k-Space Associates, Inc.

kSA MOS Thermal-Scan

Curvature, Bow, and Stress Mapping

Thermal-Stress Analysis with Heating and Process Gas Chamber

Leveraging k-Space Associates' expertise in integrating critical thin film metrology equipment, the Thermal Scan system combines the patented MOS (Multi-beam Optical Sensor) stress measurement technology with a high performance thermal processing chamber and gas delivery system. By integrating a single axis scanning stage, spatially-resolved curvature and stress measurement as a function of sample temperature is now possible. For rapid thermal processing measurement, the Thermal Scan system can acquire data at fast rates at a single wafer point in order to ensure accurate, time-resolved stress information is obtained.

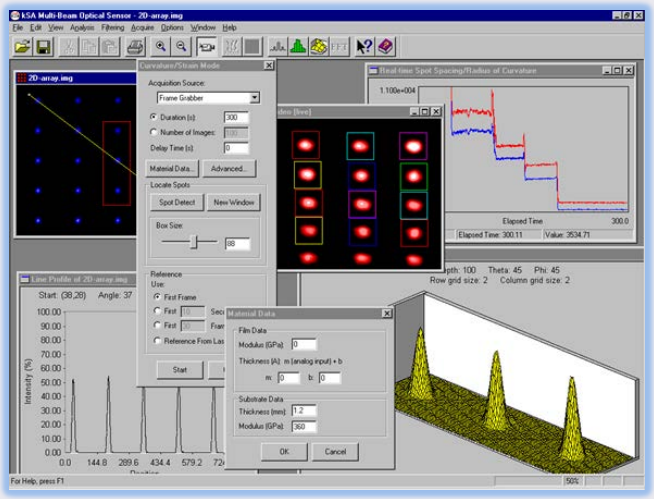
A single laser is used to generate a two-dimensional laser array. Changes in the beam spacing are used to determine curvature and subsequent stress during thermal ramping and soaking at up to 30 data points/second. In this way, the MOS Thermal Scan measures a true physical property in two dimensions that other systems, which use a point/line scan with mechanical restoring technique, cannot capture. The ability to directly image and view the entire reflected laser array greatly simplifies use and alignment compared with position-sensitive detector techniques. Simultaneous detection of the array makes the measurement inherently less sensitive to sample vibration or gas turbulence compared with scanning-laser systems, leading to increased curvature resolution capability (10x). Through the use of sophisticated image processing and data analysis algorithms, the Thermal Scan can easily detect micron-sized changes in spot position. With multiple chamber and gas introduction options, kSA MOS Thermal Scan provides unprecedented curvature and stress resolution during high temperature sample heating/cooling/annealing in most any gas environment.

Features	Benefits	Applications
Patented kSA MOS 2D laser spot array reflected off sample surface	Provides curvature, stress, and bow in both x and y planes directly and simultaneously	Map the 2D curvature of semiconductor wafers, optical mirrors, lenses, or practically any polished surface
Hi resolution X,Y scanning stages	1um spatial scan resolution over entire wafer/sample surface	Detect localized stress changes directly in very small areas. Helpful for analyzing patterning and processing effects on small scales instead of overall wafer bow.
Vibration controlled environment	Highest resolution curvature measurements in most any laboratory	No need for expensive vibration controlled tables or laboratory modifications to achieve world-class curvature/stress/bow measurements
Fully programmable scanning for selected area, line scan, or full area map	Recipe-based scanning routines for repeatable and simple scanning	User-defined scanning of all sample sizes and within sample area regions
Multiple heating and process gas chamber options	Add vacuum heating up to 1200 °C with process gas capability	Rapid thermal stress analysis and mapping during sample heating and process gas introduction for most any application

kSA MOS Thermal-Scan

Standard Hardware and Software

- Fully integrated and enclosed heating chamber, process gas piping and control, X,Y scanning system, and computer control system in robust frame
- Easy sample loading via drawer-mounted holder inside heating chamber
- Integrated UPS power supply
- 2-D array of parallel laser beams generated from a single beam laser source
    - Simplified optics and alignment system
- Optics are rigidly mounted to reduce vibrational noise
- Fiber coupled, Peltier cooled laser diode package with integrated current controller and temperature controller
- Direct contact thermocouple for sample temperature monitoring
- kSA BandiT optical temperature monitor upgrade available for direct -100°C to 1200°C measurements with semiconductor substrates



Hardware Options

Option/Part Number	Description
MOS-TS-MT	kSA MOS Thermal-Scan system with process gas introduction and sample heating up to 600 °C
MOS-TS-HT	kSA MOS Thermal-Scan system with process gas introduction and sample heating up to 1,200 °C
MOS-RGS	Cooled N2 gas introduction module. Maximum sample cooling rate of 100 °C/minute.
MOS-TS-BNIR	Upgrade to kSA BandiT optical temperature monitor

Performance Specifications

Sample Capability	Any polished surface with >1% reflectivity at laser λ
Substrate Size	Any size up to 300mm diameter
Temperature Range	RT-1200 °C (cooling stages also available)
Ramp Rates	Heating: >10 °C/sec. Cooling: 600 °C max 50 °C/min, 400 °C to RT max 5°C/min *Faster heating and cooling rates available
Radius of Curvature Resolution	Up to 100 km (1 sigma) at RT Up to 20km at HT
Spatial Scan Resolution	User selectable, down to 1um
Average Curvature Repeatability	$<2\times10^{-5}$ 1/m (1 sigma)
Average Tilt Repeatability	<1 microradian (1 sigma)

Your partner in thin film metrology

k-Space Associates, Inc., is a leading supplier to the surface science and thin-film technology industries. Since 1992, we've delivered the most advanced thin-film metrology tools and software thanks to close collaboration with our worldwide customer base.