Nitride nanowire light emitting diodes: from single wire properties to flexible light emitters

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In this presentation we will review the forefront research on semiconductor nanowire light emitting diodes with a special attention to nitride materials emitting in the green and blue spectral range. We will show that these nanomaterials have the potential to boost the device performance, to improve the energy efficiency, to reduce the cost and to bring new functionalities. In particular, we will discuss our recent advances towards flexible nitride nanowire devices. We propose a method to combine high flexibility of polymer films with high quantum efficiency provided by nitride nanowires to achieve flexible inorganic light emitting diodes. We will also discuss the fabrication and characterization of single nanowire light emitting diodes with graphene transparent contacts [1] as well as the coupling of single nanowire emitters with waveguides in order to form a functional photonic platform [2].

[1] Tchernycheva M, Lavenus P, Zhang H, Babichev A V, Jacopin G, Shahmohammadi M, Julien F H, Ciechonski R, Vescovi G, Kryliouk O, InGaN/GaN CoreтАУShell Single Nanowire Light Emitting Diodes with Graphene-Based P-Contact, Nano Letters 14, 2456 (2014).
[2] Tchernycheva M., Messanvi A., de Luna Bugallo A., Jacopin G., Lavenus P., Rigutti L., Zhang H., Halioua Y., Julien F. H., Eymery J., Durand C., Integrated Photonic Platform Based on InGaN/GaN Nanowire Emitters and Detectors, Nano Letters 14, 3515 (2014).

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Education

1999–2001 Engineer from Ecole Polytechnique, Palaiseau, France
2001–2002 Master Degree in "Laser-Matter interaction" from Ecole Polytechnique, France
2002–2005 PhD in Physics from University Paris Sud, France

Professional Experience

2005–2006 Postdoctoral fellow working on "MBE growth and analyses of III-V nanowires" at Laboratory for Photonics and Nanostructures
Since 2006 CNRS researcher at Institut d'Electronique Fondamentale, University Paris Sud

Fields of Research

- *Study of the optical and electrical properties of III-V semiconductor nanowires*
- *Nanowire-based photodetectors and light emitting diodes*
- *Nanowires for photovoltaic and piezoelectric conversion*
- *Intersubband devices based on GaN/AlN quantum wells and quantum dots*

Publications

- L. Rigutti and **M. Tchernycheva**, "Electrical and electro-optical characterization of semiconductor nanowires" pp. 641-85 in the 2nd edition of "Characterization of Semiconductor Heterostructures and Nanostructures", Edited by C. Lamberti and G. Agostini, Elsevier (2013).
- L. Rigutti and **M. Tchernycheva**, "GaN nanowire-based UV photodetectors" in "Wide Band Gap Semiconductor Nanowires for Optical Devices: The Particular Case of GaN and ZnO", edited by V. Consonni and G. Feuillet, ISTE-Wiley (2014).
- Lavenus P, Messanvi A, Rigutti L, Bugallo A De Luna, Zhang H, Bayle F, Julien F H, Eymery J, Durand C, **Tchernycheva M**, Experimental and theoretical analysis of transport properties of coreтAУshell wire light emitting diodes probed by electron beam induced current microscopy, Nanotechnology 25, 255201 (2014).
- **Tchernycheva M.**, Messanvi A., de Luna Bugallo A., Jacopin G., Lavenus P., Rigutti L., Zhang H., Halioua Y., Julien F. H., Eymery J., Durand C., Integrated Photonic Platform Based on InGaN/GaN Nanowire Emitters and Detectors, Nano Letters 14, 3515 (2014).
- **Tchernycheva M**, Lavenus P, Zhang H, Babichev A V, Jacopin G, Shahmohammadi M, Julien F H, Ciechonski R, Vescovi G, Kryliouk O, InGaN/GaN CoreтAУShell Single Nanowire Light Emitting Diodes with Graphene-Based P-Contact, Nano Letters 14, 2456 (2014).