
CORIAL
A Plasma-Therm Company

CORIAL 210IL

Get Maximum Flexibility

ICP-RIE equipment for any chemistry

Wide process range for Silicon, Metals, III-V and II-VI compounds

Support ICP, RIE, ALE and DRIE process recipes in the same reactor

Smaller wafer pieces up to full 200 mm wafer

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SYSTEM DESCRIPTION
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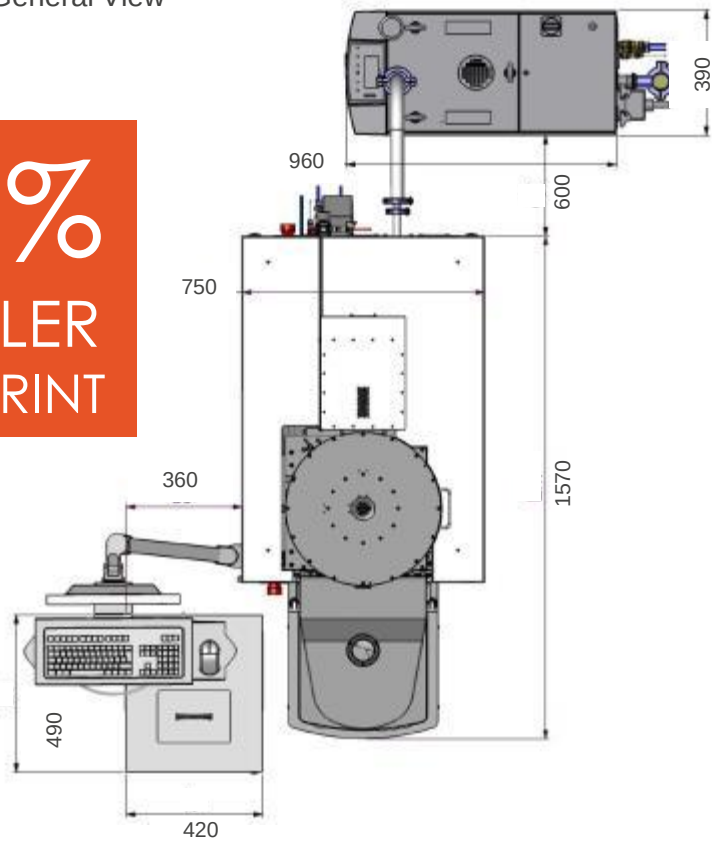
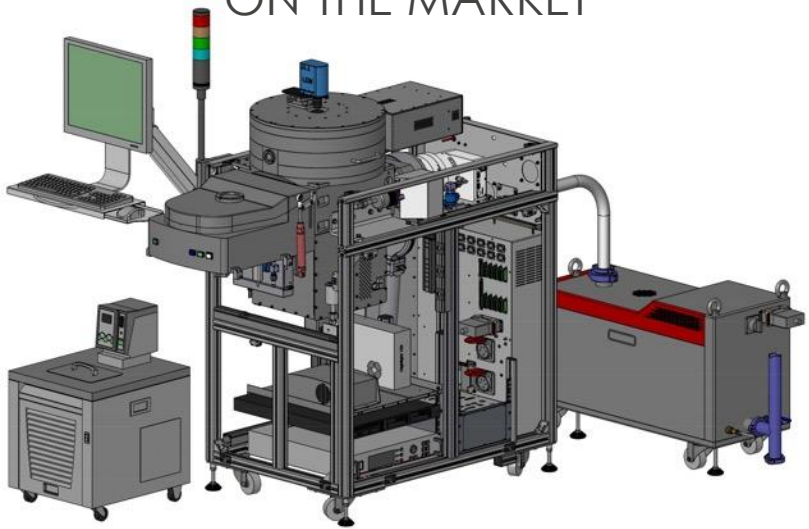
SYSTEM DESCRIPTION

General View

30 %
SMALLER
FOOTPRINT



THE MOST
COMPACT
MACHINE
ON THE MARKET



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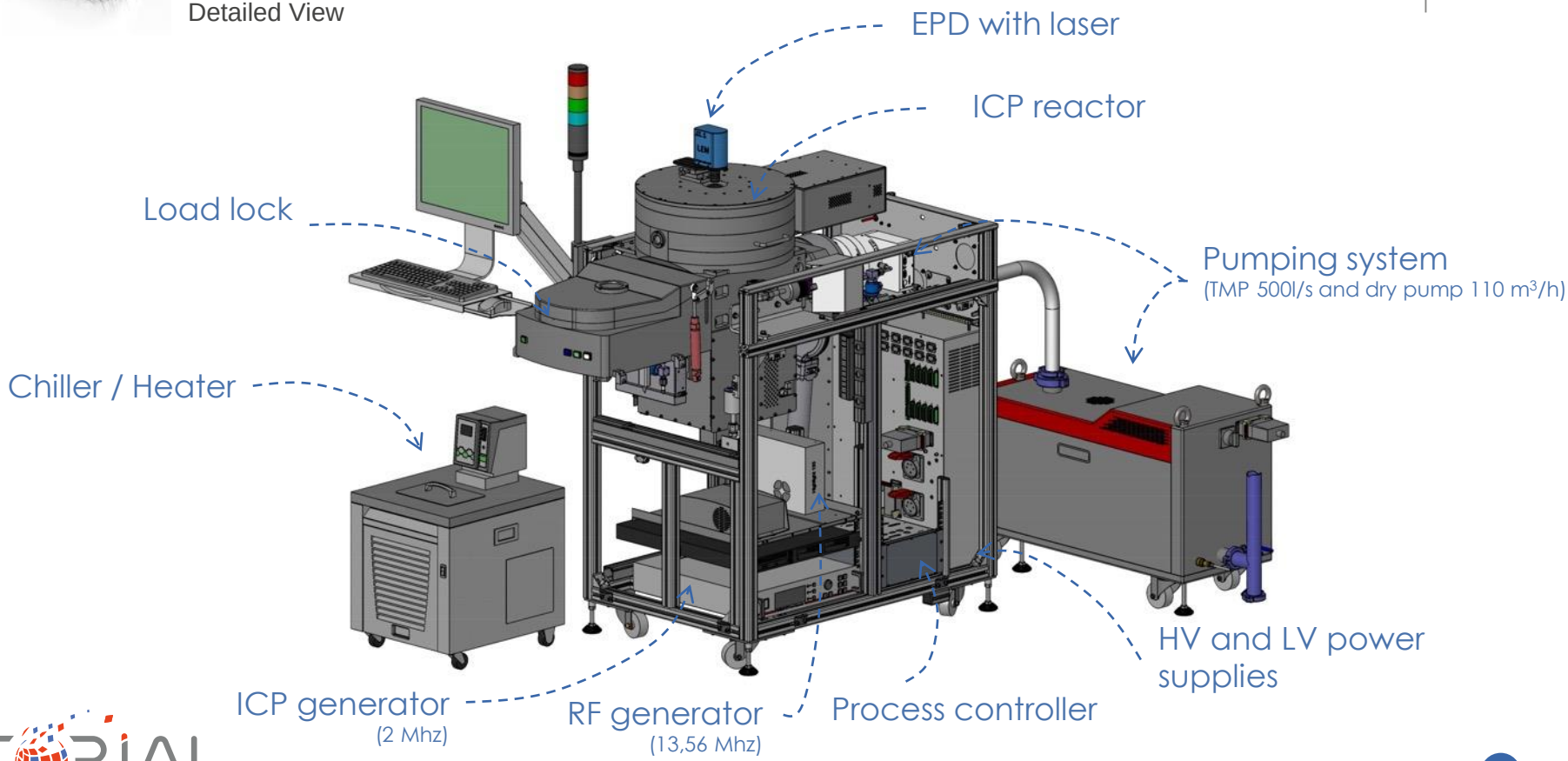
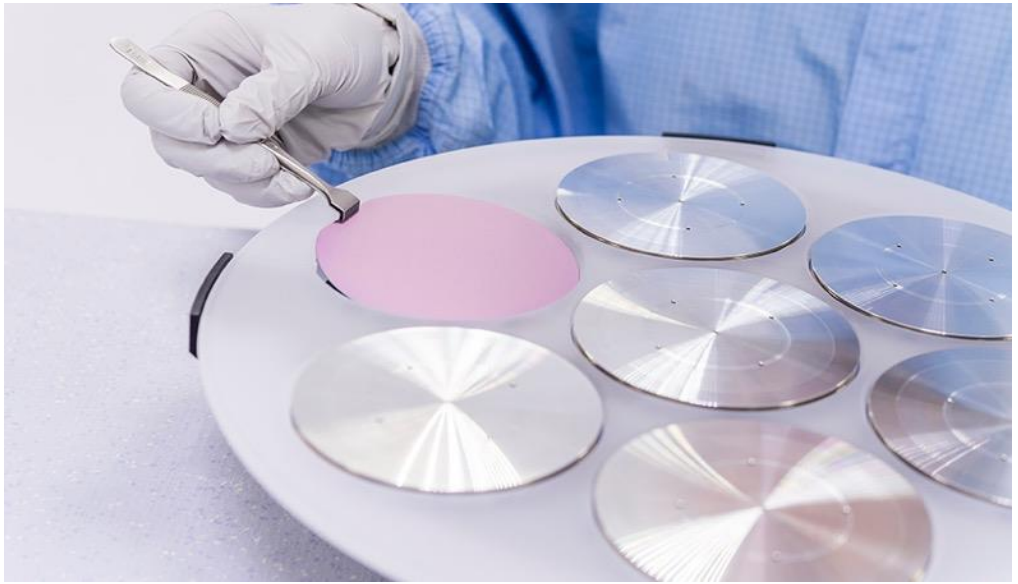
SYSTEM DESCRIPTION

Detailed View



SYSTEM DESCRIPTION

Loading



< 180 s
LOADING TIME

Vacuum robot
FAST AND REPEATABLE LOAD AND UNLOAD

Shuttle
EASY EXCHANGE BETWEEN SUBSTRATE SHAPE AND SIZE

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ICP SOURCE
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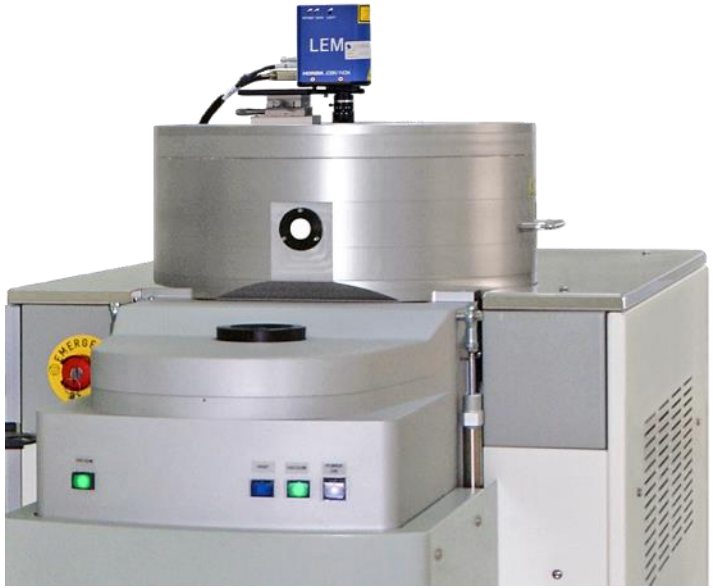
ICP SOURCE

CORIAL's Latest Generation of Reactor

FAST AND UNIFORM ETCHING



1. Load lock to run fluorinated and chlorinated chemistries in the same process recipe
2. Load lock for stable and repeatable process conditions
3. RF match box with matching range up to 2000 W
4. Uniform temperature control (from -50°C) for best repeatability
5. Hot walls (>250°C) minimize polymer condensation for selective processes
6. Hot walls and retractable liner reduce clean time
7. Retractable liner and shuttle holding to minimize process cross-contamination

Polymers 800 nm/min
Diamond 500 nm/min
GaN 1200 nm/min
…

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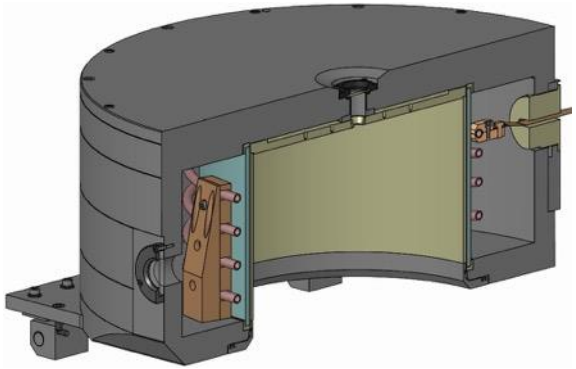
ICP SOURCE

Retractable Quartz Liner



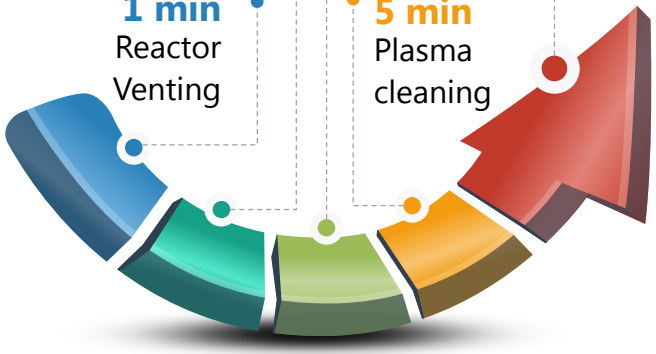
THE LINER FOR HARSH ICP-RIE PROCESSES

5 min Liner replacement

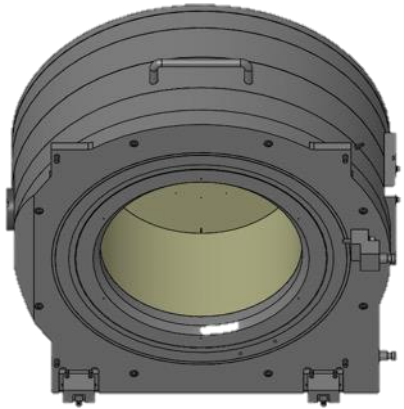
1 min Reactor Venting

4 min Pumping down to 10^{-4} Tor

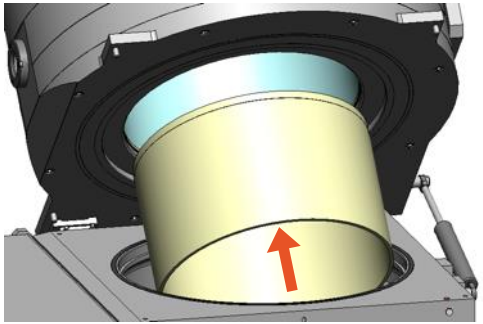
5 min Plasma cleaning



EASY LINER replacement by a single person



ZERO CROSS CONTAMINATION



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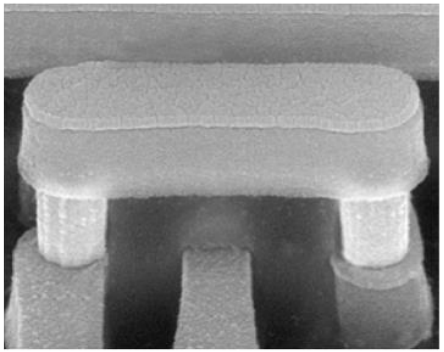
ICP SOURCE

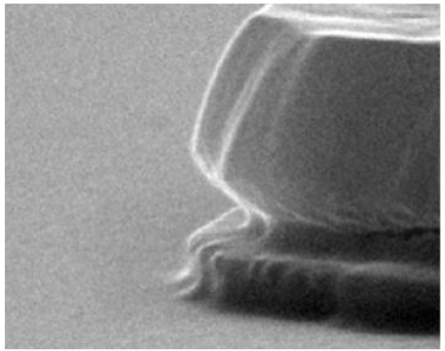
RF Coupling to ICP Source

< 15 volts

Minimum parasitic capacitive coupling giving rise to low plasma potential to enable low damage etching



SiO_2 Isotropic etching with NO RF biasing

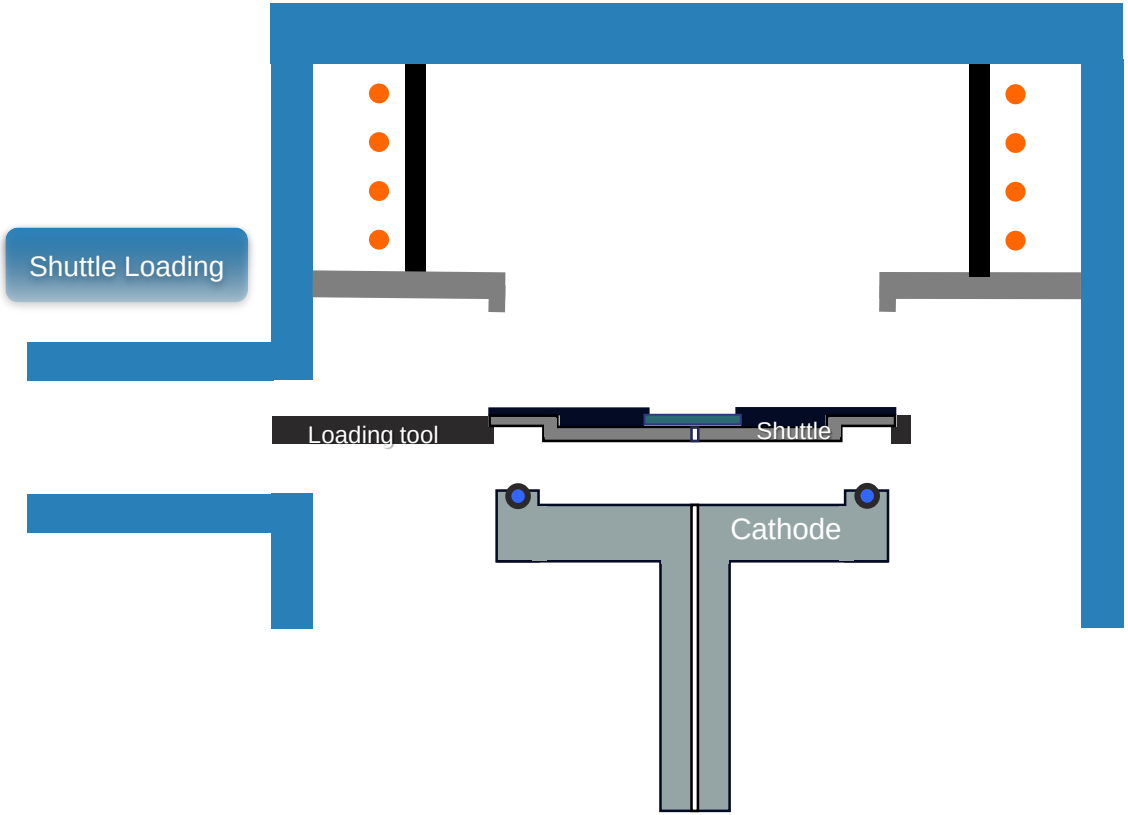


GaN Low damage etching with low RF biasing

ICP SOURCE

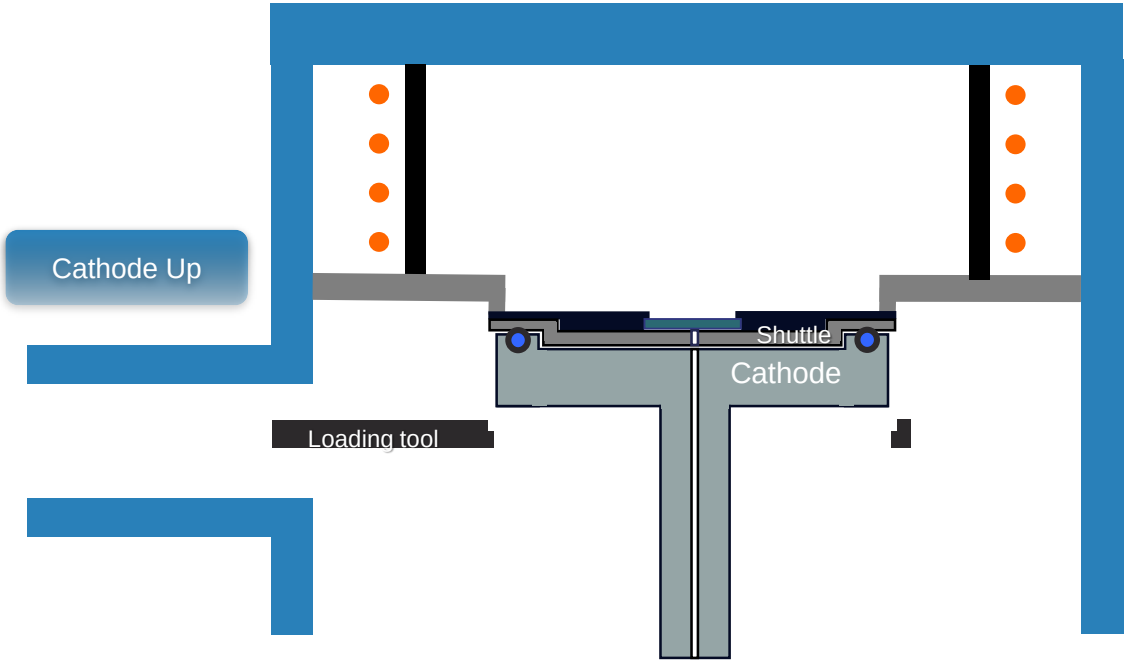
Operation Sequence

1



ICP SOURCE

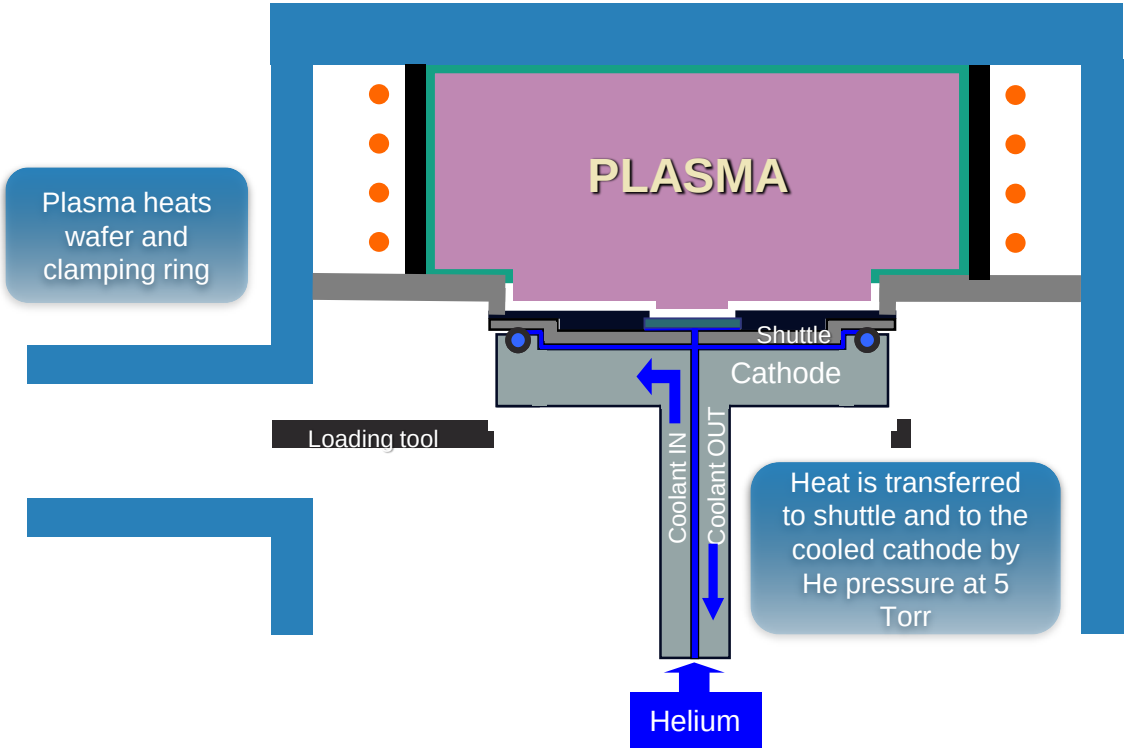
Operation Sequence



2

ICP SOURCE

Operation Sequence



3

ICP SOURCE

Temperature Control

New cathode design and efficient helium back side cooling of the shuttle and substrate ensure uniform temperature control (from -50°C) during the etch process

Test based on 1 KW configuration for sapphire etching (1 X 2” wafers)

Process	Etch rate	ICP Power	RF Power
Sapphire	300 nm/min	1 KW	280 W

No resist damage when operating at
full ICP and RF power (Novolak type photoresist baked at 110°C)

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ICP SOURCE

Reactor Uniformity

Benchmark uniformity test: 500 nm etching of thermal oxide (8” wafers)

Process	Etch depth	Uniformity	ICP Power	RF Power
Thermal SiO_2	500 nm	± 2.2%	800 W	150 W

Remaining 100 nm measured by ellipsometry
Measurement performed with 5 mm edge exclusion

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MAXIMUM FLEXIBILITY WITH THE ONLY 200 MM ETCH SYSTEM WITH THE CAPABILITY TO SUPPORT ICP, RIE, ALE AND DRIE PROCESSING IN THE SAME REACTOR

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SHUTTLE HOLDING APPROACH
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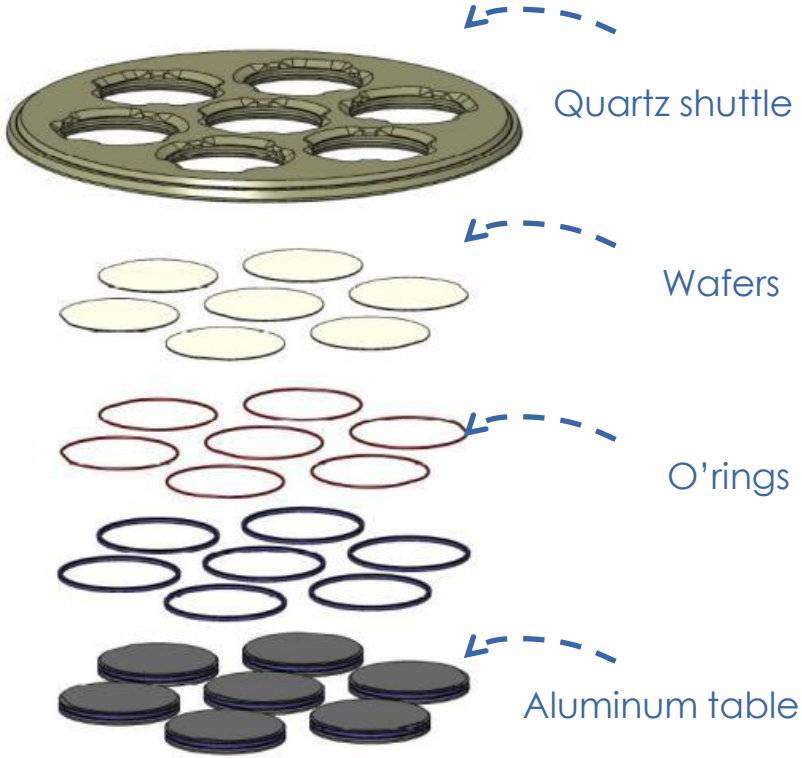
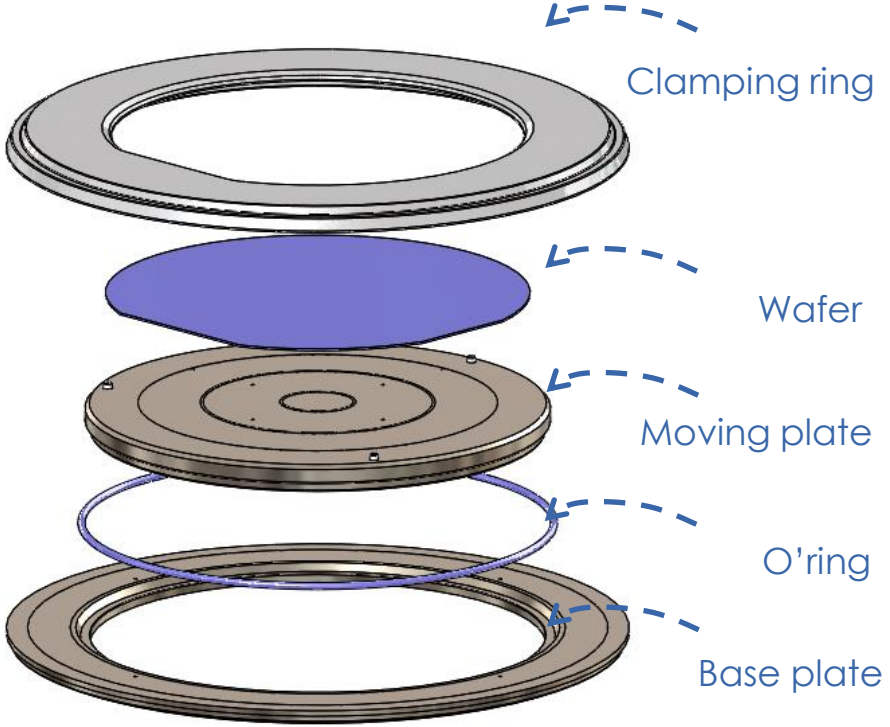
SHUTTLE HOLDING APPROACH

Portfolio

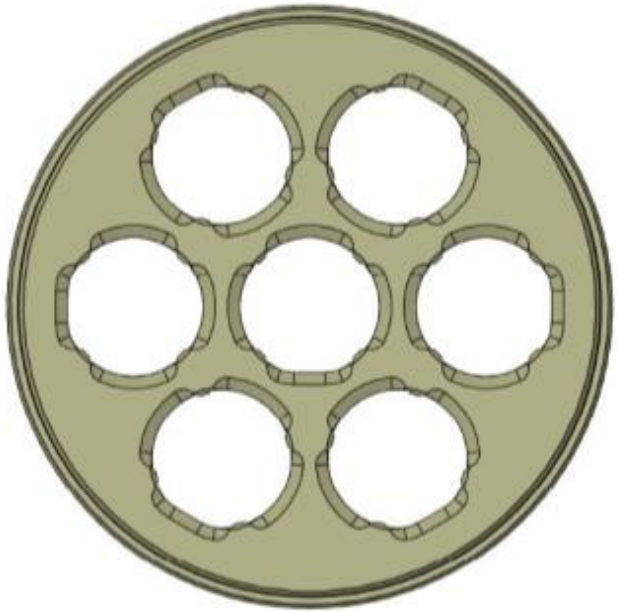




Guaranteed no wafer damage due to SOFT wafer clamping

SHUTTLE HOLDING APPROACH

Benefits



1. Quick adaptation to sample shape and size
2. Optimum process conditions with NO modification of process chamber
3. Limited cross contamination between processes by using dedicated shuttles
4. Shuttles for single wafer treatment: 1 x 2", 1 x 3", 1 x 4", 1 x 6", 1 x 8"
5. Shuttles for batch processing : 7 x 2", 3 x 3"
6. Customized shuttles are available (4" x 4", 5" x 5", etc)

PERFORMANCES ICP-RIE PROCESSES
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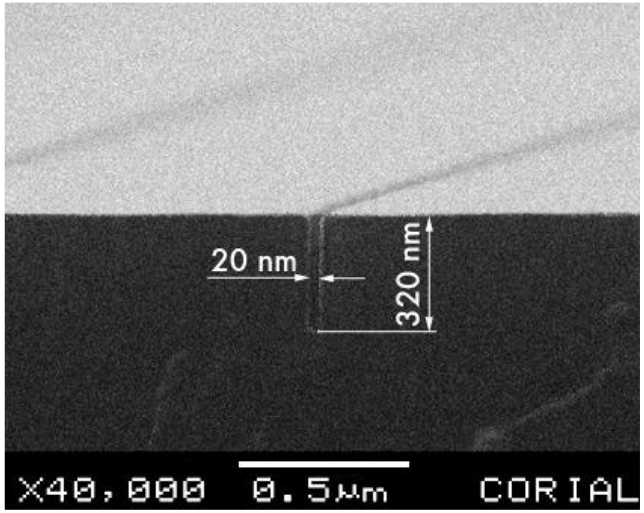
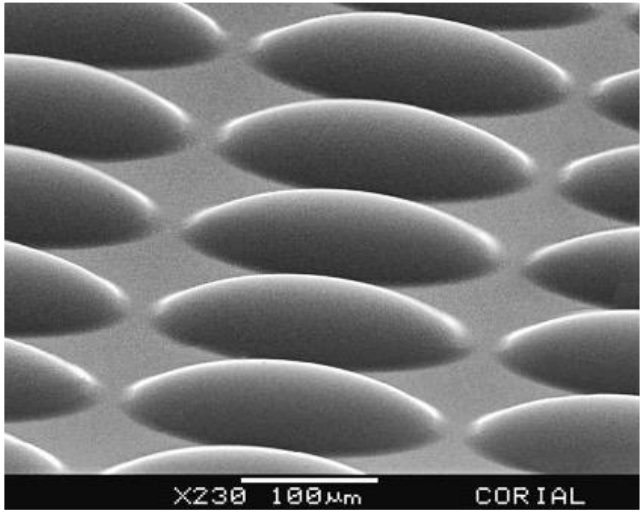
ICP-RIE OF SI

Fluorinated chemistry



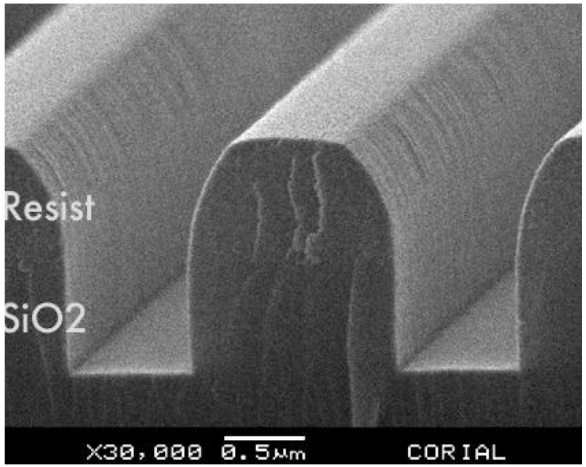
High Resolution ICP-RIE of Si



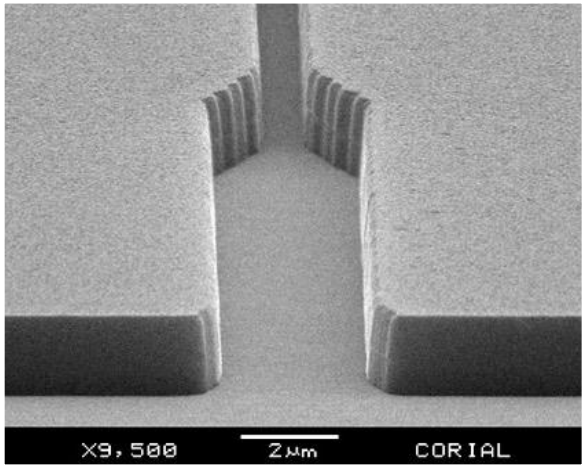
ICP-RIE of Si microlenses 40 µm high

ICP-RIE OF OXIDES AND NITRIDES

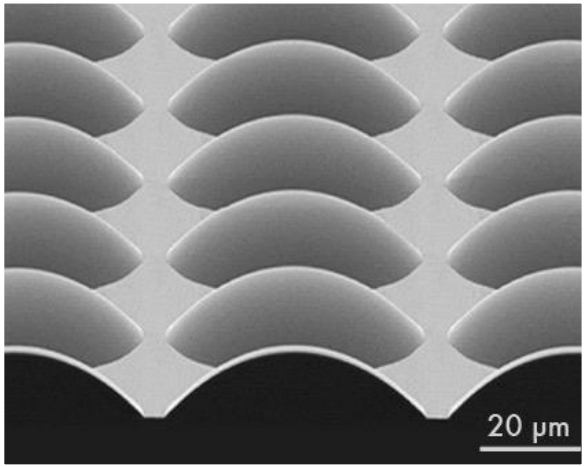
Fluorinated chemistry



ICP-RIE of SiO_2



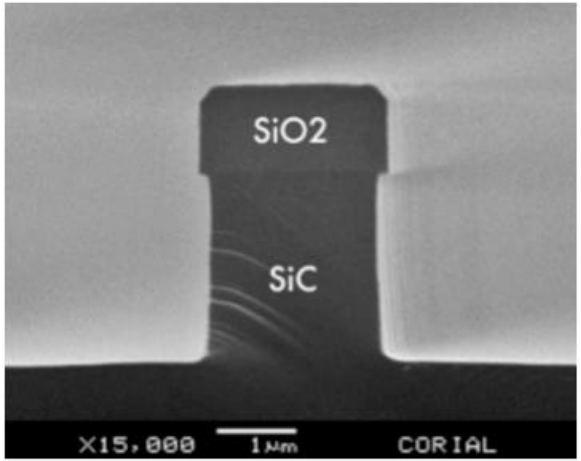
ICP-RIE of Si_3N_4



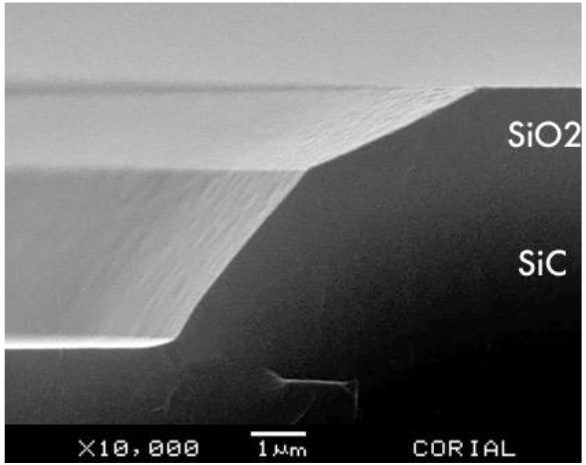
ICP-RIE of SiO_2 Microlenses

ICP-RIE OF HARD MATERIALS

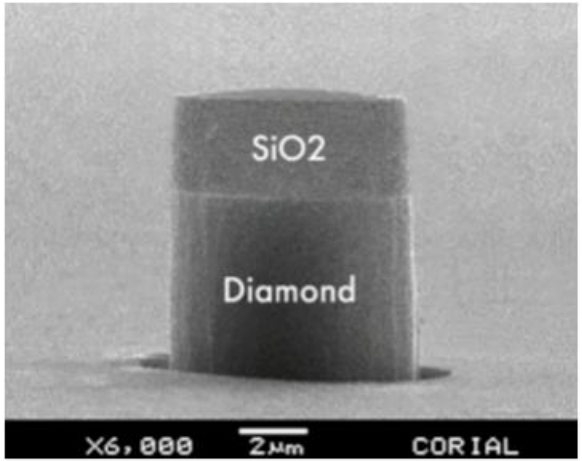
Fluorinated chemistry



ICP-RIE of SiC
With no trenching



Tapered ICP-RIE of SiC



ICP-RIE of Diamond

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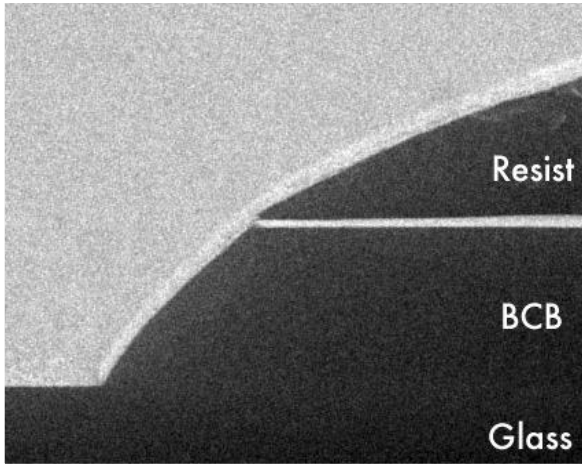
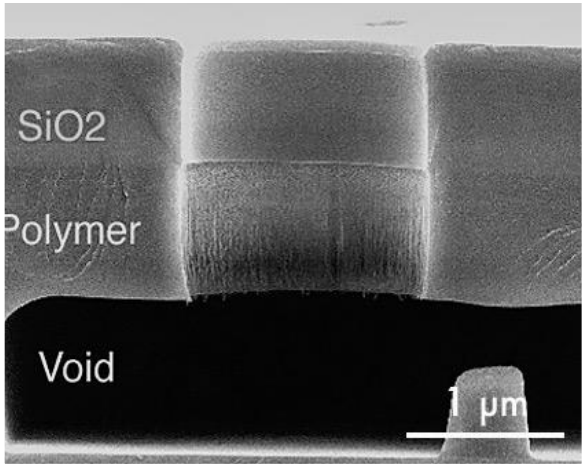
ICP-RIE OF POLYMERS

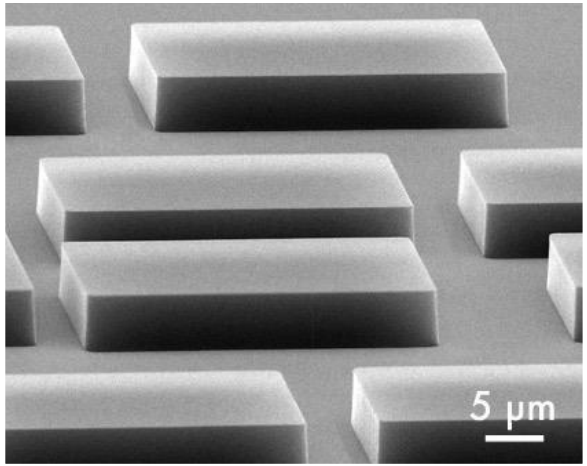
Fluorinated chemistry



BCB etching with PR mask



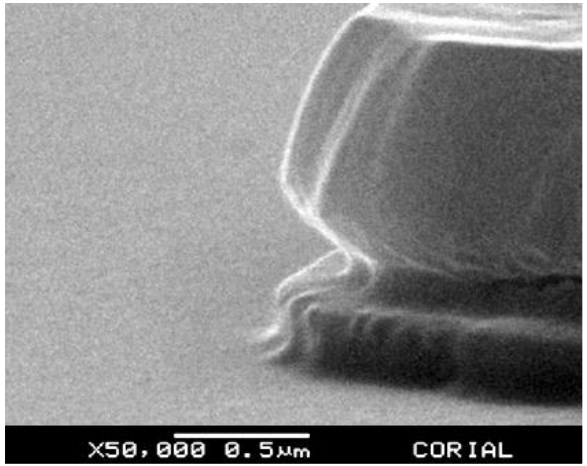
ICP-RIE of Polyimide



Anisotropic etching of Polyimide with SiO2 mask

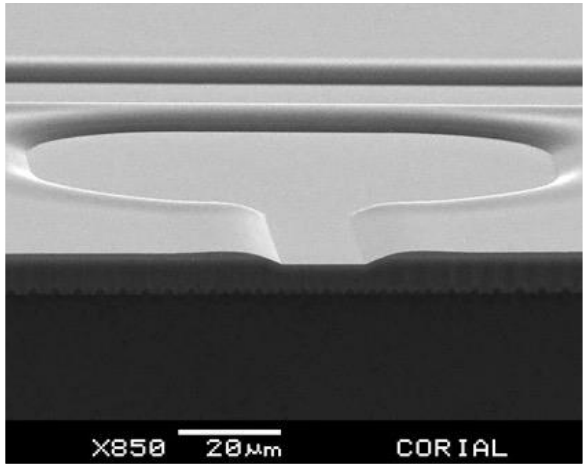
ICP-RIE OF III-V COMPOUNDS

Chlorinated chemistry



Low damage ICP-RIE of GaN

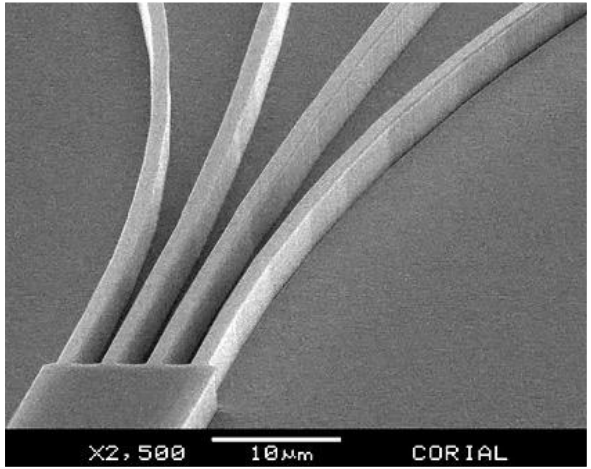
VCSEL



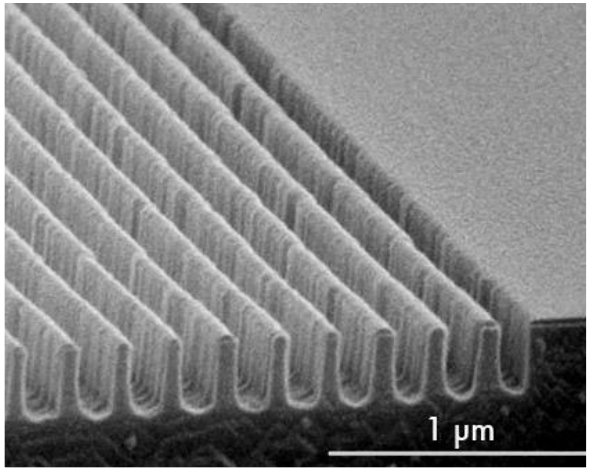
ICP-RIE of GaN (Mesa)

ICP-RIE OF III-V COMPOUNDS

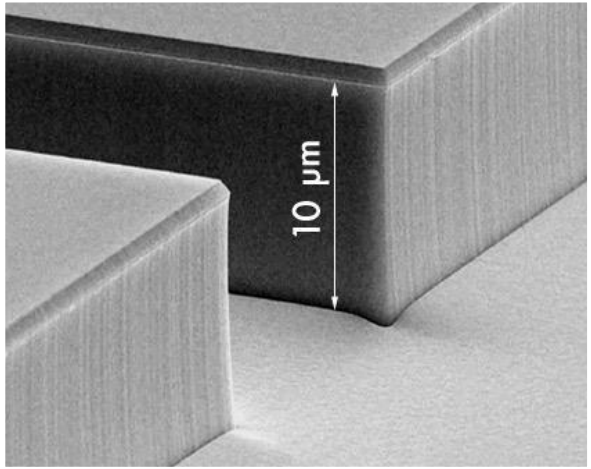
Chlorinated and hydrocarbon chemistry



ICP-RIE of InP



RIE of InP 0.1 µm lines and spaces



Deep RIE etching
of InP

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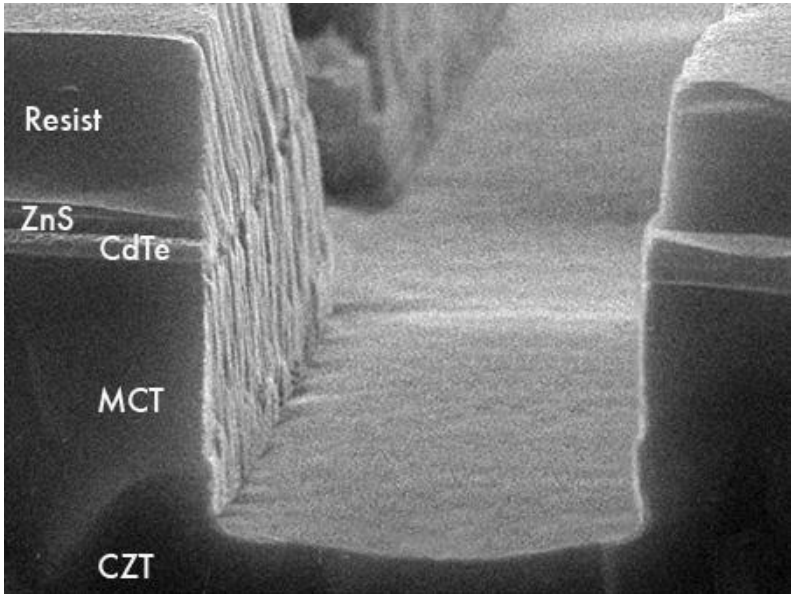
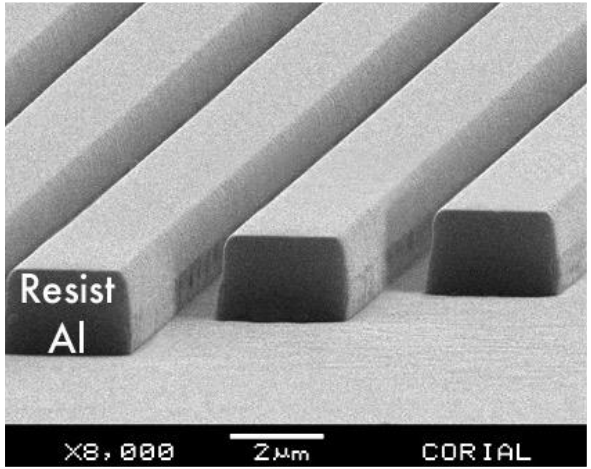
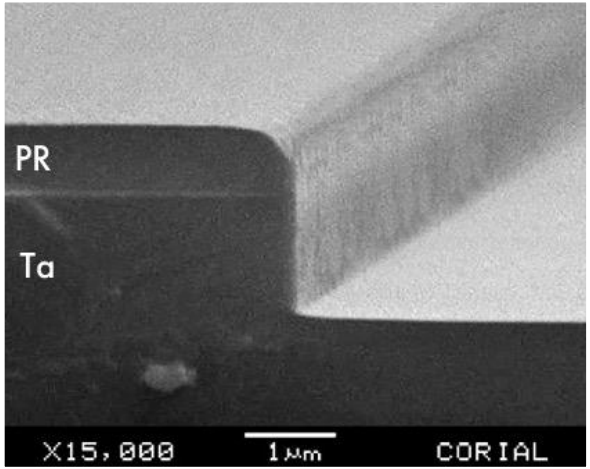
ICP-RIE OF II-VI COMPOUNDS



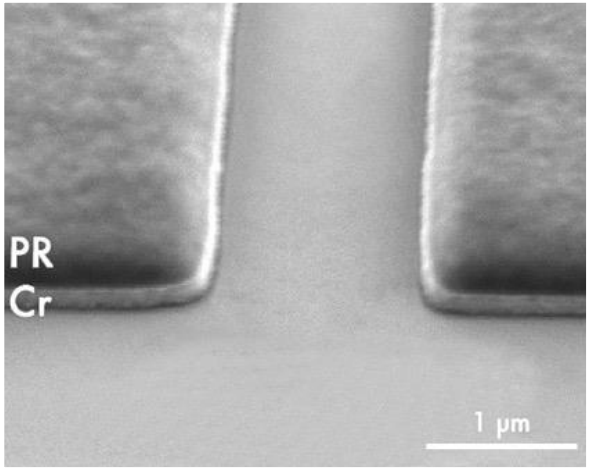
ICP-RIE OF METALS



ICP-RIE of Al



ICP-RIE of Ta



ICP-RIE of Cr

PROCESS PERFORMANCES

High Etch Rates & Excellent Uniformities

Process	Mask	Etch rate (nm/min)	Selectivity (vs mask)	Uniformity (across wafer)
Polymers	PR	800	1	±5%
SiO_2	PR	400	> 3	±3%
Si_3N_4	PR	350	> 4	±3%
Diamond	SiO2	500	> 25	±3%
Cr	PR	60	0.8	±3%
InP	SiO2	1200	> 25	±3%
InSb	SiO2	250	> 6	±3%
GaN (Mesa)	PR	600	1	±3%
GaN (Iso)	PR	1200	> 1	±3%
ZnS	PR	100	> 1	±3%
CdTe	PR	300	> 2	±3%
MCT	PR	500	> 4	±3%

PERFORMANCES DRIE PROCESSES
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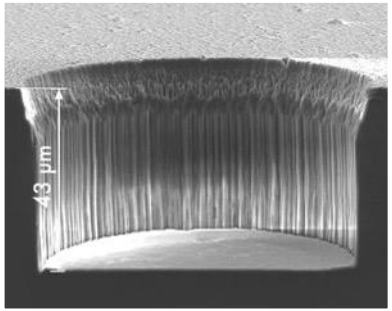
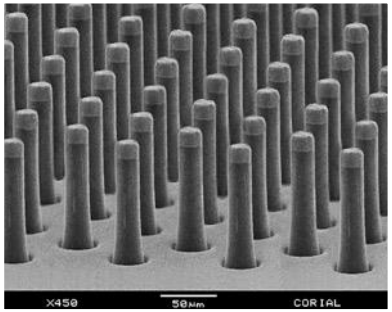
DRIE OF HARD MATERIALS

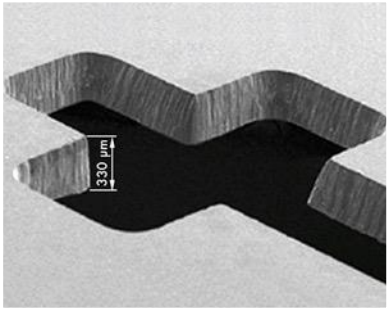
ICP power up to 2000 W and RF power up to 1000 W to enable fast and deep etching of hard materials



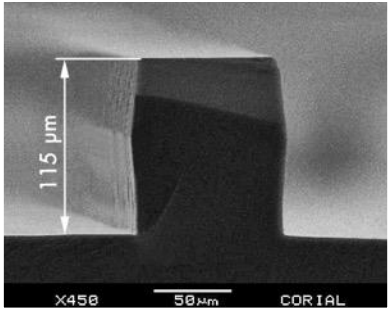
DRIE of SiC



DRIE of glass



DRIE of sapphire



DRIE of quartz

PROCESS PERFORMANCES

High Etch Rates & Excellent Uniformities

Process	Mask	Etch rate (nm/min)	Selectivity (vs mask)	Uniformity (across wafer)
Quartz	PR	> 1200	2	±3%
SiC	Ni	> 1500	> 20	±3%
Sapphire	Ni	> 500	> 6	±3%
Glass	Ni	> 800	> 15	±3%
LiNbO3 / LiTaO3	Ni	300	> 5	±3%

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PERFORMANCES TIME-MULTIPLEXED PROCESSES

CORIAL 210IL WITH COSMA PULSE

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COSMA PULSE IS A CONTROL SOFTWARE THAT BROADENS CONVENTIONAL TOOLS' PROCESS CAPABILITIES TO ENABLE TIME-MULTIPLEXED PROCESSES

COSMA PULSE DESCRIPTION

Advanced Process Control

10 ms
DATA AQUISITION

ALL PARAMETERS
CAN BE CONTROLLED AND PULSED

UPGRADE
FOR CORIAL'S SYSTEMS ALREADY INSTALLED AT CUSTOMERS' SITES

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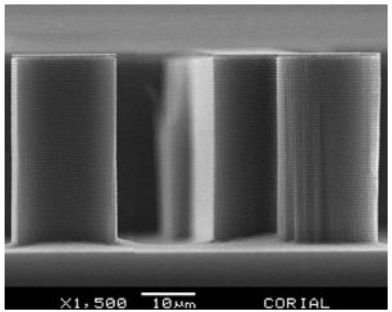
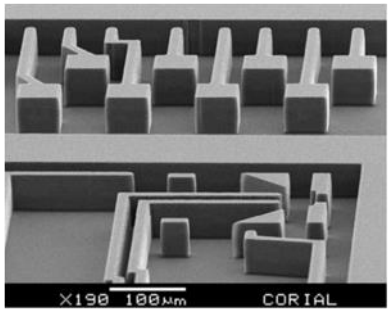
DRIE OF SILICON

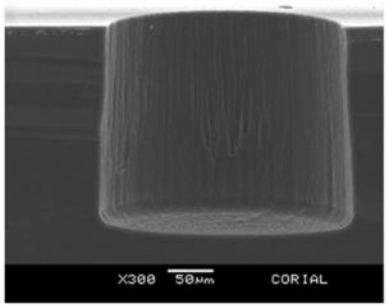
Precise control of the etch profile, fast etch rates, and excellent etch uniformity



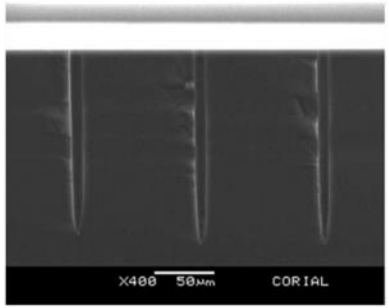
Si etching 40 µm deep



Si etching 60 µm deep



Si etching 250 µm deep



Small feature Si etching (AR 1:15)

DRIE OF SILICON

Various Aspect Ratios

Feature size (µm)	**Etched depth** (µm)	**Aspect ratio**	**Etch rate** (µm/min)	**Mask**	**Selectivity** (vs. mask)
Ø250	Through wafer	1:2	> 3.0	SiO2	330
Ø100	515	1:5	> 2.9	PR	85
Ø20	280	1:14	> 1.5	SiO2	155
Ø5	180	1:35	> 1.0	SiO2	100

Results obtained with 100 mm wafer, 20% Si open area

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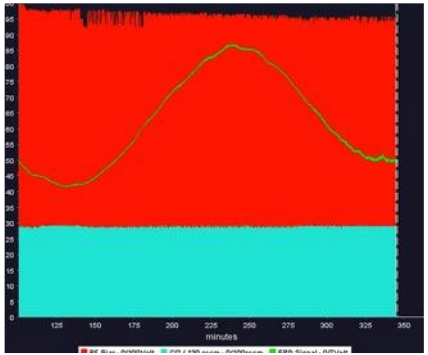
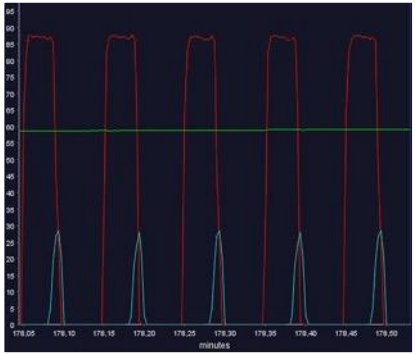
ALE OF SILICON





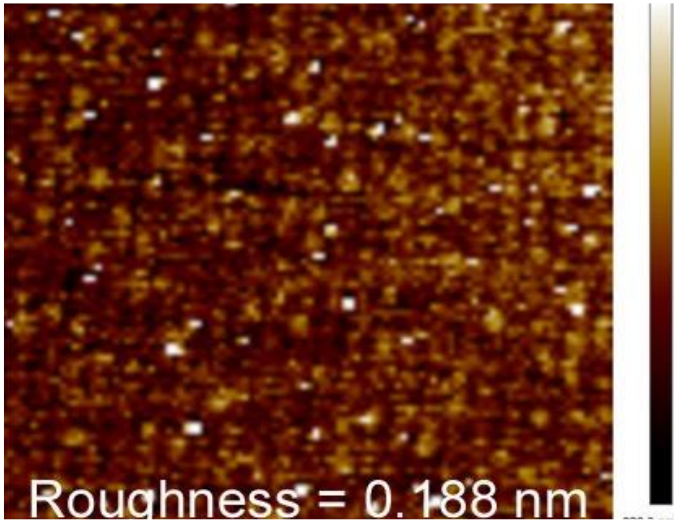
Advanced tuning of RF pulsing to control ion energy

Independent and rapid pulsing of chlorine and argon flows during adsorption and desorption steps

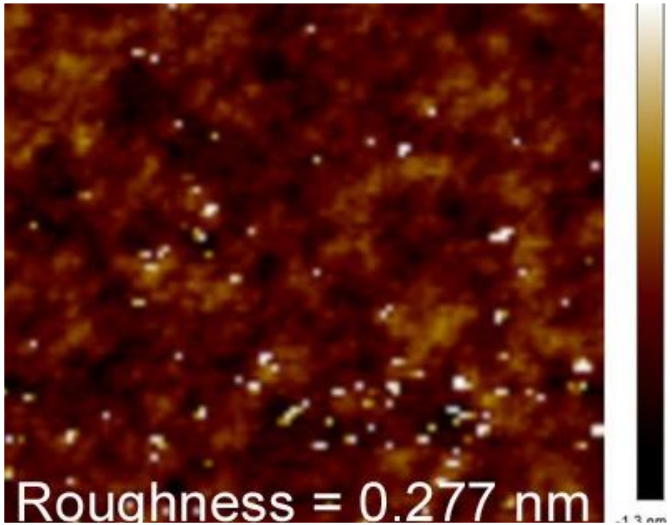
Real-time process adjustment

ALE OF SILICON

Silicon etch rate of 1.67 nm/min with atomically smooth surfaces



Silicon wafer before etching
Roughness = 0.188 nm



Silicon wafer after 0.5 µm deep etching
Roughness = 0.277 nm

PERFORMANCES SPUTTER-ETCH PROCESSES

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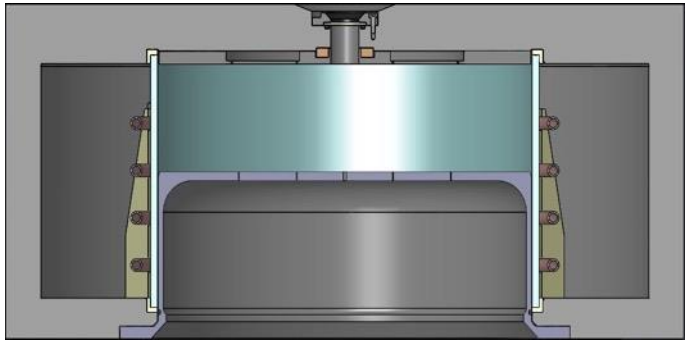
SPUTTER-ETCH

Retractable Liner



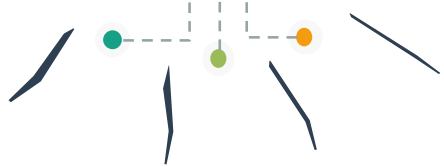
Ni COATED LINER TO COLLECT SPUTTERED MATERIALS IN **METAL RIE SPUTTER-ETCH MODE**

5 min
Liner replacement

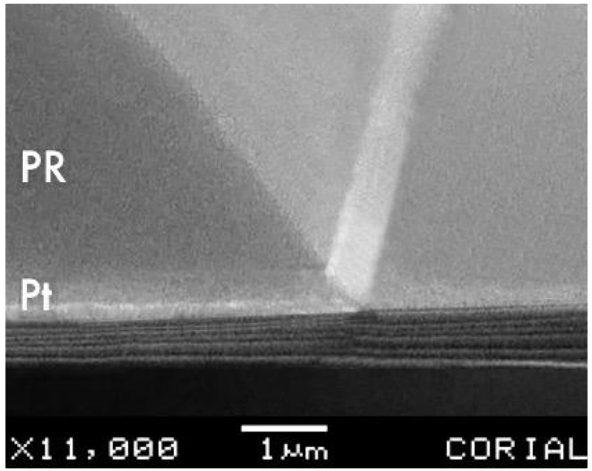
1 min
Reactor Venting

4 min
Pumping down to 10^{-4} Tor

5 min
Plasma cleaning



Pt SPUTTERING WITH PR MASK



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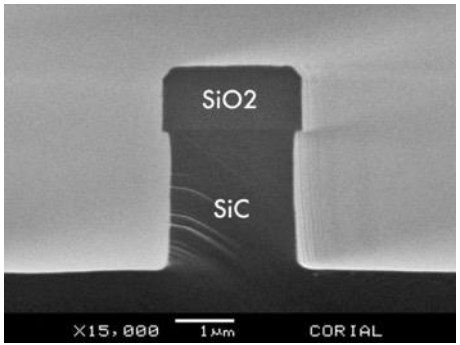
REACTOR CLEANING

High Uptime



OVER
95 %
UPTIME

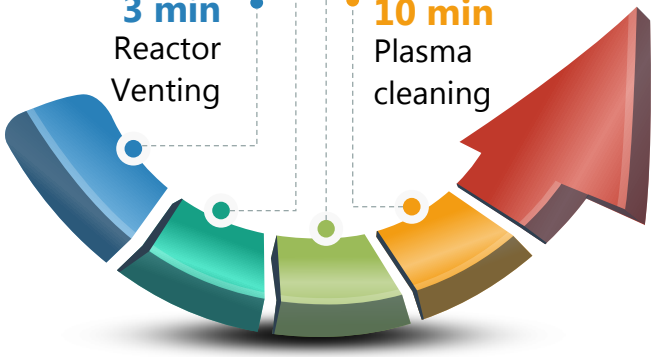
LESS THAN
30 MIN
REACTOR
CLEANING

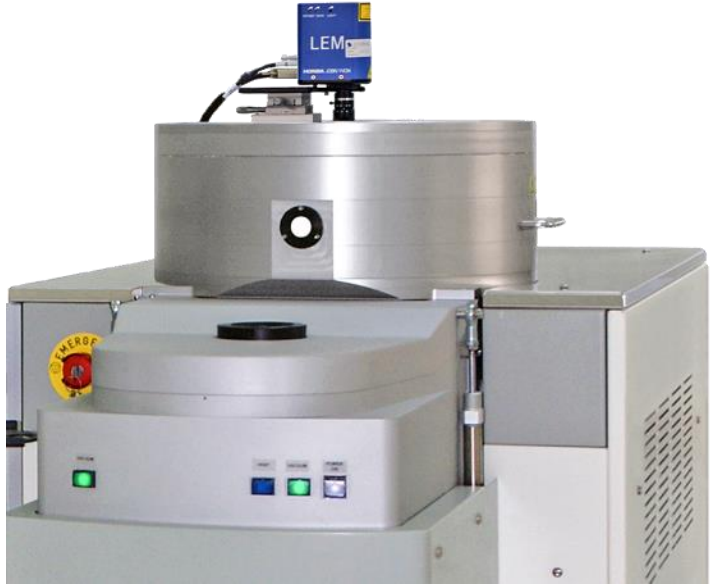
10 min
Mechanical cleaning

3 min
Reactor Venting

7 min
Pumping down to 10^{-4} Tor

10 min
Plasma cleaning





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USABILITY
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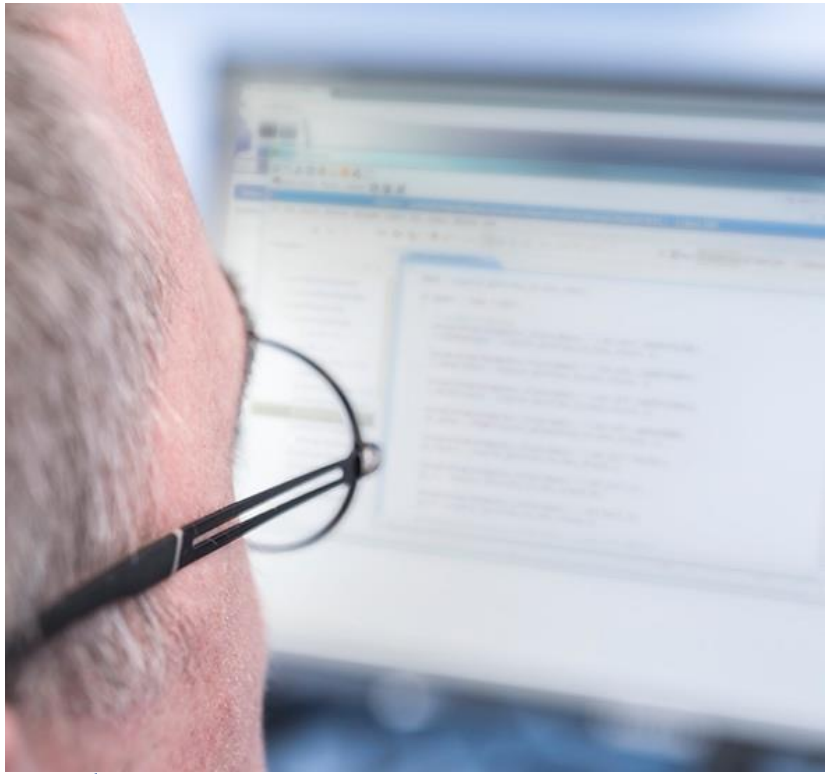
PROCESS CONTROL SOFTWARE

COSMA



COSMA

CORIAL **O**PERATING **S**YSTEM FOR **MA**CHINE

The simplest, most efficient software to develop processes, operate, and maintain CORIAL systems

DESKTOP APPLICATION

Process Editing I Process Adjustment I Process Operation I Process Tracability I System Maintenance

REMOTE CONTROL

CORIAL A Plasma-Therm Company

REPROCESSING SOFTWARE

COSMA RS

DISPLAY UP TO

4

PARAMETERS FROM A RUN

Simple and efficient software to analyze process runs and accelerate process development

REMOTE

ANALYSIS OF RUNS

DRAG AND DROP

CURVES TO CHECK PROCESS REPEATABILITY

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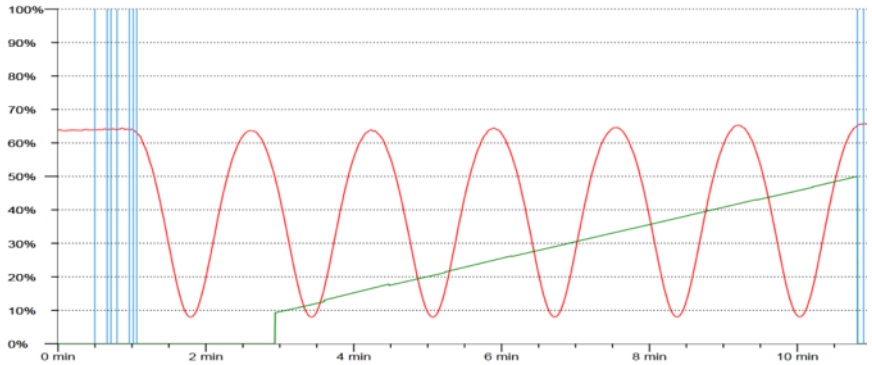
END POINT DETECTION



A CCD camera and laser diode, in the same measuring head, enables simultaneous visualization of the wafer surface and the laser beam impact on it. A 20 µm diameter laser spot facilitates the record of interference signals.

Real-Time etch rate measurement
Real-Time etched depth measurement

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Get Maximum Flexibility

ICP-RIE equipment for any chemistry

Wide process range for Silicon, Metals, III-V and II-VI compounds

Support ICP, RIE, ALE and DRIE process recipes in the same reactor

Smaller wafer pieces up to full 200 mm wafer

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