

Analysis and modeling of polaritonic gain in GaN ridge polariton lasers

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Following the demonstration of polariton lasing in GaN ridge polariton lasers [1,2], the polaritonic analog to conventional semiconductor diode lasers, we here analyse and model the laser dynamics in the interesting case of waveguide polaritons. The laser cavities are GaN etched ridge structures with DBRs operating under strong coupling [3] up to 300K with a 66 ± 10 meV Rabi splitting (Fig. 1(a,b)). They are optically pumped with a line-shaped spot, resonantly pumping the exciton reservoir.

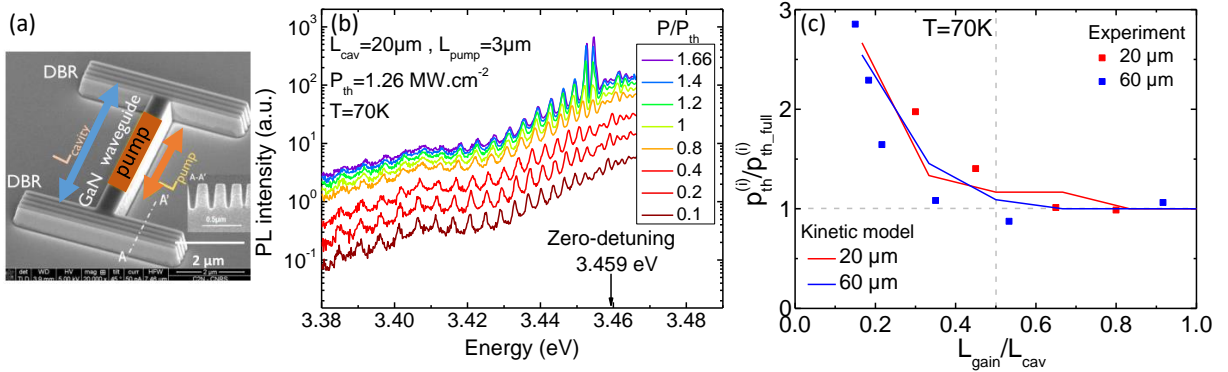


Figure 1: (a) SEM image of a 5 – μm long polariton ridge waveguide; (b) PL spectra across the lasing threshold, for a 20 μm -long ridge; (c) Laser power at threshold $p_{th}^{(i)}$, integrated along the whole excitation length, vs gain length, normalized to its value $p_{th,full}^{(i)}$ for $L_{pump} = L_{cav}$.

We study the effect of a varying optically-pumped length. The polariton laser is operated for an exciton reservoir length of just 15% of the cavity length [2]. It is worth noting that this would not be possible in a conventional ridge laser with population inversion. This experimental observation agrees quantitatively with simulations based on semiclassical Boltzmann equations for polaritons (Fig. 1(c)) [4,5].

References

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