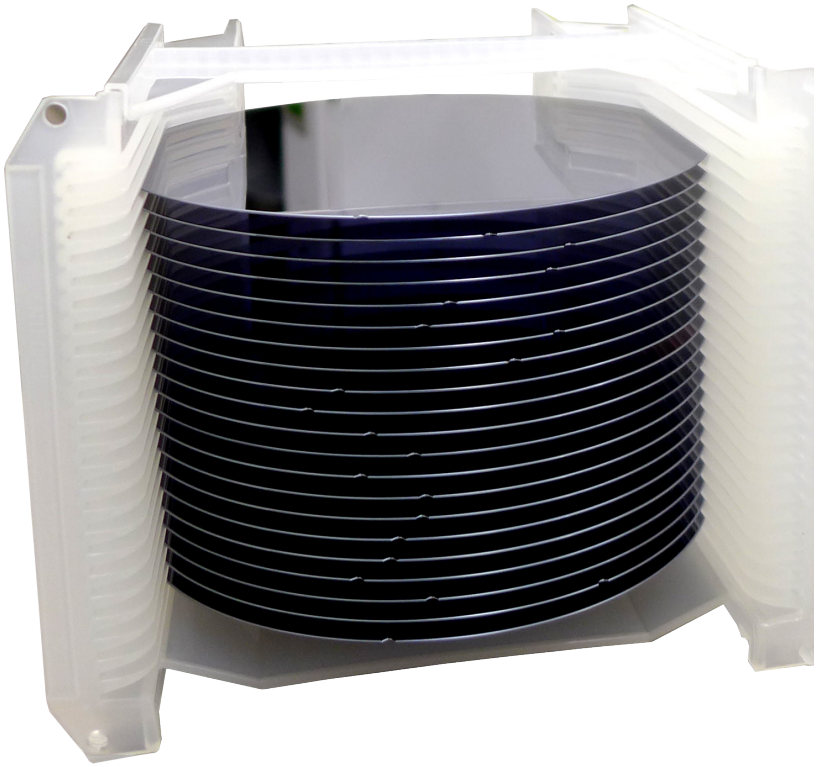
Epitaxy

III-V MATERIALS

Driving the semiconductor technology roadmap

Coherent is a global leader and foundry for the production of high-performance III-V materials for key Photonic and RF Semiconductor Components. We develop, design and manufacture advanced compound semiconductor epitaxial wafers for use in optical components, 3D sensors, wireless devices, datacenters and high-speed communication networks. Our technology improves efficiency, expands bandwidth, and increases reliability.



MAJOR PRODUCTS

- EpiDetectors®

Accelerates communication networks.

- EpiSolar®

Energizes the power grid.

- EpiBiFet®

Increases efficiency and performance.

PRODUCTION CAPABILITY

- Materials: GaAs, InP, GaP, InAs, AlAs, GaSb, InSb, InGaAs, InGaP, AlGaAs, InGaAsP, InAlGaAs, InAlGaP
- 2-inch through 6-inch wafer production platform
- State-of-the-art materials and characterization suite
- Class 1000 cleanroom
- ISO 9001:2015 certified

COHERENT

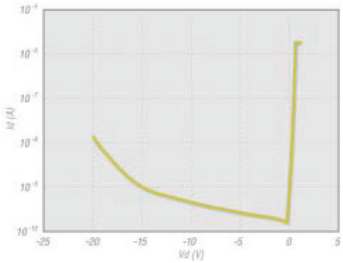
InGaAs Photodetector Wafers

Raising the bar of detector technology for telecom applications.

Performance. It's often the first thing engineers look for. But, when it comes to wafers, what's performance without volume and consistency? You've got to have all three. That's where EpiWorks comes in, supplying EpiDetector™ InGaAs photodetector wafers that combine performance with quick-lot data for better yield and quality. Grown by MOCVD, EpiWorks' InGaAs wafers surpass industry standards, bringing nextgeneration technology to your application.

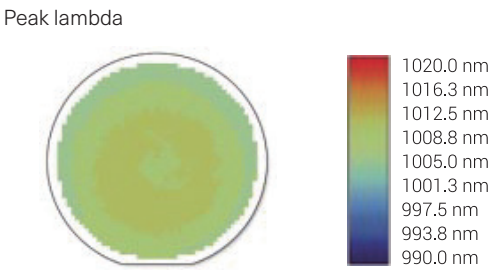
Taking you to the cutting edge
Moving to next-generation technology doesn't have to be hard, and you don't have to go it alone. EpiWorks has InGaAsP capability for advanced photodetector structures, and state-of-the-art 100 mm capability to fit your needs. Our expertise in both materials and devices results in the high-quality, high-yield products you expect and the advanced technology you need.

I-V curve for P-I-N diode



An I-V curve for a diode with a 2 µm i-layer and a 90 µm diameter. Typical devices show leakage currents of less than 1nA at a 5V reverse bias.

PL map of 100 mm InGaAsP wafer



Avg. 1007.7 nm Med. 1007.4 nm, Std. dev. 0.151% (1.526 nm)

A PL map of a 100 mm InGaAsP wafer with a 1.0 µm peak wavelength. Typical uniformity numbers are less than 0.5%.

Specifications
- 50, 75, 100 mm
- InP/InGaAs/InGaAsP
- Photodetector devices
- MOCVD production
- Telecommunications applications

Features and performance
- Typical i-layer background concentration <5e14, measured by polaron
- Quick-lot diode fab and characterization available
- Low dark current
  - Typical leakage currents less than 1nA at –5 volts
- InGaAsP capability for advanced structures

EpiWorks characterization of InGaAs photodetector wafers

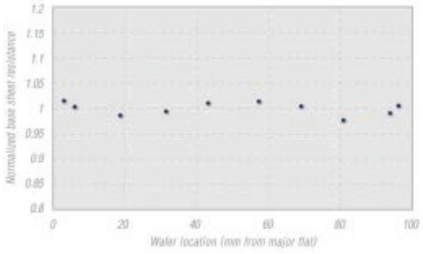
Parameter	Measurement technique	Standard tolerance of specified value
Carrier concentration	Polaron profiler, SIMS	±30% gauge capability
Lattice mismatch	X-ray diffraction	±1000 ppm
Layer thickness	AlphaStep, SIMS	±10%
Defect density	Tencor Surfscan	<10 cm-2
Leakage current (90 µm diameter)	Diode I-V measurements	±50%

InGaP/GaAs HBT Wafers

For high-performance power amplifier and high-speed digital applications.

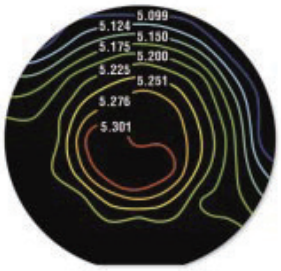
Designed specifically for today's CDMA and GSM wireless devices and OC-192 networking applications, Epiworks' InGaP/GaAs heterojunction bipolar transistors (HBT) deliver the performance and reliability you demand. Manufactured on an Aixtron MOCVD production platform, EpiHBT™ wafers set a new standard for quality, performance, and yield.

100 mm InGaP HBT base TLM uniformity



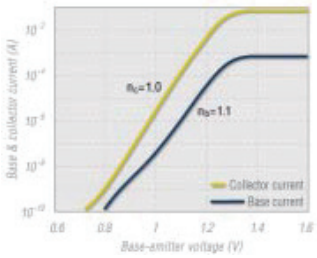
Normalized 100 mm base TLM uniformity (σ/μ) of less than 2%.

Resistivity map of 150 mm InGaP HBT



150 mm InGaP HBT with typical uniformity of less than 2%.

Gummel plot for InGaP/GaAs HBT



InGaP/GaAs HBT with a 75 x 75 μm2 emitter. The current gain is ~130, and the gain-to-base sheet ratio is Å0.55.

Specifications

- 100 and 150 mm
- InGaP/GaAs
- MOCVD production
- Power amplifier and digital applications

Features and performance

- InGaP emitter
- Carbon doped up to 4E19 cm-3
- Full-wafer fab enables
  - high-level quality assurance
  - rapid improvement of HBT processes - high uniformity
- Quick-lot data for improved yield and quality

EpiWorks characterization of InGaP/GaAs HBT wafers

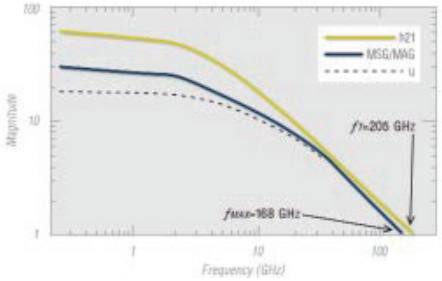
Parameter	Contactless resistivity	Standard tolerance of specified value
Sheet resistance	Contactless resistivity	±5%
Layer thickness	Profilometer and/or white light reflectance	±10%
Carrier concentration	Hall measurement	±10%
Large-area device data(Beta, R_{sb}, R_{ese}, V_{be}, BV_{ceo}, BV_{ebe}, BV_{cbo}, n_c, n_b)	Full wafer, large-area device process/test	
Defect density (0.3 to 25 μm2)	Surfscan	<10 cm^{-2}

InP HBT Wafers

Next-generation materials and technology for high-speed, low-power applications.

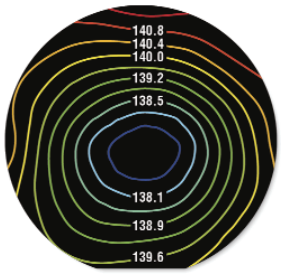
Designed to meet the demands of tomorrow's high-speed 3G wireless and OC-768 networking technologies, Epiworks' InP heterojunction bipolar transistors (HBT) combine high-frequency performance with ultra-low power consumption. Manufacturer of the world's first 100 mm carbon-doped InP HBTs, EpiWorks continues to innovate by delivering advanced DHBTs and graded-base HBTs, in addition to our leading SHBTs.

Figure of merit extrapolation



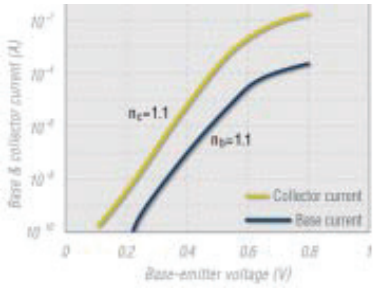
High-frequency performance for a small-area HBT with a 2500 Angstrom collector and a 600 Angstrom base, showing ft > 200 GHz and fmax > 160 GHz.

Resistivity map for a 100 mm carbon-doped InGaAs layer



Carbon-doped InGaAs layer with typical uniformity of less than 3%.

Gummel plot for InP/InGaAs SHBT



InP/InGaAs SHBT with a 60 x 60 µm2 emitter fabricated at EpiWorks on a 100 mm substrate.

Specifications

- 50, 75, and 100 mm
- Carbon-doped InGaAs
- MOCVD production
- Digital and power applications

Features and performance

- InP emitter
- Carbon doping for high reliability
- SHBT and DHBT
  - InGaAsP capability for advanced DHBT structures
  - Graded-base for higher gain and speed performance
- Quick-lot HBT fab and characterization available for aximum yield and quality

EpiWorks characterization of InGaP/GaAs HBT wafers

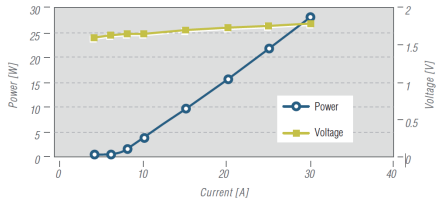
Parameter	Measurement technique	Standard tolerance of specified value
Sheet resistance	Contactless resistivity	±5%
Layer thickness	Profilometer, X-ray diffraction	±10%
Carrier concentration	Hall measurement	±10%
Large-area device data(Beta, Rsb, Rese, Vbe, BVceo, BVebo, BVcbo, nc, nb)	Full wafer, large-area device process/ test	
Defect density (0.5 to 25 µm^2)	Surfscan	<50 cm^{-2}

AlGaAs/GaAs Edge-Emitter Wafers

High-performance laser technology for industrial, medical, printer, and communications applications.

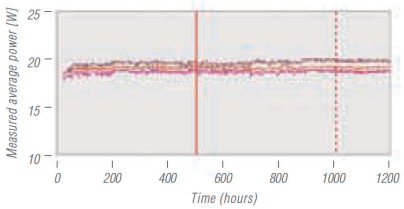
Designed to meet the demands of industrial, medical, printer, automotive, military, and communication applications, Epi-Works' AlGaAs/GaAs edge-emitter epi wafers deliver the performance and reliability you demand. Manufactured on a state-of-the-art MOCVD production platform, EpiWorks wafers set a new standard for quality, performance, and yield.

L-I-V curve for an 808 nm AlGaAs/GaAs laser bar



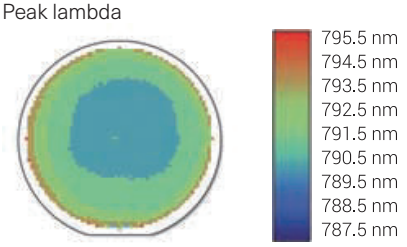
A plot of the output power versus drive current and voltage from an 808 nm AlGaAs/GaAs edge-emitter laser bar. The laser bar has 46 emitters with a cavity length of 1mm and a stripe size of 80µm. The plot shows an excellent slope efficiency of 1.1 W/A with a threshold of 7.5A.

Reliability for an 808 nm high-power laser



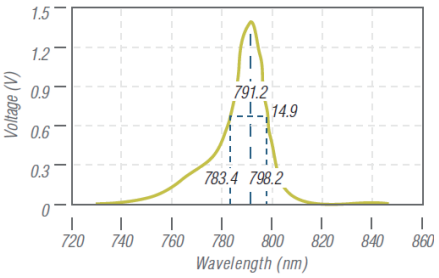
A lifetime plot for an 808 nm AlGaAs/GaAs edge-emitter laser bar with 46 emitters, a cavity length of 1 mm and an 80 µm stripe width. This device was tested under 28A of drive current at 25ºC and shows a lifetime greater than 1,200 hours.

PL map for a three-inch 808 nm high-power edge-emitting laser



Avg. 791.2. nm Med. 791.2 nm, Std. dev. 0.119% (0.945 nm)

A photoluminescence map (left) for a three-inch 808 nm laser. The map shows a standard deviation of less than 1 nm. The right graph shows a typical PL Avg. 791.2 nm Med. 791.2 nm Std. dev. 0.119% (0.945 nm) spectrum with a full-width at half-maximum of 15 nm.



Specifications

- 50, 75, 100 mm
- MOCVD production
- Laser applications

Features and performance

- Laser emission ranging from 740 nm to 980 nm
- QW Active Layer Materials: GaAs/AlGaAs/InGaAs/InAlGaAs/GaAsP/InGaAsP
- Carbon-doped GaAs up to 1E20
- Zinc-doped GaAs up to 1E20
- Carrier concentration verified via both Hall and Polaron

Epiworks characterization of GaAs edge-emitter laser wafers

Parameter	Measurement technique	Standard tolerance of specified value
QW PL Wavelength	PL Mapping	±3nm
Composition	X-Ray	±3%
Thickness	Alpha-step and PL fringes	±10%
Doping	Polaron and Hall	±30%
Defect density (diameter > 2 µm)	Surfscan	<10 cm^{-2}

sales@ii-vi.com
www.ii-vi.com