

Photonic devices, used in the generation, control and manipulation of light are changing the way we live our lives. We communicate with each other through mobile phones lit up with highly efficient white light emitting diodes (LEDs) and equipped with cameras. Our information is sent over the fibre optic backbone of the internet using pulses of infrared light. The data is more and more being stored in the cloud where light is critically used to manage the enormous data flows. It is clear that photonics will be a key technology for the 21st century.

At Tyndall, we develop original photonic devices for existing and new applications, building our own lasers and photodetectors in a fabrication laboratory using our designs resulting in devices that we can test and use. In particular, the III-V material group is interested in the development and commercialisation of III-V photonic devices. III-V compound semiconductor is an alloy, containing elements from groups III and V in the periodic table.

The candidate will help in the design, characterization and development of blue Superluminescent Emitting Diodes (SLED). SLEDs are light sources with characteristics in between LEDs and laser diodes. LEDs emit low output power, broadband emission, non-coherent and non-directional light, while lasers emit high power, narrowband, coherent and highly directional light. Instead, SLEDs generate high power, broadband, coherent and highly directional light, combining the benefits of LEDs and laser diodes. Other characteristics are small etendue, low beam divergence, and low temporal coherence. These excellent features are commonly generated in a ridge waveguide with non-reflecting facets which confines the light and eliminates the light resonance inside the cavity. The light creation mechanism in the gain medium is amplified spontaneous emission. The unique characteristics of beamed power and low temporal coherence at short wavelengths make blue SLEDs ideal candidates for applications such as projectors, fibre-based illuminators, car headlights, optical sighting and ranging equipment, high resolution optical coherence tomography, micro-display applications, smart solid state lighting, and fluorescence machine systems. The device has the potential to be commercialized in the near future. Therefore, the candidate will contribute in the implementation of this novel technology in the photonic market.

The student will have the option to choose between three projects:

The study of optical and electrical properties in blue SLED devices, key responsibilities:

- Ensure all activities are compliant with the required health and safety standards.
- Build the current-voltage and light-current experimental set-up.
- Measure the current-voltage (I-V) curve for SLEDs with different geometries.
- Measure the light-current (L-I) curve for SLEDs at different pulsed width, duty cycle and frequency.
- Analyse and discuss the experimental data.

The study and model of thermal behaviour in blue SLED devices, key responsibilities:

- Build and design the thermal imaging experimental set-up
- Measure thermal imaging.
- Simulate the thermal behaviour of the SLED.
- Develop a heat dissipater according.
- Introduce heat dissipater and contrast experimental data with simulation.

The study and model of etching profile in blue SLED devices, key responsibilities:

- Obtain etching profile features from scanning electron micrograph (SEM) pictures, etching angle and distance between etched cavity and substrate.
- Model the etching profile introducing as variable etching condition and photoresist mask profile.
- Obtain the relation between photoresist mask profile, etching conditions and etching profile.

Key requirement:

- The student(s) should be able to work independently, and have excellent theoretical and experimental skills.
- Knowledge or experience in photonic devices.
- Knowledge or experience in computing and programming languages such as C++, Matlab, python.
- The successful candidate will be well-organized and self-motivated, with good interpersonal and teamwork skills