

Growth of Single-Photon Sources and Entangled Photon Pairs by Molecular Beam Epitaxy

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Epitaxial semiconductor quantum dots (QDs) have emerged as leading solid-state platforms for the on-demand generation of single and entangled photons. Their performance critically depends on the atomic-scale control provided by molecular beam epitaxy (MBE), which enables precise engineering of material composition, interface quality, and nanostructure morphology required for quantum-optical applications. Among MBE-based growth approaches, droplet etching epitaxy (DE) [1] stands out for enabling the formation of nearly strain-free QDs with low and tunable surface densities, reduced excitonic fine-structure splitting (FSS), and fast radiative recombination. In this work, we present recent advances in MBE and DE for the realization of high-quality single-photon and entangled-photon-pair sources based on GaAs/AlGaAs and InGaAs/AlGaAs III–V material systems [2].

[1] – Covre da Silva, S. F., Undeutsch, G., Lehner, B., Manna, S., Krieger, T., Reindl, M., Schimpf, C., Trotta, R., & Rastelli, A. (2021) *Applied Physics Letters*, 119(12), 120502.

[2] - Covre da Silva, S. F., Garcia, A., Aigner, M., Weidinger, C., et al. (2026). *Nano Letters*, 26(3), 953–960.