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Reference:

Periasamy and Tippur, 2013, Meas. Sci. Technol. 24: 025202. ([link](#))

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Reference: Quality Control
for Reflective Surfaces



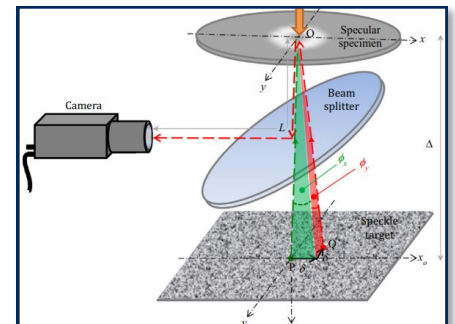
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Optical Sensor for Quality Control of Reflective Surfaces & Transparent Sheets

Overview: Auburn is seeking a licensee or development partner for an optical sensor and visualization tool for slope, curvature, and topography quantification of thin reflective or transparent sheets. This technology can be applied to films and structures such as silicon wafers, mirrors, glass and ceramics to evaluate flatness and quantify stresses. This optical method is also capable of detecting localized defects, enabling the user to detect otherwise invisible flaws. It is relatively cost effective and easy to implement and automate. Applications of this sensor can also be expanded for surfaces that are reflective outside the visible spectrum, such as infrared.

Advantages:

- **OPTICAL SENSING** — This can help identify flaws over the entire field of view that cannot be found through visual inspection.
- **NON-DESTRUCTIVE** — Measurements can be made without contacting specimen.
- **SIMPLE SETUP** — Only requirements are a digital camera, image analysis software, and minimal other standard equipment.
- **INEXPENSIVE & EASY TO USE** — Simple set up requires limited expertise to operate.
- **RAPID RESULTS** — Can perform real-time analysis; evolution of surface slopes have been visualized during thin-film polymerization on silicon substrates.
- **HIGHLY SENSITIVE** — Surface slopes on the order of 0.00001 radians have been measured.



Description:

Thin structures subjected to stresses are frequently encountered in many aerospace, automotive and electronic systems. Fabrication of electronic and MEMS devices often require quantitative evaluation of substrates and thin film flatness in terms of slopes and curves. For example, silicon wafers are coated with thin films that can introduce thermal or mechanical stresses in addition to those caused by manufacturing and service. In such situations, measurement of geometric characteristics such as deflection, slope, and curvature become important.

Minuscule deformations in many stiff, brittle substrates can lead to poor performance or induce produce premature failures. The high sensitivity of this optical device is capable of identifying defects that would otherwise go undetected. Follow-on data analysis can obtain detailed topography of measured surfaces.

Being able to identify areas of high stresses and deformations through quantitative visualization can improve quality, durability and overall performance. In applications such as microelectronics, quantification of surface stresses and deformations can be invaluable for reducing time & costs and improving quality control. This device uses a simple combination of a digital camera, ordinary light source, beam splitter (optional) and reference target. Image correlation is then used to measure angular deflection of light rays.

Status:

- Functional prototype demonstrated on polished silicon wafer, reflective glass, acrylic mirrors
- U.S. Patents [10,718,607](#) and [9,759,553](#), plus a pending continuation ([20200256670](#))
- This technology is available for exclusive or non-exclusive licensing