ECVPro+

Electrochemical Capacitance-Voltage
Profiling

Carrier Concentration Profiling for Complex Epitaxial Structures

The ECV Pro is the result of a total redesign that completely redefines ECV profiling. We have taken 25 years of profiling experience and coupled it with 25 years of advances in instrument control technology to produce the most precise, most reproducible, most highly-automated CV profiler ever. The ECV Pro was designed, from the ground up, to eliminate all operator dependent variations in the data. All the operator has to do is set the wafer on the stage. After initial setup, the ECV Pro takes care of everything else.

ECV Pro introduces the first ever in-situ camera for unprecedented levels of control. We call it ECVision™ and it allows real-time imaging of the semiconductor/electrolyte interface. Now you can see exactly what occurs at the sample surface during a measurement.

For III-Nitrides, the ECV Pro GaN option extends the performance of the system for optimal profiling of GaN, InGaN and AlGaN.

ECVision™ "To See is To Believe"

Once you have used a profiler with ECVision you will never want to go back to "flying blind." The ECV Pro uniquely features a camera that images the semiconductor/electrolyte interface. You can now be certain to eliminate data corruption due to bubbles or other disturbances, ECVision delivers novel insight of film removal or defect revelation during the etch process. ECVision can also make a permanent visual record of the semiconductor/electrolyte interface at any pre-programmed depth.

By automatically measuring the etch area, in-situ, immediately after the profile, ECVision greatly improves data accuracy. Integrated SPC software tracks the change in etch area over time. Separate charts are provided for p-type and n-type and for different electrolytes.

Profile through the base of an InP HBT structure–ECVision clearly shows the progress of the etch.

** ECVision is enabled by optimum surface reflection. Textured or patterned sample surfaces impact reflectivity and impair visibility of De-bubbling and in-situ etching quality and, in some cases, the accuracy of carrier concentration measurements at various depths. **

Eliminate Operator Variability. Operator training time is reduced. Sample preparation is simplified and the intuitive software leads the operator through the measurement process step by step reducing the possibility of errors. Recipe-driven operation means no operator involvement when profiling complex structures.

The novel design extends the sealing ring lifetime and eliminates the cost of expensive Calomel electrodes. Signal electrodes and contact sets need less frequent replacement.

The floor standing designs reduces footprint by approximately a factor of two compared with other profilers. As the electrolyte and waste are contained on the unit, there is no need for an adjacent wet-bench.

High Accuracy Measurement

Automation only has value if the measurements are accurate – and the ECV Pro excels in this aspect. The ECV Pro's newly designed digital electronics eliminate drift and significantly improves signal to noise. Capacitance is accurately determined and is calibrated to built-in standards prior to every measurement. The ECV Pro introduces a novel dual-frequency measurement so that a complete solution is found to the three-term model. The ECV Pro can measure carrier concentrations from $10^{12}cm^{-3}$ to $10^{21}cm^{-3}$ (Dependent on material quality) over a depth range from 0.05µm to 50µm with an unparalleled depth resolution of 1nm. The ECV Pro will exceed your expectations in every respect.

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Toho TECHNOLOGY

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Cells and Sealing Rings

The cell is the heart of the machine and the sealing ring is its most critical component. On the ECV Pro, the proprietary electrochemical cell minimizes maintenance by fully integrating it into the system and optimizing the electrode configuration. The new cell design more than doubles the sealing ring lifetime. It also incorporates a novel electrolyte circulation system to ensure uniform etching. Modular design makes sealing ring replacement a 30-second job while eliminating the potential to distort or damage the ring.

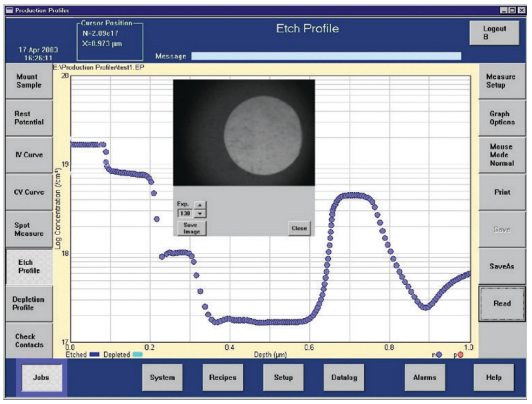
Hg Probe Alternative The ECV Pro's accuracy and reproducibility provide a viable, safe and environmentally friendly alternative to the Mercury probe. ECV Pro uses no Calomel reference electrode and is entirely Mercury free. The horizontal stage makes monitoring spatial distribution across a wafer simple and convenient. Using the depletion profile mode and the ultra-repeatable contacting area, ECV Pro can accurately measure the surface doping variations across a wafer.

An Alternative to Hall. ECV Pro offers many advantages over Hall measurements. These include measurement of electrically activated dopants and individual structural layer information. Additionally, the ECV Pro can be applied to a wide range of materials and structures and is not limited to profiling only on Si or suitable PN structures.

Specifications

Carrier Concentration	$10^{12}cm^{-3}$ to $10^{21}cm^{-3*}$
Depth Range	0.05µm to 50µm*
Depth Resolution	1nm*
Measurement Frequency	0.07kHz to 5.5kHz
Signal Amplitude	0V to 400mV pk-pk
Bias Voltage	±10V
Current Integrator	±2% up to 1024µm total
Blast Voltage	40V AC
Light Source	White Light Source (Halogen) UV Light Source (Mercury Xenon)
Operating System	Windows 11
Materials Measured	III-V, III-Nitrides, II-VI, Si, SiC
Facility Requirements	Light Vacuum
Power	110VAC - 240VAC, <5 Amps
Dimensions	630mm (W) x 800mm (D) x 1730mm (H)
Weight	160 kg

*Dependent on material quality.



ECV Pro profile of an InP/GaInAsP Laser test structure.

Software

The ECV Pro user interface is built around Industry Standard SEMI E-95 guidelines. The ECV software is extremely intuitive and guides the user, step by step, through the measurement and analysis. User-defined recipes allow automated profiling of complex structures and eliminate the need for operator supervision during measurement. Recipe control of processes markedly improves reproducibility. In production operation the ECV Pro can be programmed to signal out-of-control situations should the carrier concentration exceed process tolerance limits. For structures requiring multiple electrolytes, the ECV Pro is programmable to allow efficient and automated changing of the electrolyte.

Features

- Simplified sample preparation
- Low consumable costs
- Integrated design with small footprint
- No need for wet-bench

Industry Standard

Original Onto Innovation core technology inside