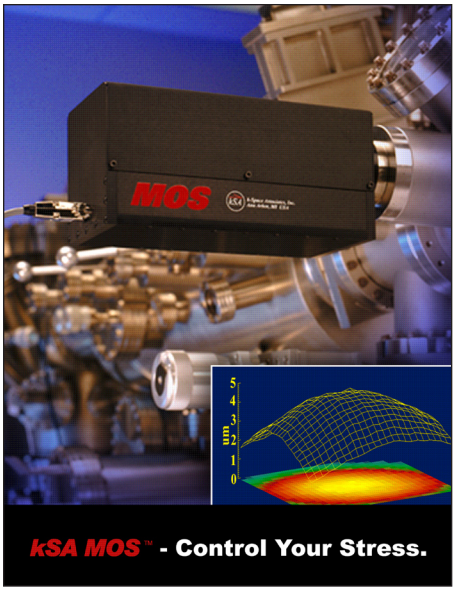
kSA MOS In-Situ Stress Monitor

k-Space Associates, Inc.

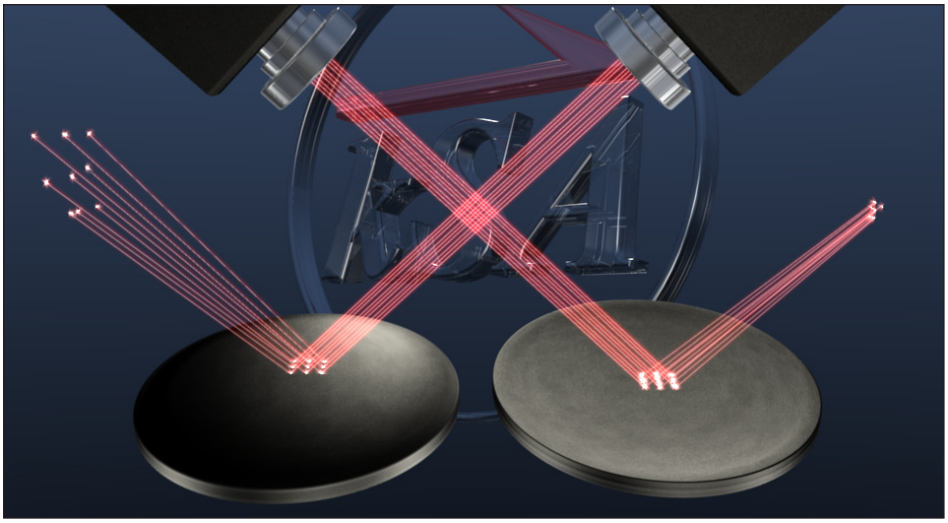


HIGH RESOLUTION IN-SITU STRESS MONITORING PROVEN FOR THIN-FILM DEPOSITION

THIN FILM STRESS MONITOR

The **kSA Multi-beam Optical Sensor (MOS)** is a thin-film stress and wafer curvature measurement tool with integrated real-time feedback for process control. This patented laser-based system is highly sensitive and is proven to be extremely robust. With the optimized optics and detection system capturing an array of reflected parallel laser beams, MOS uses proven real-time fitting algorithms to measure radius-of-curvatures up to 50 kilometers (depending on system geometry). Because the technique is optically based, it is compatible with harsh environments. MOS is ideally suited for real-time feedback to process control systems in the production or research environment.

> PATENTED MULTI-BEAM LASER ARRAY TECHNOLOGY DIRECTLY MEASURES STRESS-INDUCED CURVATURE WITHOUT USING ROTATING MIRRORS OR COMPLEX OPTICS



Stress in thin films induces curvature in the substrate. The kSA MOS system measures the curvature optically by monitoring the deflection of parallel beams of light with a high resolution CCD and real-time data processing.

A diode laser and Fabry-Perot optics are used to generate a two dimensional array of laser spots. Changes in the reflected beam spot spacing are used to determine curvature and the subsequent induced stress in real time. Beam intensity variations may also be used to determine growth rate, roughness and optical constants (n,k). The ability to directly image and view the entire 2D reflected laser array greatly simplifies use and alignment compared to position-sensitive detectors. Simultaneous detection of the array makes the measurement inherently less sensitive to sample vibration compared with scanning-laser systems because all the laser spots move together at the same frequency. As a result, movement or tilt is not detected as a change of curvature. kSA MOS can easily detect micron-sized changes in spot position, offering today's highest resolution 2D curvature detection system available.

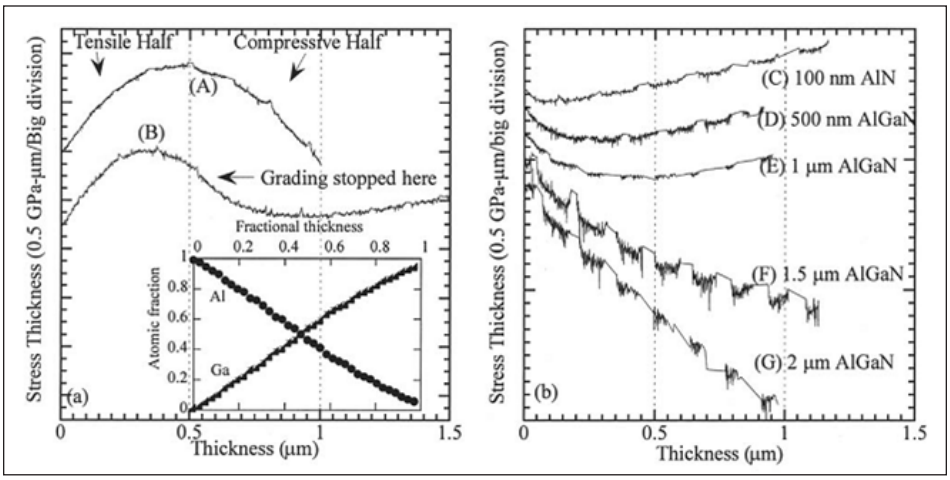
> FEATURES

- Patented, high resolution 2D multi-beam optical sensor technique
- Virtually immune to system vibration
- Two-port or single-port geometries
- Integrated real-time feedback

> BENEFITS

- Real-time analysis of 2D thin-film stress and curvature
- Evolution of stress during thermal cycling, buffer layer, and active layer growth
- Stress and strain engineering to improve device performance
- Optional real-time thickness, growth rate, and optical constant (n, k) determination

> PROVEN FOR GAN AND OXIDES

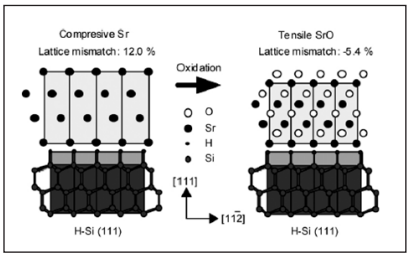


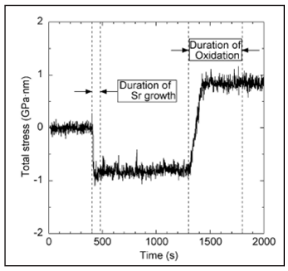
Stress-thickness vs thickness plots for the linearly graded AlGaN layer, 1(a), and the GaN layer, 1(b), deposited on different buffer layers, as indicated. Inset in 1(a) shows the linear change in composition in the graded AlGaN buffer layer.

Correlation of growth stress and structural evolution during metal organic chemical vapor deposition of GaN on (111) Si
Joan M. Redwing et al. / APPLIED PHYSICS LETTERS 88, 041904 2006

Total stress induced during metal oxidation and growth on Silicon

H. Asaoka et al. / Solid State Communications 124 (2002) 239–242





> OPTIONAL HARDWARE AND SOFTWARE UPGRADES

Option/Part Number	**Description**	**Features**
HARDWARE		
Mini-MOS M-M	Single port, 1.33" CF mount or smaller	Tailored optics and mounting for commercial MOCVD systems where optical access is limited
High Resolution Detector M-HRD/U	High Resolution CCD detector and frame grabber	2x spatial resolution increase versus standard CCD
High Resolution Shaft Encoder M-HRSE	12-bit encoder with PLC	TTL rotational triggering with 0.088 degrees resolution (4096 steps) and accompanying control software
SOFTWARE		
Growth Rate Monitor MOS-GM	Reflectivity-based monitoring	Real time growth rate, thickness, and optical constants (n,k)
Multi-Wafer MOS-MWO	Multi-wafer capability	Separate data analysis for each wafer on a rotating platen
Thermal Scan M-TSC	Thermal scan capability	Automatic temperature monitoring and control