Advances in the Realization of GaN-Based Microcavities: Towards Strong Coupling at Room Temperature

F. Semond, F. Natali, D. Byrne, M. Leroux, and J. Massies

CRHEA-CNRS, Rue Bernard Gregory, Sophia Antipolis, 06560 Valbonne, France

Owing to their high oscillator strengths, GaN-based semiconductor compounds are attractive for the microcavity community. Indeed, with such a wide bandgap semiconductor, it is believed that a new generation of optoelectronic devices like exciton lasers could be realized. Many efforts are therefore concentrated on the growth as well as on the technology of GaN compounds in order to improve the sample quality and achieve strong coupling in microcavities at room temperature.

We review our most recent advances into the realization of GaN-based microcavities following two approaches:

- The first one consist in the epitaxial growth of a bottom GaN-based DBR followed by the growth of the cavity and then a dielectric DBR is deposited on the top. The main issue is to grow high-reflectivity, low-defect density and uncracked nitride-based DBRs. In this view, a process using strain-mediating virtual AlGaN substrates has been developed [1]. Characterization of DBRs and GaN/AlGaN QWs grown on top will be presented.
- In the second approach, we only use dielectric DBRs. GaN layers are grown on silicon substrates then the top DBR is deposited and then, the silicon substrate is removed in order to deposit the second DBR. Recently using a similar approach, the first experimental observation of the strong coupling regime at low temperature in a nitride-based microcavity has been reported [2]. In order to improve the microcavity properties, state of the art GaN/AlGaN MQWs having emission linewidths between 11-24 meV were grown on silicon substrates. On the other hand, preliminary results suggest that the substrate removal and the use of etch-back steps to remove defective GaN do not affect the initial optical properties of the active region.

The strong coupling behaviour between the exciton and the cavity mode at room temperature in a nitride-based microcavity has yet to be seen but our recent results suggest that this goal is within the reach of current technology.

[1] F. Natali *et al*. APL **82**, 499 (2003)
[2] N. Antoine-Vincent *et al.* Phys. Rev. B **68**, 153313 (2003)