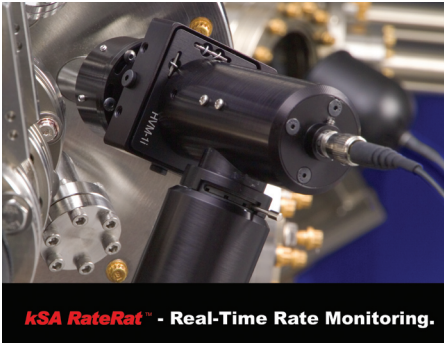




THE ONLY REAL-TIME OPTICAL MONITOR PROVEN FOR THIN-FILM DEPOSITION



DEPOSITION RATE AND OPTICAL CONSTANTS

The **kSA RateRat Pro** is a deposition rate monitor and advanced process control system. This non-invasive, in-situ, optically-based product makes thin-film deposition monitoring simple. By combining powerful advanced process control with real-time calculations of deposition rate, layer thickness and optical constants, kSA RateRat Pro makes monitoring

even the most complex multi-layered materials easy and precise. The kSA RateRat Pro detects and analyzes surface reflectance in real time. Using sophisticated **Virtual Interface** algorithms originally developed at Sandia National Laboratories, kSA RateRat Pro determines deposition rate, layer thickness, and optical constants with as little as 750 Å of material. kSA RateRat Pro provides real-time data analysis and output for feedback into process control software, and is ideal for input into MOCVD, MBE, sputtering, and evaporation control systems.

The kSA RateRat Pro system uses a diode laser (multiple lasers and wavelengths available depending on application), high-speed photo detector, 16-bit data acquisition

board, and laser modulator to acquire reflectivity data during thin-film deposition. The laser is modulated by inputting a user-selectable modulation frequency to the laser control module. The modulated reflectance signal is Fast-Fourier Transformed (FFT) to find the peak frequency amplitude. This improves signal-to-noise ratio because only light signal at the laser's modulation frequency is analyzed. Then, the calculated peak frequency amplitude is converted to an absolute reflectivity via a scaling factor, and the resultant reflectivity is plotted, stored, and fitted as a function of acquisition time. All data acquired during a deposition run may be stored and loaded at another time for post-acquisition analysis.

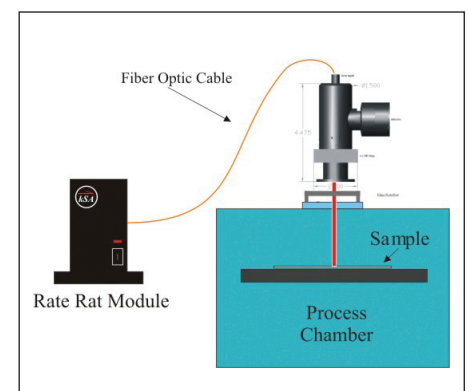
> FEATURES

- Two port or 1.33" CF single port, normal incidence mounting
- Integrated real-time feedback for process control
- Growth recipe support

> BENEFITS

- Real-time analysis of growth rate, thickness, and optical constants (n,k)
- Modulated diode laser and FFT signal analysis
- Automated calibration procedure
- Spatially resolved growth rate during substrate rotation

> SIMPLE INSTALLATION

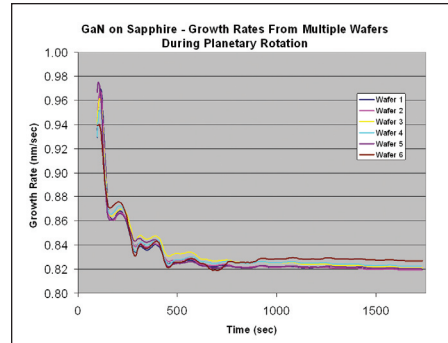




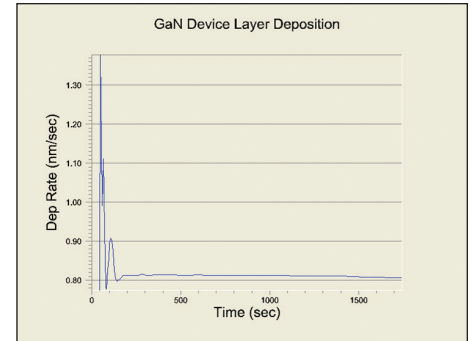
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> PATENTED VIRTUAL INTERFACE TECHNOLOGY

- Real-time update of current n , k , and deposition rate values and standard deviation of these values
- Ability to generate a thin-film deposition recipe, so multiple layers can be fit properly in real time
- Each layer in the recipe has a user-estimated n , k , and growth rate value and can be triggered via an external trigger signal or be time or layer-thickness based
- Optional ability to output n , k , deposition rate, and thickness to analog output channels to provide input into a process control system
- If needed, external triggering may be used to time data acquisition with external events or multi-wafer substrate rotation
- User-friendly Windows 2000 or Windows XP standard environment with file handling and extensive error checking
- Data storage in ASCII and binary file formats facilitate alternative data analysis
- Cut-and-paste functionality as well as export publication-quality graphics



GaN growth rate during planetary multi-wafer MOCVD. kSA RateRat Pro tracks each wafer individually via OEM trigger interface.



MOCVD growth of GaN based device: kSA RateRat Pro converges to real-time deposition rate with less than 750 nm of growth

> OPTIONAL HARDWARE UPGRADES

Option/ Part Number	Description
kSA Rate Rat Compact with 532 nm Laser RR-C	For mounting on 1.33" mini-conflat flange(s) or slit viewports. Typically used on commercial MOVPE reactors.
kSA RateRat System Upgrade to 405 nm Laser RR-405	Fully integrated 405 nm laser (replaces 532 nm) for ~30% faster determination of film thickness, deposition rate and optical constants (n,k).
RateRat Single Wafer Recipe Control RR-SWRC	User-programmable recipe software module for layer thickness and repetition. Additional Rack mount enclosure (RAT-RACK) is available for applications that require more than eight (8) I/O lines supported by the standard rack.
kSA Mini-RateRat Compact Production System RR-MWR	Production-worthy multi-wafer real-time deposition rate and optical constant monitoring system. Integrated 532 nm laser, photodetector, upgraded control electronics and software. Includes the following production-level capabilities.

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.