Master / PhD Thesis Project

III-nitride nanostructures for far-UVC emitters

Context: UV radiation is effective for inactivating a large range of pathogens. This technique is receiving renewed attention due to the global pandemic as an immediately deployable and cost effective option. However, the common sources used for disinfection emit in the 254-270 nm range. This radiation is highly carcinogenic and cataractogenic, which represents a health hazard. Recently, it has been demonstrated that far-UVC emission in the 220-230 nm range can efficiently inactivate bacteria without harm for humans, since it cannot penetrate the outer (non-living) layers of human skin or eyes. Within this internship, we will explore the efficiency of AlGaN nanostructures as emitters in the 220-230 nm spectral range. We will exploit the enhanced radiative efficiency that results from carrier confinement in nanometer-scale localization centers (atomic layer thickness fluctuations, alloy inhomogeneities or quantum dots), we will study the doping ratios required to improve conductivity and transparency, and we will boost the light extraction efficiency by nanopatterning.

Objectives and available means: The student will work on the fabrication and characterization of III-nitride nanostructures for far-UVC emission. This implies training in material growth by molecular beam epitaxy, modeling using Comsol and/or RSoft, device fabrication technologies for nanopatterning (at the PTA facilities) and a variety of optical characterization setups, including photoluminescence and cathodoluminescence.

The team: The student will integrate a research team of the Nanophysics and Semiconductor Lab. (NPSC), under the supervision of Eva MONROY.

Have a look at our webpage: http://www.pheliqs.fr/en/Pages/Eva-Monroy.aspx

For more information on our work, read our recent publications (available on demand):

[1] S. Cuesta, A. Harikumar, and E. Monroy, *J. Phys. D: Appl. Phys.* **55** 273003 (2022)
[2] A. Harikumar, et al., *Nanotechnology* **31** 505205 (2020)
[3] S. Cuesta, et al., *Appl. Phys. Lett.* **119**, 151103 (2021)

Collaboration and networking: The research will develop in collaboration with the LETI-DPNC (David COOPER, Adeline GRENIER) for structural/chemical characterization, and with Institut Néel (Martien DEN HERTOG, Fabrice DONATINI), Univ. of Lyon (Olivier BOISRON) and Paul-Drude-Institut in Berlin (Jonas LÄHNEMAN) for advanced optical characterization in the deep-UVC.

We are seeking for students with a background on semiconductor physics and optoelectronics, and highly motivated for experimental laboratory work.

APPLY NOW!

To apply for this position, send your application (including CV) by e-mail to: eva.monroy@cea.fr

French Commission for Atomic Energy and Alternative Energies
Interdisciplinary Research Institute of Grenoble
Quantum Photonics, Electronics and Engineering Laboratory
17 av. des Martyrs – 38054 Grenoble cedex 9 – France