## 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 heterostructures for laser diodes (400 nm - 450 nm), UVB 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, direct wafer exposure, CD ≥ 50 nm
- electron beam resist processing cluster
- Vistec SB251
- ATM Vision MAXIMUS 804

**i-Line**
- i-Line stepper lithography for CD > 400 nm
- spin coating and developing
- NIKON NSR-2205i12D | Süss ACS 200, IOS Cube 5 | 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
- Suss MA 8, EVG 420 | Süss MA 100 | Pokorny bench with CONVAC spin coater

**oven**
- BCB vacuum cure oven
- Yield Engineering Systems YES-PB6-2P-CP-E

## Deposition and Annealing

**PECVD**
- PECVD silicon nitride for passivation and dielectric layers
- 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 sputtering**
- sputtered Ta₂O₅, Al₂O₃, SiO₂, Si₃N₄ for optical coatings and passivation layers, sputtered WSiNₓ, AuGe, NiCr, Ni for metallic coatings, interconnects and resistors
- TiW, Au, Ir, ITO | WSiNₓ, Pt, Ir
- Ardenne CS 730
- Leybold Z 590 | Balzers PLS 570

**evaporation**
- Al, Au, Cr, Ge, Ni, Pd, Pt, Ti, V | Au, Sn, In | Cu, Ge, Pt, Ti, Au, Ni, Mo
- Leybold 560 HV | Leybold A700 | Balzers PLS 570

**UHV evaporation**
- Ti, Pt, Au, Ni | Au, Al, Ir, Mo, Ni, Pd, Pt, Ta, Ti, V, W
- Leybold 560 UHV | Pfeiffer Classic 580

**electroplating**
- Au
- MOT

**rapid thermal annealing**
- ohmic contact formation
- AST SHS 100, AST SHS 2800

## 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., SiO₂, Si₃N₄, Al₂O₃ / metal etch: e.g., Ti, Ir, WSi₂, WSiNₓ, Al / polymer etch: e.g., photo resists, polyimides, KMPR, BCB
- PVA TePla GIGABatch 360 M | Sntech Si100 (O₂, SF₆, CF₄) | several plasma etch tool types: Sntech Si591 RIE, Si500, and Si500 RIE using fluorine- and chlorine-based gases such as: SF₆, CF₄, CHF₃, BCl₃, Cl₂ as well as: Ar, He, O₂

**dry etch in-situ etch control**
- laser interferometry
- GF-Messtechnik Nanomes

**wet etch**
- GaAs
- SSEC M 3300

**cleaning**
- wet strip (NMP) | mask cleaning
- Hamatech HME 900 | Hamatech HMP 900

**metal lift-off**
- NMP
- SSEC M 3302, Hamatech HME 900
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<td>DC wafer prober</td>
<td>I-V measurements down to 0.1fA (100nV) and up to 1A (200V), TLM</td>
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<td><strong>Ion Implantation</strong></td>
<td>ion implantation</td>
<td>acceleration voltage 15 keV to 400 keV, gaseous, liquid or solid sources, e.g., H, He, N, O, ... up to max. 250 amu</td>
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<td><strong>Backend</strong></td>
<td>wafer thinning</td>
<td>lapping and polishing of GaAs, SiC, sapphire, Si</td>
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<td>wafer dicing</td>
<td>Up to 6° GaAs, Saphir, SiC, Sapphire, Si, Quartz</td>
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<td>GaAs</td>
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<td>scribing, dicing, drilling of SiC, GaN, AlN, Si</td>
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<td><strong>Mounting and Assembly</strong></td>
<td>dicing (scribe &amp; break)</td>
<td>e.g. bars of laser diodes (AlGaInAsP)</td>
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<td>soldering perform tayloring</td>
<td>AuSn, SAC, PbSn</td>
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<td>die bonding</td>
<td>AuSn, SAC, PbSn - soldering with soldering depot or preform - atmosphere forming gas, formic acid or pure H₂</td>
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<td>dispensing glue / soldering paste</td>
<td>glues - conductive: H20E (Ag filled) - isolating: 353ND, H61LV, H70 - space qualified: solithane / soldering pastes - AuSn, SAC, PbSn</td>
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<td>laser diode heat dissipation</td>
<td>C-mount (up to 4 contact tabs), CCP (up to 24 contact pins), special designed CCPs, e.g. for laser bars</td>
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<td>UV LED heat dissipation</td>
<td>SMD packages, solder bonding, Au stud bonding, capping</td>
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<td>HF applications up to 10 GHz, power applications 50 A / 600 V</td>
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<td>Au wire 25 µm, 17.5 µm, Al wire, wedge-wedge, ball-wedge, ribbon</td>
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<td>band gap, composition, defect luminescence by photoluminescence (10 K - 300 K), excitation 193 nm - 1 µm locally resolved band gap, composition, defect characterization in layers and devices (failure analysis, incl. preparation) by CL (80 K - 300 K)</td>
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