphor Plate Attachment
- Phosphor Coating
- Remote Phosphor

The common requirements for dispensing LED optical materials include:

- Accurate and consistent fluid amounts, often using silicone which is difficult to dispense due to elasticity
- Tiny fluid dot sizes
- Selective area in conformal coating
- Fast throughput—high unit per hour (UPH)
- Sustaining suspension of phosphors in fluid
- Conformal spraying or coating

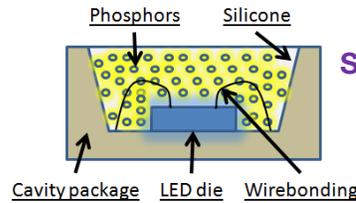
The correct amount of phosphor must be distributed evenly over the LED die. A white LED is typically made by combining a blue LED with yellow phosphor. It is the secondary emission from the yellow phosphor combined with the correct blue light mixture that makes white light. Color quality is determined by the amount of phosphor and its distribution over the LED, and may be specified and measured by the x- and y-coordinate range of the emitted light's CIE (International Commission on Illumination). Find out more about each application below.

LED assembly requires various manufacturing processes that include fluid dispensing.

Cavity Encapsulation

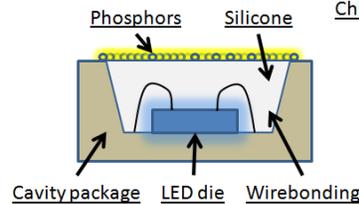
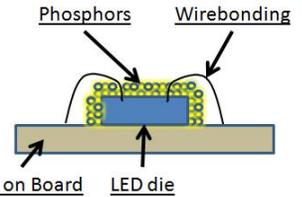
Cavity encapsulation is the most common method of covering the LED die. A mixture of phosphor and a binder (e.g., silicone or epoxy) is used. Since phosphor particles tend to settle out, one of the technical challenges is to ensure uniform mixing and dispersion of the binder and phosphor. Less uniformity can adversely affect the color quality.

After LED chips are placed in the cavity bottom, the silicone phosphor is jetted to encapsulate the cavity. Nordson ASYMTEK's patented Calibrated Process Jetting+ (CPJ+) and active nozzle technology ensure dispense weight accuracy and consistency, which contribute to a tight CIE.



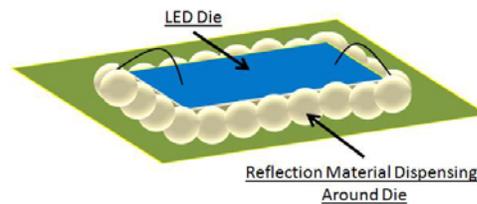
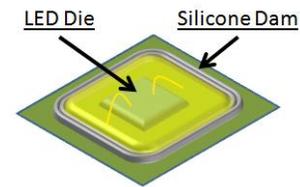
Silicon Phosphor Encapsulation

Phosphor Coating



Remote Phosphor Coating

Dam and Fill Dispensing



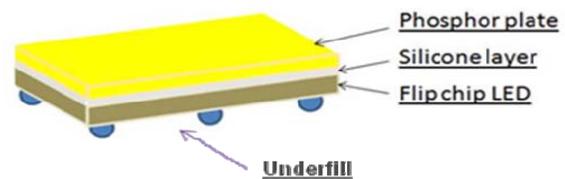
Dispensing reflection material around a die

Phosphor Coating

Phosphor coating and remote phosphor technologies are aiming for less binder and more uniformity by spraying phosphor with minimal binder on die surface or optics surface. The thin phosphor layer is formulated on die or optics. Achieving uniform spray thickness is a key challenge.

Phosphor Plate Attachment

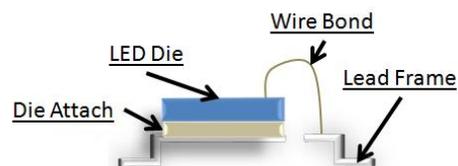
Phosphor plate attachment requires an exact amount of clear silicone dispensed on the die, similar to die attach applications. Excess silicone causes side-drop and may result in plate tilting on the die.



Silicone layer dispensing & underfill dispensing

Polymer Conformal coating for LED signboards

Underfill for Flip Chip LEDs



Die attach dispensing

Challenge: LED Silicone Phosphor Dispensing

Requires billions of units to be produced.

Solution: High-speed jet dispensing systems.

Sticky silicone is difficult to dispense.

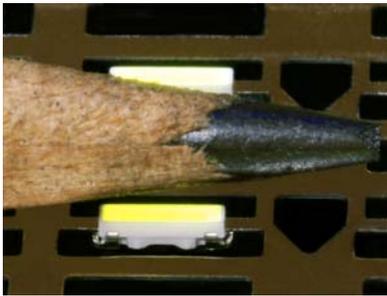
Solution: Nordson ASYMTEK's active nozzle technology.

Narrow cavity: 400um widths.

Solution: The jets can dispense small dot sizes 100-200um.

Inaccurate amounts of phosphor/silicone change CIE quality.

Solution: Dispense consistent fluid amount using advanced CPJ+ software, exclusive to NordsonASYMTEK dispensing systems.



Pencil next to side-view LED for size reference

Challenge: Lens Attachment

Lens attachment requires exact adhesive amounts dispensed at specific locations, which are sometimes in the bottom of cavities due to the optics structure.

Optics alignment between lens and LED die is critical and the assembly needs to avoid contamination of the lens. The proper amount of adhesive is also critical to ensure the proper parallelism of the lens during bonding.

Product Solutions

Low-Volume Dispensing Systems



DispenseMate® D-583/585 and the Spectrum™ S-820

High-Volume Dispensing Systems

21.500 Units/hour

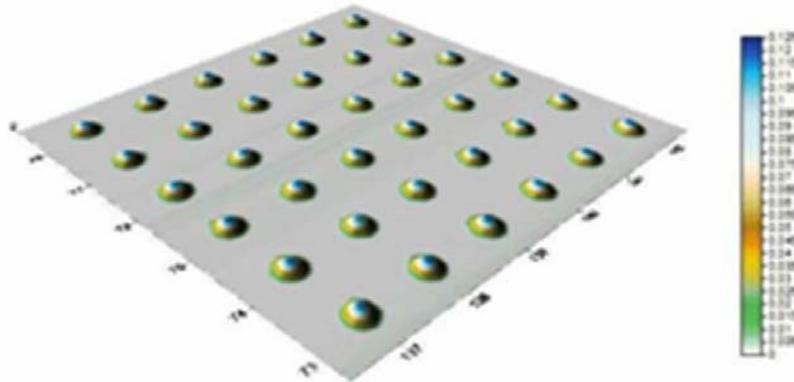


Spectrum™ S-920N with MH-912S Same-side Load/Unload Handler

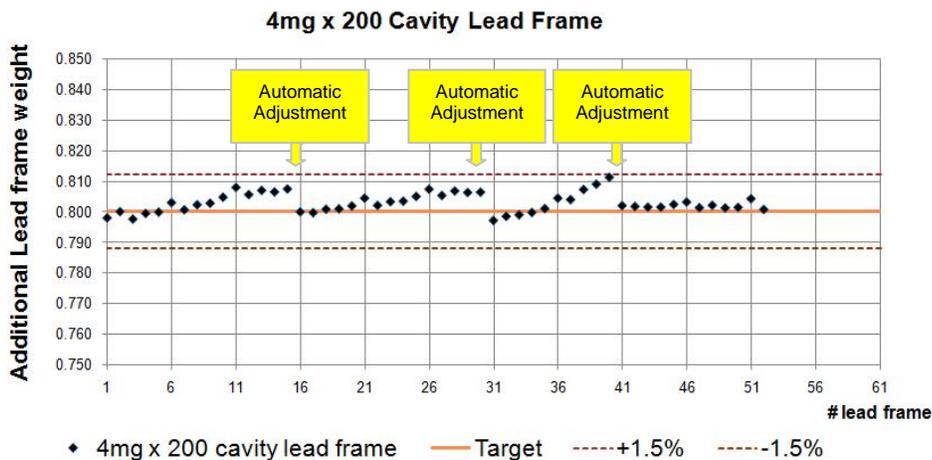
Calibrated Process Jetting (CPJ+) Software

- Automatic calibration of dispensing weight with machine-embedded scale.
- Automatic dispense weight adjustment at programmed intervals.
- Hand-free operation.

Accurate and consistent dispensing contributes to tight CIE LED production.



Automatic process control using CPJ+ adjusts dispense weight during production.



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