In-Situ *4000* Process Monitor

Real-time Measurement of Thickness and Growth Rate

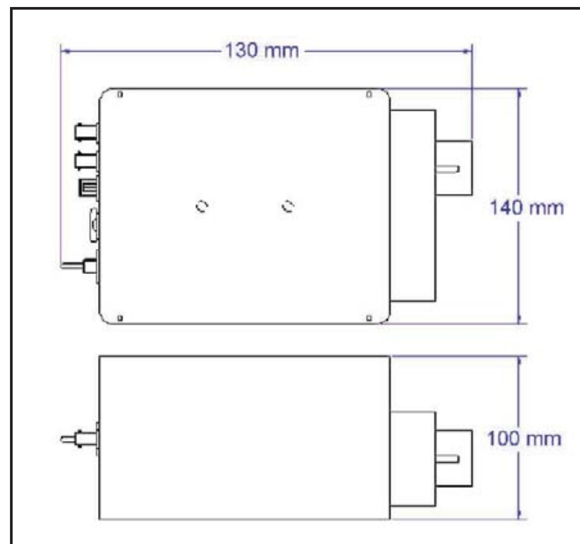
IS4K

Features

- Real-time Measurement of Temperature and Film Thickness on a Single View-port
- Real-time Measurement of Growth Rate and Film Index
- Dual Wavelength for Window Coating and Substrate Transparency Compensation
- Emissivity Compensation for “True” Temperature
- Closed-Loop Control of Temperature and Film Thickness
- Fully Digital Communication for Production and EMI Compliant Environments

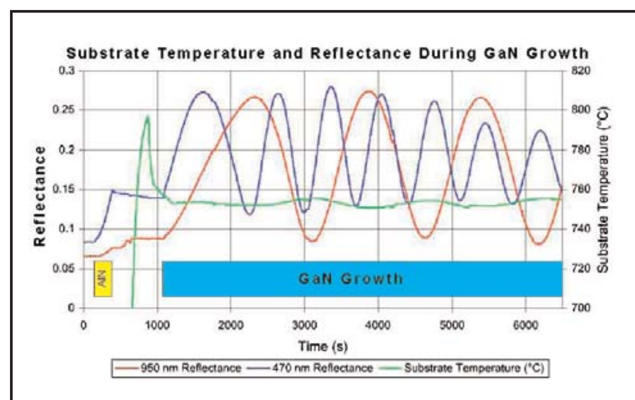
Description

The In-Situ *4000* process monitor is an ideal solution for closed-loop monitoring and control of multilayer thin film growth during MBE or MOCVD processes. The system provides real-time and accurate information on the substrate temperature, film thickness, growth rate and refractive index using a single, normal incidence view-port. Temperature is measured using a two color infrared pyrometer specifically designed to be insensitive to window coating problems and instrument alignment errors. The radiometer compensate for changing emissivity and correct the pyrometry measurements. The two independent optical reflectometer signals are analyzed by powerful software algorithms to provide thickness, growth rate, and refractive index in real-time.



Specifications

Specification	Value
Temperature Ranges	225°-500°C 450°-850°C 600°-1200°C
Compatible Substrates	Si, GaAs, InP, Sapphire
Radiometer Wavelengths	950, 850 nm
Temperature Equivalent Noise	<0.5C @450C Si
Reflectometer Wavelengths	950, 470 nm
Reflectometer Equivalent Noise	<1 nm @ Films > 100 nm
Target Distance Range	400 mm to infinity
Field of View	1 or 2.2 (>7 mm)
View-port	2.75” CF
Dimensions	100 x 140 x 130 mm
Alignment	Video Monitor
Computer Requirements	Windows 95, NT 4.0 or higher



In-Situ *4000* Monitoring the Growth of Nitride Films. (See Appl. Note 1401 and 1402)

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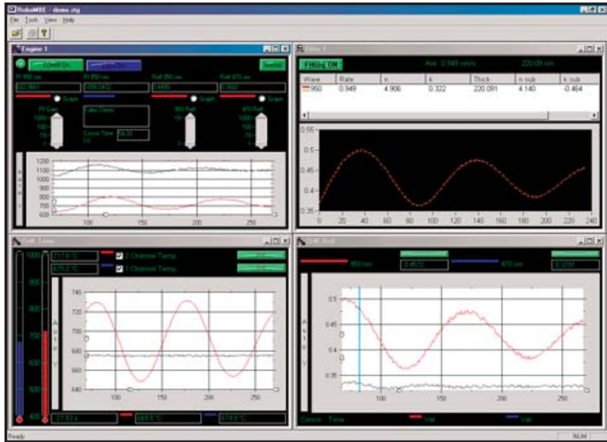
Software Applications

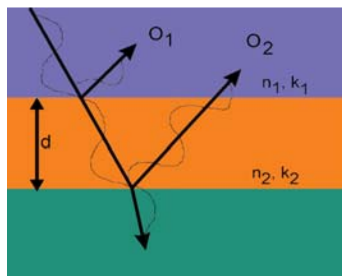


Software Description

The In-Situ *4000* software application is integrated into RoboMBE™ software automation and control system. The In-Situ *4000* base application performs the data acquisition from the optical head, computes the emissivity compensated temperature of the substrate in real time, and computes the specular reflectance of the substrate. The user-friendly graphical interface allows each of the measured variables to be displayed on the screen numerically, or in moving “strip charts”, as well as allowing logging of the data to a spreadsheet compatible log file. Substrate tilt errors experienced during substrate rotation are accommodated easily through a built-in sample and hold filter in the software application.

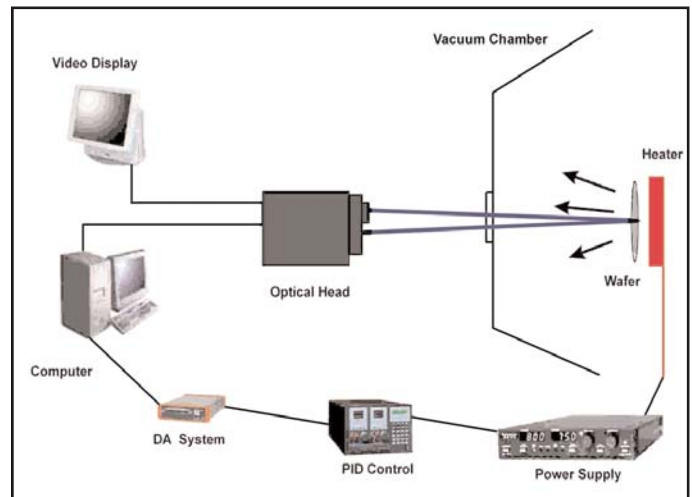
Growth Rate and Film Index Fitter

An optional software plug-in module for real-time fitting of growth rate, film thickness and index of refraction. The period of the oscillation, amplitude, phase and damping characteristics of the reflectance data are dependent on the film's complex index of refraction. The growth rate fitter software plug-in takes the reflectance information and computes a current growth rate for a given film by fitting to multi-parameter analytical model. The film index fitter allows computation of the film index of refraction. The Layer Sequencer offers a method to automate and monitor the fitting of many different successive layers. This enables the user to develop complex layer recipes for stacks of multi-layers.



Remote Control Interface

An optional software plug-in module for external communication of measurement results and for executing commands via a RS232 link and hardware interface for temperature and shutter control via an USB link and Data-Acquisition System. The In-Situ *4000* Remote Control Interface allows closed-loop control of temperature and film thickness. The DA system provides an analog output signal representing the emissivity corrected temperature or the thickness value. This signal can be used as an input for a PID control of the substrate heater supply. Shutter control for up to four materials is provided by digital outputs.



The schematic diagram above shows the layout of the In-Situ *4000* Process Monitor Remote Control Interface System.

Model	Description
IS4K-0L	In-Situ 4000 Process Monitor, Base Instrument Temperature Range 225°C - 500°C
IS4K-00	In-Situ 4000 Process Monitor, Base Instrument Temperature Range 450°C - 850°C
IS4K-01	In-Situ 4000 Process Monitor, Layer Instrument Layer Thickness Measurement Only
IS4K-05	In-Situ 4000 Process Monitor, High Temperature Temperature Range 600°C - 1200°C
IS4K-024	In-Situ 4000 Growth Rate and Film Index Fitter Powerful Real-Time Plug-in Software
IS4K-06	In-Situ 4000 Remote Control Interface External Communication and Close-Loop Control

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