

Compound Semiconductor Fabrication

State-of-the-art facilities. Dedicated people

What are compound semiconductors?

Compound or III-V semiconductors are materials that contain both Group III and Group V elements from the Periodic Table. Characteristics of III-V semiconductors such as their high electrical mobility, their ability to produce light efficiently, and their ability to function at high speed in microwave equipment or in fast computers, make them particularly suited to the fabrication of opto-electronic devices. Common III-V semiconductors used at Tyndall include gallium arsenide, gallium nitride, and indium phosphide.

What devices are fabricated in the Compound Semiconductor Fabrication laboratory?

CFF Compound Semiconductor fabricates devices and structures using III-V materials. These are mainly edge emitting laser diodes, vertical cavity surface emitting lasers (VCSELs), light emitting diodes (LEDs), and resonant cavity light emitting diodes (RCLEDs) for Photonics research, also Schottky mixer and multiplier diodes, and circuits on GaAs membranes for THz applications. Ancillary and support activities include packaging techniques such as wire bonding, bump bonding, and reliability testing of THz devices.

What role does CFF Compound Semiconductor fabrication play at Tyndall?

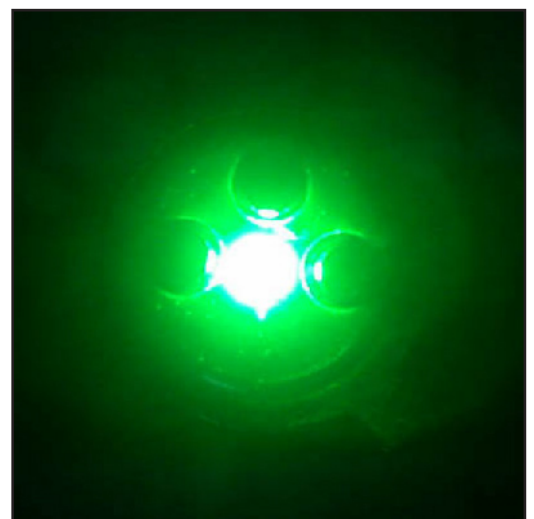
We provide fabrication support in the compound semiconductor area to Tyndall research groups by working with and developing new processes of practical importance for research. We also provide fabrication support to Industry Access and directly to commercial clients.

What fabrication services can CFF Compound Semiconductor offer?

We offer the following with at least 4" wafer capability:

- A fully equipped optical lithography facility with contact mask alignment printing to 6" wafer.
- Dry etch capability with two Inductively Coupled Plasma (ICP) etchers providing comprehensive etch processes for III-V materials, dielectrics, and various polymers.
- **Deposition processes for dielectrics** by E-beam evaporation of a wide range of dielectrics (Al_2O_3 , AlF_3 , Ga_2O_3 , HfO_2 , In_2O_3 , ITO, MgO_2 , Na_3AlF_6 , Si, SiO_2 , SnO_2 , TiO_2 , YtO, ZnO_2 , ZnS) with in-situ ion beam substrate cleaning and film densification for improved adhesion.
- Dielectric deposition by plasma enhanced CVD of SiO_2 , low stress SiN, Si.
- Sputter deposition - SiO_2 , Si, (reactive & metal deposition also possible).
- General wet processing
- Backside wafer processing such as chemical or mechanical wafer thinning
- Ancillary processes such as rapid thermal annealing (RTA), ashing, selective oxidation, silylation, scribing, wire bonding, wire bumping.

[more overleaf >](#)



Above: GaN RCLED emitting at 530nm for POF applications

From Atoms to Systems

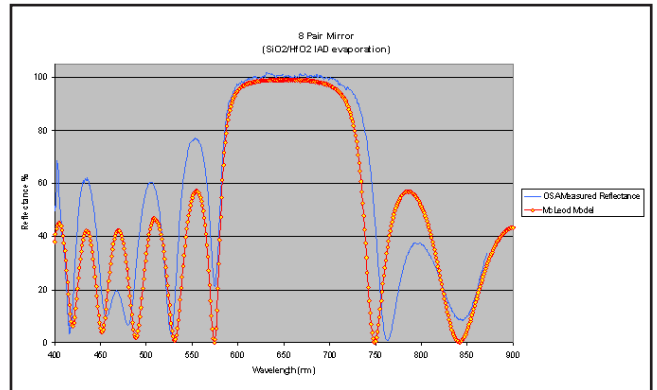
Characterisation of processes by:

- Surface profile step height measurement
- Thin film thickness measurement
- Line width and feature size measurement
- Optical and scanning electron microscope inspection
- Focused ion beam sectioning

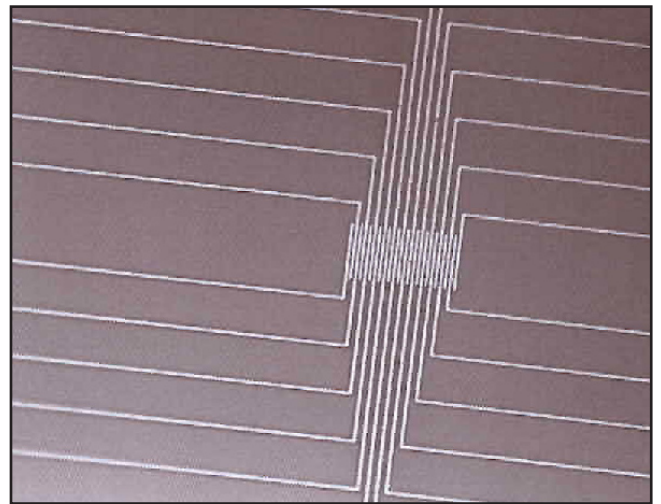
What other activities are CFF Compound Semiconductor involved with?

We provide process support for the fabrication of a wide field of devices such as metal electrode structures for characterising nanowires, for biotechnology sensors, and for medical implants. We deposit AR coatings and mirrors for photonic applications and fabricate structures that are used for microfluidics applications.

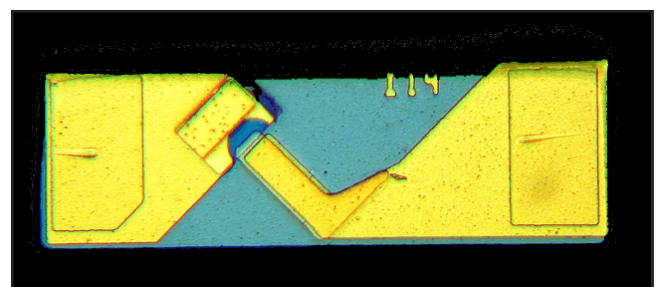
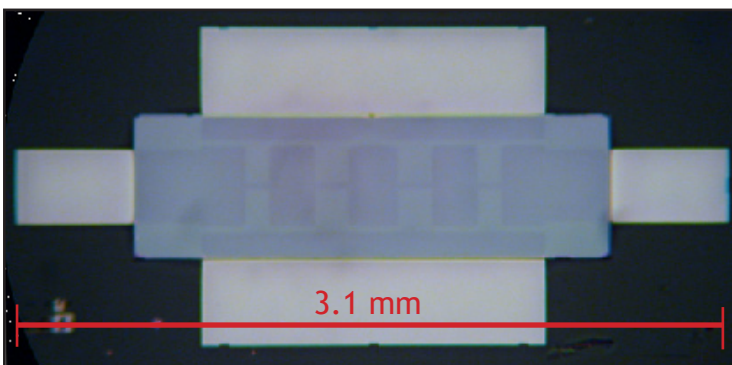
We are also active in terahertz technology, building on a history of high frequency Schottky diode fabrication and developing sub-millimetre wave circuits on GaAs membranes, novel planar Schottky diodes, and bonding techniques for mounting high frequency MMICs.



Above: 8 Pair mirror (SiO₂/HfO₂ IAD evaporation)



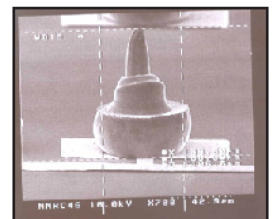
Above: 0.75 μm lines and spaces array of gold interdigitated electrodes for nanowires characterisation



Above: Novel planar Schottky multiplier diode

Right: Wire bump made from 18μm diameter gold wire before bonding >

Above Left: Backside view of beam-leaded membrane with filter metalisation visible through the thin 3 μm membrane



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