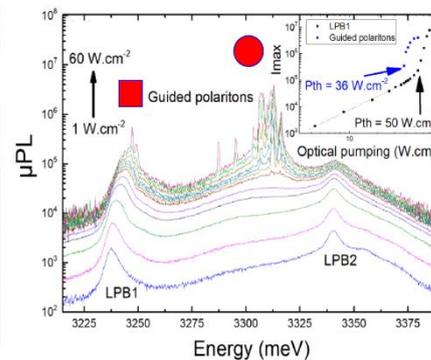
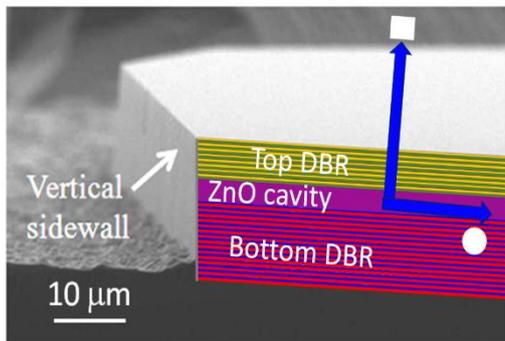


Polariton lasing competition

NANO



SEM image of a microcavity containing an (AlN/AlGaN) DBR, a ZnO active region cavity and a top (SiO₂/HfO₂) DBR grown on a patterned Si substrate. Photoluminescence spectra as a function of pumping power, displaying vertical (square) and horizontal (circle) polariton lasing.

First demonstration of concomitant vertical and in-plane polariton lasing

Polaritons are the quasiparticles resulting from the strong coupling between a confined photonic mode and an excitonic resonance. Since their observation in 1992, most studies have been carried out in vertical microcavities, which are usually fabricated by introducing an active region between two Bragg mirrors. In 2017/2018 we demonstrated for the first time the possibility of achieving polariton condensation on in-plane guided modes, suggesting the possibility of observing within the same microcavity polariton

condensation on vertical and on guided modes.

To demonstrate this competition we have studied a vertical microcavity grown on a patterned Si substrate and measured it near a vertical sidewall of one of the mesas (see left panel). As shown by spectrally- (right panel) and angular-resolved measurements (not shown), polariton condensation can indeed occur in both kinds of polaritons branches (circle and square), one or the other being preferred depending on the actual exciton-photon detuning.

Breakthroughs

First ever demonstration of concomitant polariton condensation (lasing) on vertically-confined and horizontal propagative polariton modes.

Perspectives

This competition might have existed in previous reports on polariton condensation, calling for a revision of some accepted ideas, and point towards new cavity designs optimizing (ie. minimizing) such competition.

Participants : B. Alloing, M. Al-Khalifioui, S. Chenot, M. Leroux, F. Semon, J. Zuniga-Perez

Collaborations : C2N (S. Bouchoule), Institut Pascal (J. Leymarie and G. Malpuech), and L2C (T. Guillet)

More information : O. Jamadi et al., Light Sci. Appl **7**, 82 (2018), O. Jamadi et al., Phys. Rev. B **99**, 085304 (2019) and ANR Plug-And-Bose (ANR-16-CE24-0021)

Contact: Jesus Zuniga Perez - jzp@crhea.cnrs.fr