

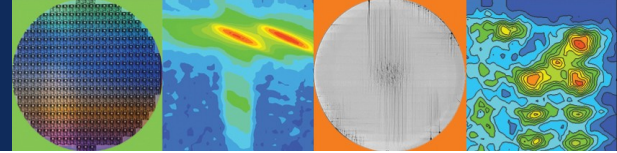
QC3 HIGH RESOLUTION DIFFRACTOMETER



Productivity Without Compromise

A dedicated high resolution X-ray diffraction system for the characterization of semiconductor materials

QC3 Overview



Introduction

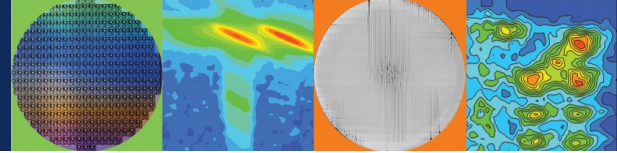
Jordan Valley's QC3 is the latest in the long running range of QC instruments. Following on from the Bede QC200, it is a dedicated quality control tool for high resolution X-ray diffraction for the compound semiconductor industry. It is suitable for the characterization of all common semiconductor substrates, including Si, GaAs, InP, GaN and others. Measurements can be run partially or fully automated, with user-customizable scripts handling the routine work.

The system has an optional robot for a fully automated system, or the incorporation of a sample plate with multiple locations for smaller wafers (up to 4 100mm wafers can be accommodated on a single plate). Software allows recipes to be assigned to different wafers in the batch, reducing the user intervention within the system.

Features & Benefits

- Dedicated and optimized HRXRD system with no compromise required to accommodate other techniques
- High intensity gives higher precision for the same throughput or higher throughput for same precision (compared to previous QC systems)
- Low cost of ownership
- Low running costs
- XRGProtect™, to ensure the tube lifetime is maximized
- Eco-mode, reduces power consumption of the system is reduced when there is no measurement being performed
- Batch wafer measurements with optional robot or multi-sample plates
- Easy to use, no expert required to run the system
- Fully automated alignment, measurement and analysis of wafers
- Uses tried and trusted, industry-leading RADS software for automated analysis
- Results can be reported remotely

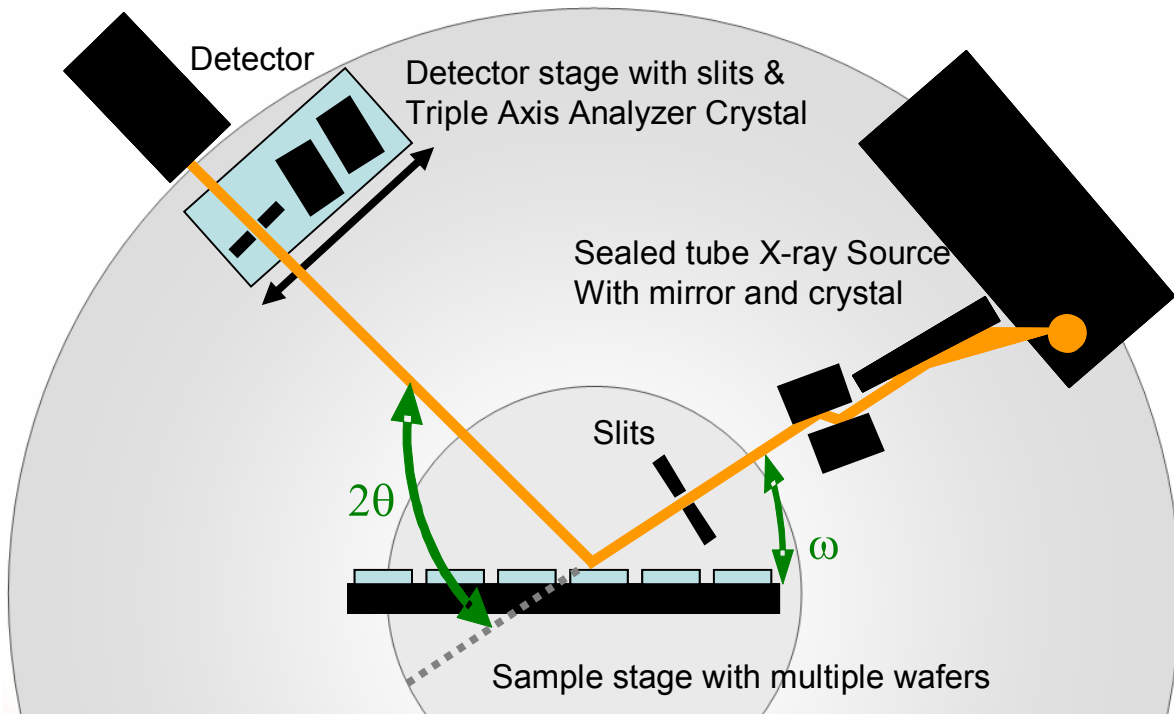
Applications



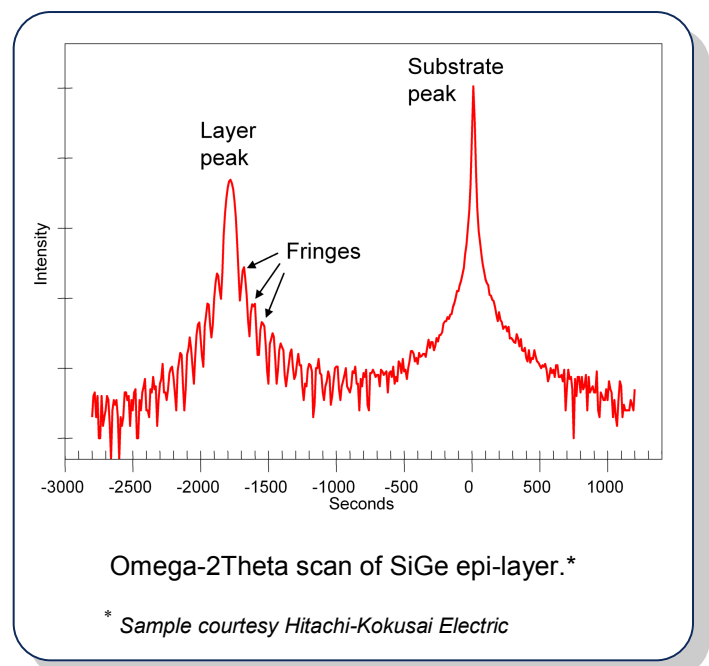
HRXRD and Relaxation

Materials: Single crystal substrate (e.g. Si, GaAs, InP, GaN) and epilayers, including multi-layer structures

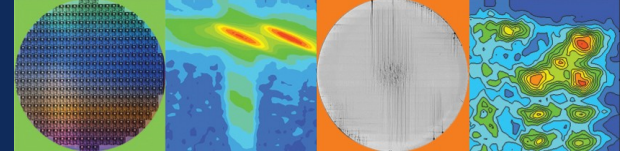
Parameters: layer thickness, composition and relaxation, strain, area uniformity, mismatch, dopant level, miscut, layer tilt.



- Direct measurement of relaxation / strain / composition of layers within a multilayer structure
- Automated sample alignment, measurement, analysis and reporting
- Analysis performed by the JV-HRXRD (formerly Bede RADS) software.
- Symmetric, asymmetric and skew symmetric reflections possible for compound semiconductor substrates



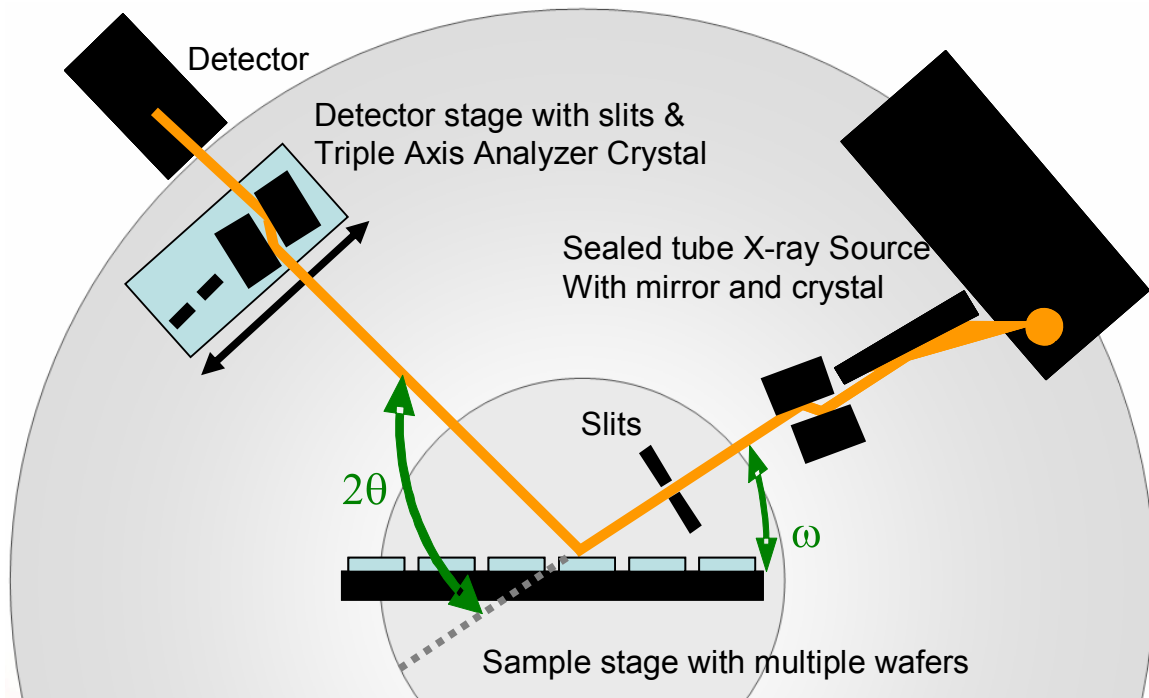
Applications



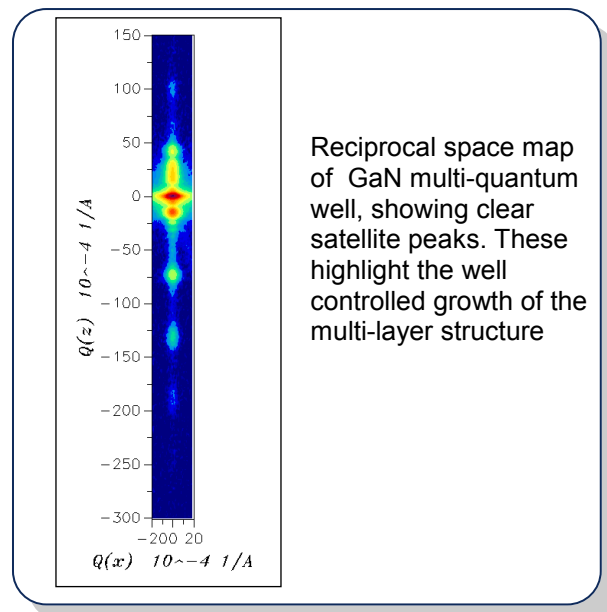
Triple Axis & Reciprocal Space Maps

Materials: Single crystal substrate (e.g. Si, GaAs, InP, GaN) and epilayers, including multi-layer structures

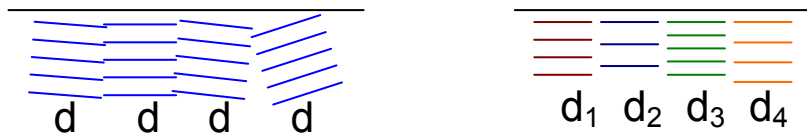
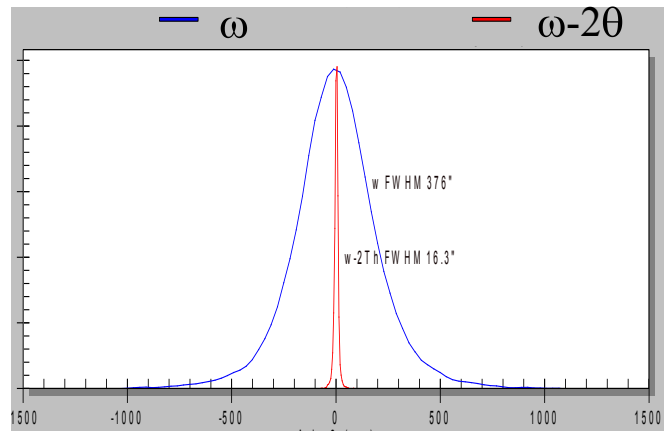
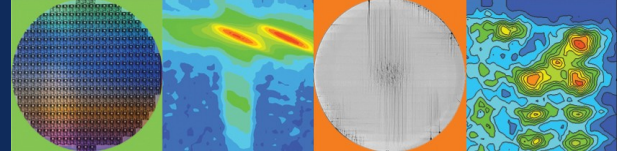
Parameters: layer thickness, composition and relaxation, strain, area uniformity, mismatch, dopant level, miscut, layer tilt.



- Direct measurement of relaxation / strain / composition of layers within a multilayer structure
- Automated insertion of triple axis analyzer crystal into the beam
- Automated sample alignment, measurement, analysis and reporting
- Reciprocal space maps created using Contour software
- Triple axis diffraction scans can be simulated using JV-HR XRD (formerly Bede RADS) analysis software

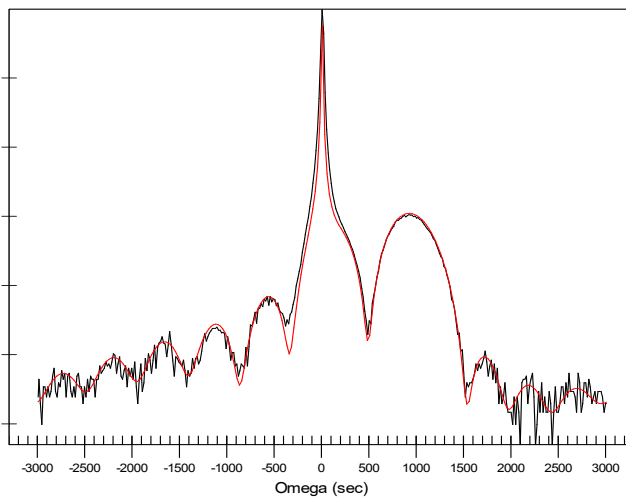


Example Data



Fix 2θ , scan ω : measure tilt mosaic Scan $\omega-2\theta$: measure strain

Experimental data, collected with triple axis analyzer crystal. Fixing the detector allows the mosaic tilt to be investigated, whereas scanning the sample and detector together probes changes in lattice parameter (due to strain).

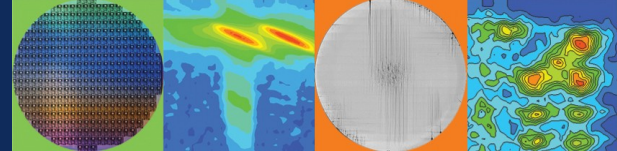


Experimental data (black), collected with triple axis analyzer crystal, and RADS simulation (red) of AlGaIn layer on GaN.

Progress	Residuals	GOF Function	Errors	
	THICKNESS (nm)	MATERIAL	X	RELAXATION (%)
2	3.934 ± 0.091	GaN [hexagonal]	0.0000	0.00
1	28.125 ± 0.104	Al(x)Ga(1-x)N [hexagonal]	0.2977 ± 0.0010	0.00
SUB.	∞	GaN [hexagonal]	0.0000	100.00

RADS simulation gives individual layer thickness and composition of simple and more complex structures.

Specifications



Item	Specification
X-ray Tube / Generator	2.2kW Cu LFF tube
X-ray beam Resolution	<10", K α 1 (Ge004)
	<50", K α 1 (Ge220)
Omega Range Resolution	14° to 38°, ~1"
2Theta Range Resolution	29° to 100°, ~2"
X / Y Range Resolution	>300mm on both, 0.010mm
Z Range Resolution	10mm 0.010mm
Phi Range Resolution	Unlimited 0.01°
Chi Range Resolution	-45° to 5° 0.01°
Detector Dynamic Range	~5 x 10 ⁷
Wafer sizes (manual)	Small pieces to 300mm, multiple smaller wafers on single plate
	Custom wafer plates available on request
Robot wafer sizes	4" – 200mm, other sizes available on request
Footprint	~1m x 1m (no robot)

Software

RADS

The original and still the best dynamical HRXRD simulation and fitting software. Allows simulation of symmetric and asymmetric spectra. RADS uses a patented genetic algorithm to ensure robust and precise data analysis with results you can trust.

PeakSplit

General HRXRD calculation software. It can be used either to analyze data or predict where peaks are likely to occur to efficiently plan data scans

Contour

Mapping software, for area maps, reciprocal space maps and texture maps (including ODF)

Control and Acquisition

Control and acquisition software to control the instrument. Standard measurements can be easily defined, and custom routines implemented for all applications and materials. Provides an interface for either robot loading or multiple wafers per sample plate.

