

KSA MINI-MOS FOR GaN and MOCVD GROWTH

kSA Mini-MOS installed on Veeco D-180 MOCVD System

IN-SITU REAL-TIME STRESS EVOLUTION DURING GROWTH OF TODAY'S DEMANDING MATERIALS

Most nitride-based deposition is performed on substrates of different material makeup (e.g. sapphire and SiC). Inherent stresses, both due to lattice mismatch and differing thermal expansion coefficients, are inevitable in such material systems. These stresses can be large, and can cause adverse effects, including substrate heating non-uniformity (due to wafer curvature) and diminished device performance. As a result, it is crucial to monitor and control these stresses during the deposition process.

The **kSA Mini-MOS (Multi-beam Optical Sensor)** provides this capability. Mini-MOS is an extremely sensitive, laser-based system for in-situ, real-time monitoring of thin film stress, deposition rate, and substrate curvature. Based on proven and patented kSA MOS technology, Mini-MOS is a smaller version of its big brother, designed for use on MOCVD reactors where optical access and space are limited.

The kSA Mini-MOS system utilizes a single array of laser spots to calculate curvature and stress in real-time. By monitoring the time-dependent reflectivity, the deposition rate is determined as well. The system is ideally suited for real-time feedback to process control systems in the production or research environment.

The kSA Mini-MOS handles wafer and platen rotation in a variety of ways. Data can be taken continuously during rotation, with scattering from the platen ignored. Data can be sorted wafer-by-wafer based on the reflected laser signal. Or data can be acquired based on an input trigger for precise acquisition timing.

> FEATURES

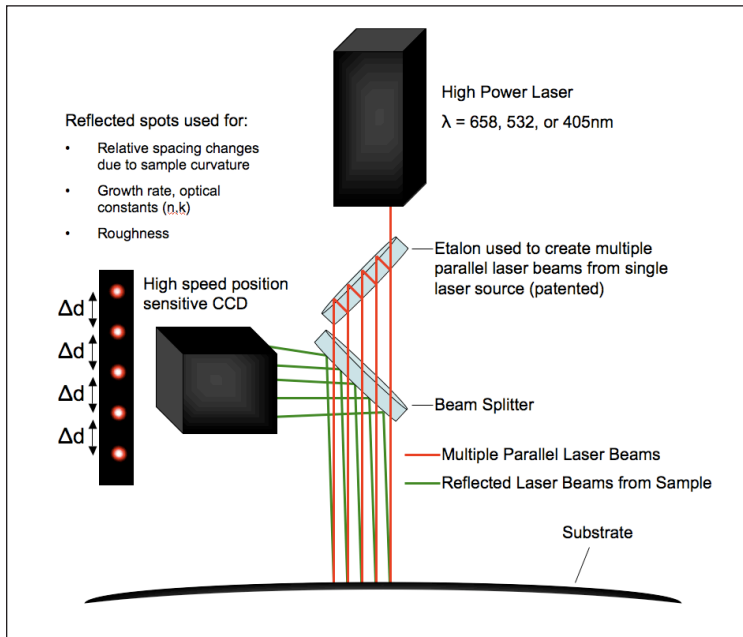
- Simultaneous detection of the laser spot array makes the measurement virtually immune to vibration.
- Flexible design options allow integration onto Aixtron, Veeco, Thomas Swan style MOCVD reactors.
- Multiple laser spots (typically a 1 x 4 array) allows for increased curvature and stress resolution, as well as simultaneous spatially-resolved growth rate measurement.

> BENEFITS

- Fully supported rotational triggering functions.
- Optimized optics and detection system combined with proven fitting algorithms result in typical radius of curvature detection of 2 - 10 kilometers depending on system geometry.
- Real-time reflectivity, growth rate, and optical constant (n, k) determination.



k-Space Associates, Inc.



kSA Mini-MOS uses a 3 or more laser spot array generated from single optic for highest resolution and repeatability

> OPTIONAL HARDWARE

12-bit High-resolution Detector/ Digital Frame Grabber M-HRD/U

Description

The MOS system can be configured with a 1300 x 1030 pixel, 12-bit, high-resolution detector. This detector offers a CCD sensor with nearly twice the spatial resolution of our standard 768x480 detector. The increased spatial resolution and bit depth can provide nearly twice the radius of curvature detection capability. In a well-controlled experimental setup, radius of curvature detection can approach 20 km or greater. The ultimate resolution of the system is, of course, dependent on the particular configuration of the MOS system and the specific reactor geometry.

kSA Mini-MOS uses a single etalon optic that generates a linear array of laser beams (typically 4 or 5 spots) to measure the relative spacing changes due to curvature induced by thin film and/or thermal stress during MOCVD growth. One advantage of the etalon technique is that you can simply change the angle of the etalon to create the number of spots desired, increasing system resolution and repeatability. k-Space has spent more than 10 years working on the quality of the laser and optics we use and on creating very sophisticated algorithms to determine the position of the laser spots. As such kSA Mini-MOS can actually determine the position of a laser spot on a CCD with a reproducibility of 0.01 pixel. This is what gives our systems the best curvature resolution and reproducibility in the industry. We have in-situ systems installed around the world that can achieve resolutions of 100,000 meters. When you want to measure the stress due to a few mono-layers of InGaN, kSA Mini-MOS can deliver.

YOUR PARTNER IN THIN FILM CHARACTERIZATION

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 characterization tools and software thanks to close collaboration with our worldwide customer base. We realize the best products are developed with our customers' input, so we're good listeners. For your real-time surface analysis, curvature/stress, temperature, deposition rate, or custom project, we look forward to helping you with your thin-film characterization needs.