Queensland Microtechnology Facility processing and analysis equipment overview May 2011

Equipment /area	Make and Model	wafer size compatibility	QMF use / purpose	Typical Standard Operation Procedure performance	Process possible/ not qualified SOP
Lithography area / suite			Housing lithography processing equipment	- Cleanroom class 100 / M3.5 / ISO5 - yellow light - temperture 21 +/-0.2° - RH 45 +/- 3% upgrading towards class 10 2011	
HMDS oven	YES 3/10	configured for 150mm wafers and fragments - up to 200mm	Provides HMDS treatment to overcome photoresist adhesion issues on Si, poly Si, SiO2, Silicon oxynitride, BPSG, TiN, TiW +?. Process effective for up to 3 weeks		image reversal via use of NH3. NH3 yet to be facilitised.
Resist coat	SSE OPTIcoat ST22+	configured for 150mm wafers and fragments - up to 200mm	Recipe controlled precise photoresist coat of wafers and fragments	AZ 6612 resist - 150mm wafer - %U: < 0.5% - Thickness: 1µm - Edge bead removal: 5mm	second resist pump available
Soft bake	SSE OPTIcoat ST22+	configured for 150mm wafers and fragments - up to 200mm	Precise resist thermal treatment: - prior to exposure - post exposure - post development	part of process flow	
Exposure	Quintel Ultra µ line7000	configured for 150mm wafers and fragments - up to 200mm	Resist exposure of 150mm wafers and fragments	Proximity mode >3µm features -Vacuum contact to ~ 1µm - 86° profile on targeted features	
Resist development	SSE OPTIcoat ST22	configured for 150mm wafers and fragments - up to 200mm	Recipe controlled resist development	part of process flow	
thin film measurement	Nanospec AFT 180	up to 200mm with manual rotation of wafer	Quick (<10sec) and accurate measurement of: - SiC on Si <10nm to 3µm - SiO on Si - <10nm to 4µm - Si3N4 on Si - <10nm to 1µm - Neg resist on Si - 50nm to 4µm - Poly Si on oxide -50nm to 1µm - Neg resist on SiO2 400nm to 3µm - polyimide on Si - 50nm to 3µm - Positive resist on Si -50nm to 4µm - Positive resist on SiO2 400nm to 3µm - reflectance mode for metal characterisation - other films on Si on known RI		
Critical Dimension measurement	Nanoline CD 50/51	150mm stage	Quality control and process engineering tool for assessment of lithography and etch processes		
Mask cleaner	Ultratech 602	up to 7" square	Cleaning of masks note - for hard contact printing, mask should be cleaned after every exposure to maximise quality		

Main cleanroom - ball room concept			Housing of none lithography processing and analytical equipment	- Cleanroom class 1000 / M4.5 / ISO6 - temperature 21 +/-1°	
Wet processing					
Wet bench for RCA cleaning - Non contaminating	Weslan	up to 150mm wafer	RCA clean to remove metal ion contamination of incoming and processed SiC wafers - 4 bath system with quick dump rinse systems - processing baths SC1, 1%HF, SC2, Piranha	(shows improvement in std CV measurements)	
Wet bench for non ion critical contamination applications	SPS	up tp 150mm wafer	whole wafer and wafer batch processing as required - fragment capability		Ti etch SiO2 etch Al etch Ni etch Si etch
wafer rinse dryer	Semitool SRD	150mm	Final rinse and dry after wet processing from Weslan		
Cleanroom analysis equipment					
thin film measurement	Nanospec AFT 210 system	up to 200mm with manual rotation of wafer	Quick (<10sec) and accurate measurement of: - SiC on Si <10nm to 3µm - SiO on Si - <10nm to 4µm - Si3N4 on Si - <10nm to 1µm - Neg resist on Si - 50nm to 4µm - Poly Si on oxide -50nm to 1µm - Neg resist on SiO2 400nm to 3µm - polyimide on Si - 50nm to 3µm - Positive resist on Si -50nm to 4µm - Positive resist on SiO2 400nm to 3µm - reflectance mode for metal characterisation - other films on Si on known RI		
Optical microscope	Olyimpus MX50AF -IC inspection microscope	up to 200mm	optical inspection and image recording - 100x, 500x and 1000x mag - sub micron resolution - bright field and dark field imaging - Nomarski differential interference contrast imaging		
Profileometer	Veeco Dektak D150 including XY stage and vision software	150mm (whole of 200mm can be measured by rotating wafer on stage)	Surface roughness determination - step height measurements to determine etch rates < 1nm resolution - 3D mapping		
Resistivity measurement - 4 point probe	Magne-tron Instruments M800		metal and Si resistivity measurement		
Ellipsometer	Rudolph AutoEL IV	up to 150mm	Automatic measurement, standard processes. - Multi-wavelength - Automatic R-θ sample stage, - Transparent single and double films - Transparent double films - absorbing single - absorbing double layers, - polysilcon over single film, - thickness, - NU, KU, NL, KL, TL calculations.	λ=633, 546 and 405nm	
Patterned Wafer Inspection System	KLA Tencor Surfscan 7700	2' 3" 1mm thick 100mm 525+/- 25µm 150mm 675+/- 25µm 200mm 725+/- 25µm	Particle Sensitivity 0.15-mm diameter latex spheres on bare silicon and patterned process wafers Standard processes	30 wafers per hour (200mm)	

Deposition and etch					
Epitaxial SiC growth	n/a	up to 150mm mainly (200mm possible)	Reseach and development of device quality SiC on Si films - n type - p type - n and p film stacks	Uniformity <1% 2mm edge exclusion Typical Thickness - nanometres to over 1µm	
Plasma etch	LAM 480	150mm wafer handling	isotropic dielectric plasma etch - SiO2, Si3N4, polymers and photoresist	Features >3µm SiO2 etch non -uniformity <+/-6% 5mm edge exclusion	
Plasma etch	STS LPX ICP SR including wafer cooling from electrostatic clamping	150mm wafer handling	SiC etch research and development Other research development applications as required gases available include: Ar, O2, N2, NO, C4F8, SF6, Cl2, HCl, SiCl4, BCl3, HBr …..		Poly Silicon etch SiO2 etch Al and Al alloy etch Ti and TiN etch note: volume production proven chamber for metal etching
Atmospheric furnace	Hi Tech furnaces UK	up to 200mm	Reseach and development of high quality growth of SiO2 on SiC. - also used for Si oxidation - gases include O2, Water vapour, NO, N2O, HCl - Temperature to >1300° C	Dry oxide growth on 150mm Si wafers -20 wafer batch -Uniformity <2% 3mm edge exclusion -Wafer to wafer non uniformity <2% @ 1000°	Wet oxidation from water bubbler enabling faster and thicker oxide growth
LPCVD furnance	Hi Tech furnaces UK	up to 200mm	Deposition of polysilicon and Low Temperature Oxide gases available SiH4, N2, O2 ++ Polysi from SiH4 - undoped LTO from SiH4 + O2	Poly Si - 150mm wafers - growth rate 90nm/min - uniformity <3% 3 mm edge exclusion - uniformity <1% wafer to wafer 8 wafer load LTO - good electrical isolation - uniformity ~10% 20mm edge exclusion	
Atmospheric furnace	Hi Tech furnaces UK	up to 150mm wafers - 200mm conversion possible	Solid source doping of Si and polysi		P type - boron doping N type - phos doping
Vacuum ovens -2 off	MTI	up to 200mm	storage of n and p type solid source diffusion dopants		
Metal and dielectric deposition by sputtering	Surrey Nano Systems - Gamma	up to 200mm	DC and RF magnetron sputtering - Degas in load load to 200° - 4 x 100mm targets - RF bias and etch - substrate temp to 800° - reactive sputtering with N2 and or O2 - metallisation for device fabrication Ti/ TiN /Al film stack, Ni, ++	Aluminium 1% Si 300° C < 5% non uniformity Reflectivity relative to Si @ 435nm > 195% @ 480nm > 210%	Ni deposition Al deposition Ti deposition TiN deposition Cr deposition Si deposition ++

Sub wafer fab area - housing auxilary equipment - vacuum pumps, process gas abatement, DI water plant, etc and also houses other processing equipment					
Dicing saw	Disco 2HST	up to 150mm wafers	wafer dicing - blades for Si, SiC and sapphire		
Tube furnace - 70mm dia		Up to 50mm dia	Anneal, oxidation -gases N2, Ar, O2 - temp to 1400° C		
Evaporator for metal depostion	Jeol - JEE-4X	< 3cm square samples	simple metallisation of small samples		
DC sputter system	Emitech K575x	<2cm square samples	SEM sample coater and non critical metallisation - stage to 200° - 2 x 1" target turbo pumped		
RF sputter -metal and dielectric deposition	Originally Denton	small samples	R+D use mainly for dielectric films - 100mm target - gases Ar, O2 turbo pumped		
Electical test and physical analysis - none cleanroom					
SEM	Jeol JSM 6510LV - 2009	up to 150mm	Imaging SiC films, lithography, etch profiles etc		
Profileometer	Tencor alpha-step 200	100mm	Surface roughness determination - step height measurements to determine etch rates >2nm		
Semiconductor parametric analyzer	HP 4145B		4 Channel, current-voltage measurement, DC		
Hot chuck	MDC	up to 150mm	Room temperature to 300ºC, 4 probes to connect to sample		
LCR meter	HP4284		AC impedence measurment 20Hz-1MHz, L.C.R		
Femto Ammeter	Keithley 6430		DC current - voltage measurement		
Quasistatic CV	Keithley 595		Characterise oxidesemiconductor interfaces and non-volatile memory		
Hall effect measurement	GU design/ build	1cm square approx	Measure doping levels of semiconductors		
Ellipsometer	GU design/ build	up to 150mm	Thin film measurement, thickness, n&k	λ=633nm, 1&2 layer models	
Microscope with dimension measurement	Nikon Measurescope	up to 200mm	Inspection and feature measurement to 1μm		
wire bonder	Kulicke and Soffa Industries model 478		Not re-commissioned as yet		
wire bonder	Kulicke and Soffa Industries model 484EE		Not re-commissioned as yet		
Probe Station			4 probes, dark, shielded		