



EXAMPLE:

Grayscale calibration reflectance standards for a semiconductor vision metrology system

BACKGROUND: A major semiconductor manufacturer had a flip chip substrate vision inspection system that worked on non-calibrated gray values from 0 to 255. Their current one-piece standards were hard-mounted into a tray and the sections of differing grayscale values could not be separated.

They wished to move to a calibrated system by developing the module's software to calibrate to specific gray targets. They desired targets that could be separated and fitted into standard JEDEC trays, allowing them to be handled by the module like normal packages so the calibration could be seamlessly automated.

KEY APPLICATION CHARACTERISTICS:

The targets needed to be robust to automated handling and compatible with standard JEDEC trays. The reflectance values needed would run the gamut from 2% (black) to 99% (white) and be calibrated on both sides.

SOLUTION:

Labsphere proposed a solution of grayscale targets manufactured from Spectralon® reflectance material. Spectralon® can be manufactured to virtually any reflectance value and can be machined to a wide variety of shapes and sizes. As a thermoplastic, it can be handled by automated equipment without damage.

Labsphere was able to machine pockets into the Spectralon® targets and press stainless steel dowel pins the diameter of the solder bumps into those pockets to create a marker the vision system would register.

In order to be recognized and positioned by the vision system, each standard needed several contrast features that mimicked the solder bumps used as fiducials on the actual devices being inspected. Labsphere was able to machine pockets into the Spectralon® targets and press stainless steel dowel pins the diameter of the solder bumps into those pockets to create a marker the vision system would register.

As the inspection equipment used a variety of lighting geometries and colors on both the top and bottom sides of the packages, a reflectance calibration using 0°/45° geometry was chosen as opposed to standard 8°/h geometry¹. Labsphere calibrated both sides of every standard and transmitted that data with each shipment of standards.

¹ When measuring reflectance, the geometry is reported as light incident/collected with angles measured relative to the normal of the reflecting surface. The letter h is short for hemispherical and d is short for diffuse. Common geometries are 8°/h, 0°/45°, 0°/d, and d/0°.

For further data on Spectralon®, please refer to “A Guide to Reflectance Materials and Coatings” featured on our website.