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Laser Scanning Technique For Strain Mapping

The different materials comprising an electronic package expand at different rates under thermal stress. Differing expansion rates cause deformation among the individual layers contributing to an uneven strain across the whole package. More frequent failure occurs in the areas under greatest stress, so manufacturers would prefer a sensing technique that can measure stress over an entire layer of material. Among current measurement techniques such as Digital Image Correction (DIC) and Mirco-Moire methods, a tradeoff exists between sensor accuracy and size of the area scanned. There is need for a device that covers the gap in scanning ability and offers a robust measurement of thermal stress.

Researchers at Arizona State University have developed a strain sensing mechanism that measures the change in the angle of diffraction of a laser beam focused on a surface undergoing thermal stress. Nanoscale inconsistencies in the package material are amplified and detected as changes at the milliscale level. By focusing the laser beam and scanning the laser across the entire package, the mechanism is able to maintain a spatial resolution on the order of tens of micrometers so that the desired sensitivity and accuracy can be achieved. This enables a manufacturer to detect inconsistencies over an entire layer without giving up measurement precision.

Potential Applications

- Integrated Circuit Manufacturing.
- Semiconductor Quality Assurance

Benefits and Advantages

- Accuracy – Increases sensitivity of measurements.
- Robustness – Fills metrology gap between current techniques by measuring larger areas without significant loss of accuracy.
- Versatility – Scans electronic packaging made of a number of different materials.

For more information about the inventor(s) and their research, please see Dr. Hongbin Yu's directory webpage

Dr. Hanqing Jiang's directory webpage