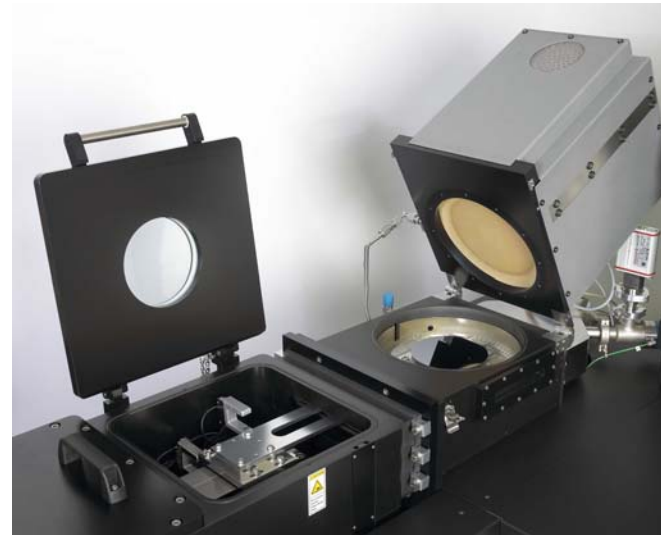
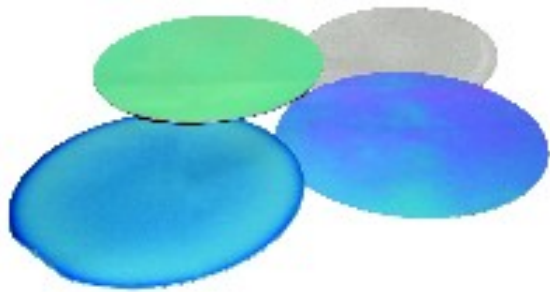


# ***AXIC Introduction***



**January 19, 2009**

# Company Profile

AXIC was founded in 1988, as a manufacturer of advanced Plasma Processing and XRF Metrology solutions for semiconductor industry.

AXIC developed the 1st film multi-modes plasma etch tool successfully and became well known in dry etch products. By working closely with customers over the years, AXIC has developed many new advanced ICP DRIE and low temperature PECVD products.

AXIC Products are marketed and supported by FSM sales and service organization in U.S. and factory trained sales agencies world wide.

AXIC also provides sales / services for a few selected companies including RTP, PVD, ALD, PIII, ellipsometer, spectroscopic and other products.

# AXIC Products

- Iso-Lok 200<sup>®</sup> ICP DRIE with loadlock
- BenchMark 800-III<sup>®</sup> ICP DRIE and low temperature PECVD
- BenchMark 800-II<sup>®</sup> RIE and PECVD
- PlasmaStar 200<sup>®</sup> RIE, PECVD and Asher
- MultiMode HF8<sup>®</sup> multi-function etcher
- Precision 1000<sup>®</sup> XRF

# Product Lines

## from Trading Principals

- **Allwin21** – Rapid Thermal Processors
- **Ultech** – Sputterer, Plasma Immersion Ion Planter, Evaporators, Spin Coaters
- **Syskey** – Inline Sputterer, ALD
- **Chemical Safety Technology** – Wet Etch station
- **NanoView** – Spectroscopic Ellipsometers. Offers a special tool for measuring Anti-Reflective film for solar application
- **Secon** – High rate microwave etching for surface texturing of solar cells

# Key Features List of AXIC ICP Etcher and RIE

- Chamber made of billet anodized Al
- All brand name components (Advanced Energy power supplies, Alcatel pump package, Norcal downstream pressure control, Verity optical emission spectroscopy for end point detection and others)
- Quality workmanship
- Modular design for maximum flexibility in system configuration
- Digital MFC programmable for use of unlimited gas types without removing MFC from system
- Insitu adjustable top electrode to optimize process uniformity (BenchMark RIE only)
- Recipe driven operation
- Built in sequential safety interlock to prevent operator error with three levels of security
- GUI – touch screen or mice
- Provide initial process recipes

# Iso-Lok<sup>®</sup> 200 ICP

## Load Locked ICP – DRIE and PECVD

### System Specification

- ICP Source for High Rate Process
- DRIE – Compound semiconductor materials, metals, Si, SiO<sub>2</sub>, Si<sub>3</sub>N<sub>4</sub>
- Low / No Damage Etch – Vertical Walls
- PECVD – Low Stress, Low Temperature SiO<sub>2</sub>, Si<sub>3</sub>N<sub>4</sub>, SiO<sub>x</sub>N<sub>y</sub>
- All Digital Components
- 1 KW, 13.56 MHz RF ICP Power (optional 3 KW)
- 600W, 13.56MHz RF Bias Power
- Automatic Matching Network
- Downstream Pressure Control
- Turbo and mechanical pumps
- PC Control with Windows Operating System
- Recipe Driven Programming with Graphical Presentation



# BenchMark 800-III ICP Etch or Deposition System

- All Digital Components
- 1KW, 13.MHz RF ICP Power (optional 3KW)
- 600W, 13.56MHz RF Bias Power
- Automatic Matching Network
- Downstream Pressure Control
- Turbo and mechanical pumps
- PC Control with Windows Operating System
- Recipe Driven Programming with Graphical Presentation



# BenchMark 800-II RIE/PECVD

- All Digital Components
- 600W, 13.56MHz RF
- Automatic Matching Network
- Insitu Adjustable top electrode
- Water-cooled bottom electrode
- Up to 6 MFC's
- Downstream Pressure Control
- Turbo and mechanical pumps
- PC Control with Windows 2000
- Recipe Driven Programming with Graphical Presentation





# BenchMark ICP and Iso-Lok Operating Software – MANUAL MENU

The screenshot displays the 'MANUAL MENU' of the BenchMark Production software. The interface includes a menu bar (File, Configuration, Manual Operations, Recipe Management, Production, View, Debug, Help) and a toolbar with icons for file operations and process control (GO, STOP, pause, resume). The main window is divided into several control panels:

- Process Valves:** Includes controls for Rough, Throttle Valve, HiVac, Foreline, Turbo Purge, Gauge Iso, and Chamber Vent, each with a 'CLOSE' button.
- MFC Valves:** Includes controls for O2, CF4, and C4F8, each with a 'CLOSE' button.
- Setpoint and Flow:** Displays 'Setpoint' and 'Flow' values in sccm for various parameters, with a 'FREEZE' button and 'Valve Status' indicator.
- Process Pressure Control:** Features 'Activate Setpoint' (OFF), 'Position' (00°), and 'Process Pressure' (0 mT) readouts.
- Turbo Pump Control:** Includes 'TURBO' (OFF) status, 'Turbo at Speed' indicator, and 'HiVac' (0.000 mT) and 'Foreline' (00 mT) pressure readouts.
- ICP RF and Bias RF:** Each has a 'MANUAL TUNING' section with 'ON/OFF' (OFF) buttons and readouts for Setpoint, Forward, Load, and Reflected power (0 W), and DC Bias (0 -V).

A status bar at the bottom indicates 'Recipe Completed' and provides details: 'Start Time: April 11, 2006 at 18:10:11', 'Cassette:', 'Wafer:', and 'Recipe: Warning - Manual Subsystem Window (cycle 1 of 1)'.

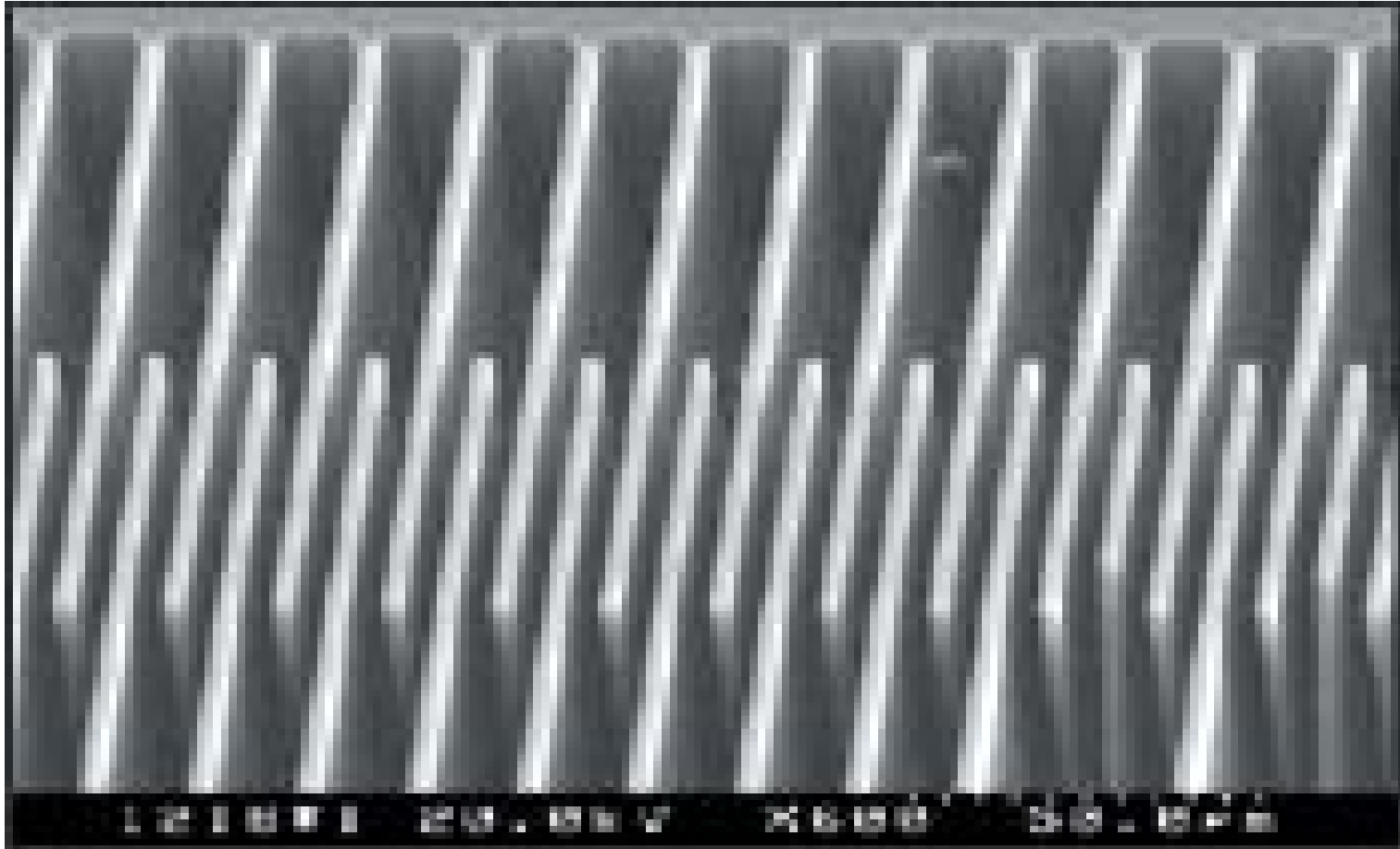
# Iso-Lok 200 GaN Target Process Specification (Example)

- Etch Rate – 0.5 – 1.0um/min with SiO<sub>2</sub> mask  
0.3um/min with photoresist
- Selectivity – 5-10:1 with SiO<sub>2</sub> mask  
1:1 with photoresist
- Very clean and smooth etch surface
- Straight sidewall
- Low ion induced damage

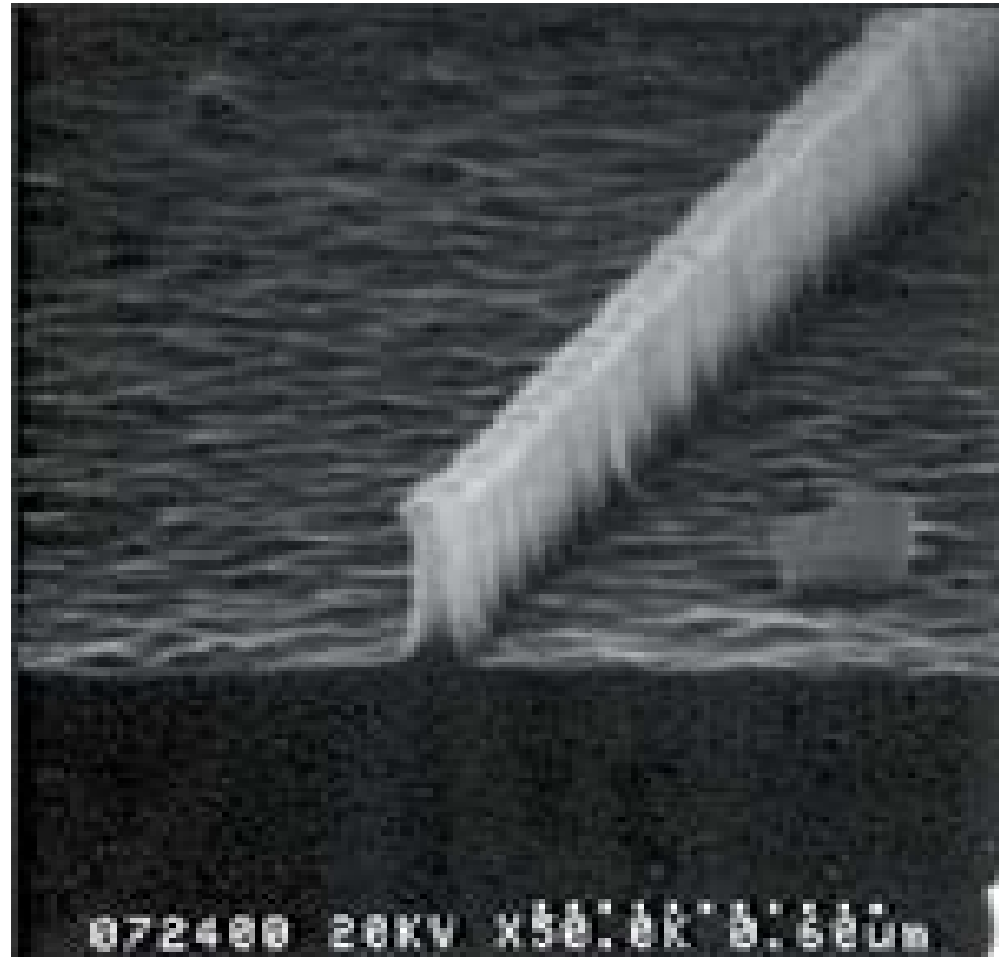
# GaN Etch Recipe (Example)

- Cl<sub>2</sub> – 37.5 sccm
- N<sub>2</sub> – 12.5 sccm
- Pressure – 1.2 Pa (8mTorr)
- Bias Power – 200W
- ICP Power – 500W
- Etch Rate – 0.645um/min
- Etch Selectivity with SiO<sub>2</sub> (40nm) mask – 13.3
- Side-wall Angle – 85.2 deg.
- Process Temperature - 85 deg. C
- Adding 10% BCl<sub>3</sub> will create non-radiative surface recombination states and minimize creation of surface states
- Using BI<sub>3</sub> and BBr<sub>3</sub> will increase etch rate
- A pre-clean step using H<sub>2</sub>SO<sub>4</sub>:H<sub>2</sub>O<sub>2</sub> (3:1) is also recommended

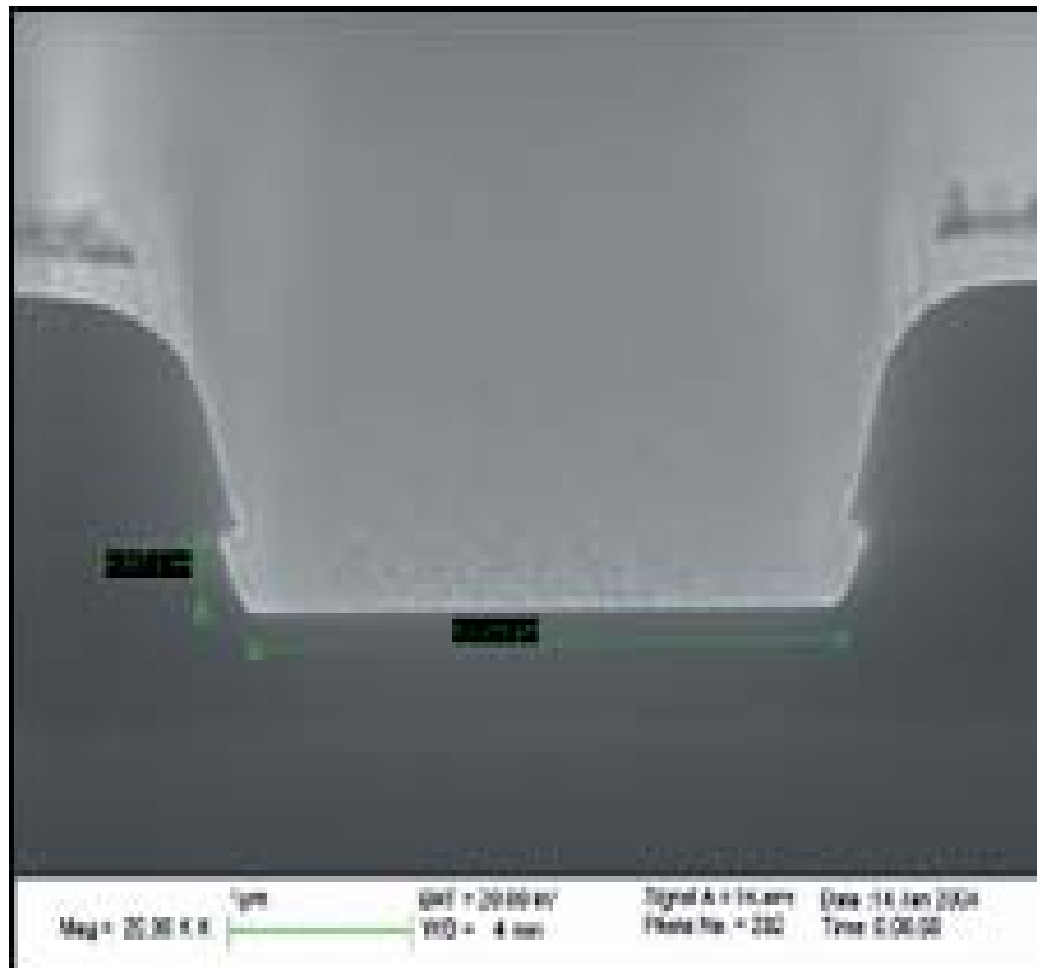
# BenchMark ICP – Etch Photo of Silicon



# BenchMark RIE – Etch Photo of Poly Silicon



# BenchMark RIE – Etch Photo of Silicon Nitride



# BenchMark Deposition Specifications

- ICP
  - SiO<sub>2</sub> & Si<sub>3</sub>N<sub>4</sub>: 100°C  
1500 – 2000 Å/min  
± 5%  
IR – 1.45
- PECVD
  - SiO<sub>2</sub> & Si<sub>3</sub>N<sub>4</sub>: 300°C  
500 Å/min  
± 5%  
IR – 1.45

# PlasmaStar Key Feature List

- 12"x14" active plasma area
- Process up to 12" wafer or multiple smaller wafers
- Stainless steel construction
- Top electrode with showerhead
- Water-cooled bottom electrode



# PlasmaStar 200 Plasma System

- 1KW, 13.56MHz RF
- Automatic Matching Network
- Multi-Electrode Configuration - Parallel plate (RIE) or cage/shelf (PE) electrode
- Up to 4 MFC's
- Downstream pressure control
- PC Control with Windows 2000
- Recipe Driven Programming with Graphical Presentation
- Ideal for Solar Cell Edge Isolation



# Precision 1000 XRF

- Ideal Tool for Measuring CIGS, CdTe for Thin Film Solar Cell Applications
- Metal and Alloy Film Thickness and Composition Measurements
- EDS and WDS Capability
- Up to 8" wafer
- Small Footprint
- Affordable



# Partial Customer List

- Motorola
- LumiLeds
- Cree Research
- Lexmark
- National Research Council
- GE Research Center
- Xerox (PARC)
- JDS Uniphase
- Los Alamos Lab
- International Rectifier
- Intel
- HP
- Harvard University
- MIT
- Purdue University
- Caltech
- Cascade Microtech
- United SiC
- Sandia National Lab
- Rutgers University
- JDS Uniphase
- Virginia Tech
- Georgia Tech
- NASA
- Simon Fraser University
- Ohio University
- University of Texas
- Implant Sciences

# Conclusion

- AXIC offers the most effective, high quality and economical dry process solutions
- AXIC offers customized tools as required by end users
- AXIC offers continuous, comprehensive application and service support