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Wafer Processing Capabilities up to 4“ wafer size

Service	Process Details	Core Equipment
MOVPE Heterostructure Growth		
AlGaAs, AlGaInP	growth of customer-specific GaAs-based heterostructures for laser diodes (630 nm - 1180 nm), Bragg mirrors, saturable absorbers, modulators, etc. on 2“-4“ substrates	2 x AIX 2800G4 12x3“/4“
AlGaN	growth of customer-specific GaN- and AlN-based hetero-structures for laser diodes (400 nm - 450 nm), UVB & UVC LEDs, GaN HFETs, AlN HFETs, vertical transistor structures, GaN templates, AlN templates on 2“-4“ substrates	1 x AIX 2600G3 8x4“ (transistor structures, GaN),1 x AIX 2600G3 11x2“ (AlN templates), 2 x AIX CCS 6x2“ (UV LEDs, GaN lasers, AlN transistors)
Lithography		
electron beam	shaped electron beam writing of photo masks and direct wafer exposure for CD ≥ 50 nm | Gaussian electron beam direct wafer writing for CD > 10 nm | electron beam resist processing cluster	Vistec SB251, RAITH EBPG 5200 | ATM Vision MAXIMUS 804, AMCOSS AMC2000
i-Line	i-Line stepper lithography for CD > 400 nm | MEMS stepper lithography for CD > 2 µm and large depth of focus | spin coating and developing | developing	NIKON NSR-2205i12D, NIKON NES1W-i06 | Süss ACS 200, IOS Cube 5 | AMCOSS AMC2000 | Hamatech HMP 90
contact	double-side mask aligner, wafer bond alignment | single-side mask aligner | manual resist coating and baking for small wafers or pieces	Süss MA 8, EVG 420 | Süss MA 100 | side Pokorny bench with CONVAC spin coat-er, SAWATEC SM-150/HP-401 duo, SAWA-TEC SM-150/HP-160-250-III duo
oven	BCB vacuum cure oven	YES PB6-2P-CP, YES-PB6-2P-CP-E
Deposition and Annealing		
PECVD	PECVD silicon nitride for passivation and dielectric layers	Oxford PlasmaPro 100, Sentech SI 600 D
IC-PECVD	deposition of silicon nitride, silicon oxide and silicon oxynitrides for passivation and dielectric layers	Sentech SI 500 D
RF and DC sputtering	sputtered Ta_2O_5, Al_2O_3, SiO_2, Si_3N_4 for optical coatings and passivation layers, sputtered $WSiN_x$, AuGe, NiCr, Ni for metallic coatings, interconnects and resistors | TiW, Au, Ir, ITO | Ag, Al, Ti, TiW | Au, Ir, TiW	Ardenne CS 730 Leybold Z 590 | Leybold Univex 600C | Aurion
evaporation	Al, Au, Cr, Ge, Ni, Pd, Pt, Ti, V | Au, Sn, In | Al, Au, Mo, Ni, Pd, Pt, Ti, V	Leybold 560 HV | Leybold A700 | Leybold Univex 600C
UHV evaporation	Ti, Pt, Au, Ni | Al, Au, Ir, Mo, Ni, Pd, Pt, Ta, Ti, V, W, Ge | Al, Au, Mo, Ni, Pt, Ti	Leybold 560 UHV | Pfeiffer Classic 580 | Leybold Univex 600C
atomic layer deposition	Al_2O_3	Sentech SI PEALD-M cluster tool with two ICP etch chambers SI 500
electroplating	Au | Au (from cyanidic & sulphitic baths), Ni and Sn	MOT | ClassOne Solstice S8
additive micro-manu-facturing	direct 3D Au printing with submicron resolution	Exaddon µAM system
rapid thermal annealing	ohmic contact formation | dopand activation up to 1600°C	AST SHS 100, AST SHS 2800 | Hemera HT

Service	Process Details	Core Equipment
Etching and Cleaning		
dry etch	ashing of photo and electron beam resists | descum, ashing | semiconductor etch: e.g., GaAs, AlGaAs, InGaAs, InGaP, InP, GaN, AlGaN, AlN, SiC, Si / dielectrics etch: e.g., SiO_2, Si_3N_4, Al_2O_3 / metal etch: e.g., Ti, Ir, WSi_x, $WSiN_x$, Al / polymer etch: e.g., photo resists, polyimides, KMPR, BCB	PVA TePla GIGABatch 360 M | Sentech SI100 (O_2, SF_6, CF_4) | several plasma etch tool types: Sentech SI591 RIE, SI500, and SI500 RIE using fluorine- and chlorine-based gases such as: SF_6, CF_4, CHF, BCl_3, Cl_2 as well as: Ar, He, O_2
diamond etching	anisotropic etching at RT and isotropic etching at 400°C	Sentech: SI 500 ICP
DRIE - deep reactive ion etching	DRIE at cryogenic temperatures or pulsed / time-multiplexed etching (BOSCH)	Sentech: SI 500 C DRIE
dry etch in-situ etch control	laser interferometry	GF-Messtechnik Nanomes, Sentech SLI 760, Horiba LEM-CT
wet etch	GaAs	SSEC M 3300
cleaning	wet strip (NMP) | mask cleaning	Hamatech HME 900 | Hamatech HMP 900
lift-off / metal lift-off	NMP | NMP free solutions, metal lift-off with NMP	SSEC M 3302, Hamatech HME 900, Obducat QS S 200 LO | ClassOne Spray Solvent Tool, ClassOne Solstice S4
critical point dryer	for up to 3” wafers	Tousimis Autosamdri 931
Electrical Process Control Monitoring		
DC wafer prober	I-V measurements down to 0,1 fA (100 nV or 0.5 µV) and up to 1 A (200 V), TLM, C-V measurements	Karl Süss, Cascade & MPI semi-automatic wafer prober, Keysight Formfactor
Ion Implantation		
ion implantation	acceleration voltage 10 keV to 500 keV, gaseous, liquid or solid sources, e.g., H, He, C, N, O, Ar, Ge, Sn, As..., up to 200 mm wafers, heatable chuck up to 700 °C	HVEE
Backend		
wafer thinning	lapping, grinding, mechanical polishing of GaAs, GaN, SiC, sapphire, Si	Logitech LP50, PM 5, PM 6, DISCO DAG810
surface planarization	planarization of ductile materials (metals, BCB)	DISCO DAS8920
wafer bonding	metal bonding, anodic bonding, BCB bonding, temporary bonding, aligned bonding	EVG501, Süss Bonder SB8
wafer dicing	blade dicing of up to 150 mm GaAs, sapphire, SiC, Si, quartz	Disco DAD 321, ADT 7100
laser dicing	full cut laser dicing of T-cut layouts (SiC, Si) and wafer coring (resizing of up to 200 mm wafers)	DISCO DFL7161
diamond scribing & breaking	GaAs	Opto System LDH-100TS
laser scribing & breaking	GaN, GaN/sapphire	Opto System WSS 4000, LDH-100TS
laser micro processing	scribing, dicing, drilling of SiC, GaN, AlN, Si	Innolas ILS 500S-Air

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Service	Process Details	Core Equipment
Mounting and Assembly		
dicing (scribe & break)	e.g. bars of laser diodes (AlGaInAsP)	Opto System OSM-90TS, LDH-50TS
soldering perform tayloring	AuSn, SAC, PbSn	InnoLas ILS500S
die bonding	AuSn, SAC, PbSn - soldering with soldering depot or preform - atmosphere forming gas, formic acid or pure H_2	Finetech Sigma, Femto; SET Accμra Opto; Cammax EDB80, EDB80P
dispensing glue / soldering paste	glues - conductive: H20E (Ag filled) - isolating: 353ND, H61LV, H70 - space qualified: solithane / soldering pastes - AuSn, SAC, PbSn	Robot Masushi 350PC, ovens from Memmert and Binder
laser diode heat dissipation	C-mount (up to 4 contact tabs), CCP (up to 24 contact pins), special designed CCPs, e.g. for laser bars	Finetech Pico, Unitemp RSS160-400, RSS350
UV LED heat dissipation	SMD packages, solder bonding, Au stud bonding, capping	Finetech Sigma, Femto; Robot Masu-shi 350PC
transistor housing	HF applications up to 10 GHz, power applications 50 A / 600 V	Finetech Pico, Sigma
wire bonding	Au wire 25 µm, 17.5 µm, Al wire, wedge-wedge, ball-wedge, ribbon	Bondtech 5830, 5632; TPT HB16, HB05
Metrology and Inspection		
film thickness measurement	optical thickness measurement	Sentech RM2000, FTP500
X-ray fluorescence analysis	metal layer thickness and material composition of stacks; analysis of aqueous electrolytes	FISCHERSCOPE X-RAY XDV-µ
scanning electron microscope	wafer inspection up to 4" | materials characterization by cathodoluminescence (CL), electron microprobe (EDX)	Hitachi S4800, Hitachi Regulus 8230 with Oxford Instruments Ultim Max EDX | Zeiss Ultra with Gatan CL
scanning acoustic microscope	analysis of metal stacks for wafer up to 150 mm	PVA Tepla HD^2-SAM
atomic force microscope	for up to 150 mm wafers, scan range of 100 x 100 µm^2, cAFM module with a current sensitivity of 100 nA/V	Bruker Dimension Edge
laser scanning microscope	optical inspection and analysis	Keyence VK X1000
CD SEM	CD measurement	KLA-Tencor 8100
ellipsometer	optical properties	Sentech SE400
white light interferometer	surface topology	Zygo LOT NV6300, NewView 9000
defect measurement	defect and particle detection and classification atomic force microscopy	KLA Candela CS20 Bruker Dimension Edge
crystalline properties	high-resolution X-ray diffraction	2 x Panalytical Xpert Pro
electrical properties	sheet resistance | carrier concentration and mobility (T-resolved Hall measurements)	KITEC MRES-2000M | proprietary setup
optical properties	band gap, composition, defect luminescence by photolumi-nescence (10 K - 300 K), excitation 193 nm - 1 µm locally resolved band gap, composition, defect characteriza-tion in layers and devices (failure analysis, incl. preparation) by CL (80 K - 300 K)	proprietary setup Gatan CL in Zeiss Ultra SEM