Silicon nanostructures and devices for advanced LEDs

J. M. Ramírez[1], Y. Berencén[1], A. Anopchenko[2], N. Prtljaga[2], A. Tengattini[2], L. Pavesi[2], P. Rivallin[3], J. M. Fedeli[3] and **B. Garrido**[1]

[1]Departament d'Electrònica, Universitat de Barcelona, Carrer Martì i Franquès 1, Barcelona 08028, Spain
[2]Nanoscience Laboratory, Department of Physics, University of Trento, Via Sommarive 14, Povo (Trento) 38123, Italy
[3]CEA, Léti, Minatec campus 17 rue des Martyrs, 38054 Grenoble cedex 9, France

Silicon based devices have been demonstrated as a potential alternative for photonic applications, providing several advantages towards the monolithic integration using the mainstream CMOS manufacturing tools [1].

However, there are still some needs that must be overcome such as the development of an efficient silicon-based and monolithically integrated light source (LED or a LASER) electrically pumped. Although this matter has attracted much attention and has been widely studied during the last years [2, 3] there is still room for improvement in this field, especially when using Si nanostructures (Si-ns) in combination with rare earth ions. The influence of Si-ns into Er ion excitation is well known due to its benefits either under optical (increase of the excitation cross-section) or electrical pumping (lowering of the tunnelling barrier height) and provides a good scenario for the realization of cost-effective light emitting devices with different operation ranges.

In this paper we present an overview of the work done towards the implementation of an integrated and efficient Er doped light source coupled to a slot waveguide and to an output coupler for wafer testing. The optimization of the material was previously performed by means of the electro-optical characterization in MOS capacitors replacing the oxide by the active layers. The transport properties [4], the power efficiency and the response to a pulsed excitation [5] were also investigated in these layers, providing valuable information of the best and more convenient fabrication parameters to be used for the coupled system.

Finally, a road map for the next generation of Si-based devices in our research group will be highlighted, displaying and appealing future work to be done in silicon based light sources.

References

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