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The preparation of single-and entangled photon pairs (EPPs) is a critical component in the field of quantum information networks. Quantum Dots (QDs) embedded in micro-cavities are a promising realization of such non-classical light However, in most implementations of coupled QD-cavities, the spontaneous emission is only enhanced within a small bandwidth, which compromises the efficient extraction of photon pairs.

Here, we discuss the fabrication and functionality of a photonic Bier-Glas cavity. By design, this device architecture combines the Purcell enhancement of a photonic micropillar structure with broadband photonic mode shaping of a vertical, tapered waveguide [1]: The low Q-factor microcavity supports broadband optical resonances, and therefore has the potential to can support the efficient extraction of entangled photon pairs. The cavity, which is characterized by a small mode volume, also promises significant spontaneous emission enhancement of the quantum dots due to the Purcell effect. The combination of the tapered waveguide puts extraction efficiencies larger than ε = 0,70 within reach. Our device is based on a MBE grown GaAs/AlGaAs heterostructure containing a low density layer of InAs QDs grown with the partial capping and annealing technique. Careful optimization of the subsequent reactive ion etching step allows us to implement its characteristic Bier-Glas shape. Initial optical characterization verifies the presence of optical resonances, as well as pronounced, bright QD emission signals.

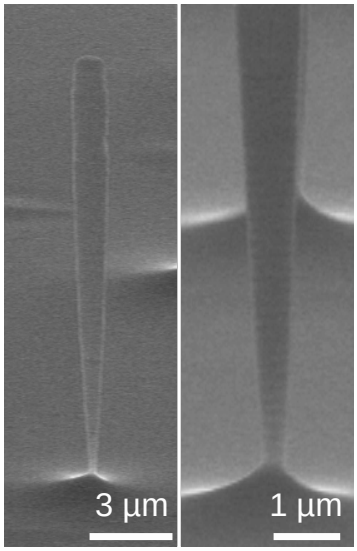

Figure 1-SEM Image of a Photonic Bier-Glass device and a zoom in the DBR section.

References

[1] N. Gregersen et al. *Photonic "hourglass" design for efficient quantum light emission* Opt. Lett. 44, 2617-2620 (2019)