Growth and Characterization of InAs/InP Quantum Dots by Droplet Epitaxy in MOVPE at the Telecom C-band for Quantum Information Technologies

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We study the Droplet Epitaxy (DE) in Metal Organic Vapour Phase Epitaxy (MOVPE) of InAs/InP quantum dots (QDs) for applications in quantum information technologies at the telecom C-band. Among III-V QDs, InAs/InP are very attractive as high-performance single and entangled photon sources [1]. Here, we show a multi-step growth procedure for Indium droplet crystallization into InAs QDs and how it affects the QD morphology [2]. Controlling the QD formation and morphology during growth is fundamental for tuning their size, shape, symmetry, and thus fine-structure splitting (FSS), a key parameter for achieving a higher entanglement degree [3]. We also demonstrate Indium droplets formation on $In_{0.53}Ga_{0.47}As$ and $In_{0.719}Ga_{0.281}As_{0.608}P_{0.392}$ lattice-matched layers to InP and their crystallization into QDs for the first time by DE in MOVPE [4,5]. We present morphological characterizations of such QDs by Atomic Force Microscopy (AFM), Transmission Electron Microscopy (TEM) and Cross-sectional Scanning Tunnelling Microscopy (XSTM) [2,4-6], see **Figure 1**. Optical investigations by means of low-temperature micro-photoluminescence (LT-μPL) show bright single-dot emission around 1.55 μm for InAs QDs on both bare InP and InGaAs(P) layers [2,4,5], confirming their good optical quality at the telecom C-band. Our studies explore the flexibility of the DE in MOVPE for the large-scale fabrication of a broad range of high-quality nanostructures for applications in quantum information technologies at the telecom C-band, particularly as high-performance single and entangled photon sources.

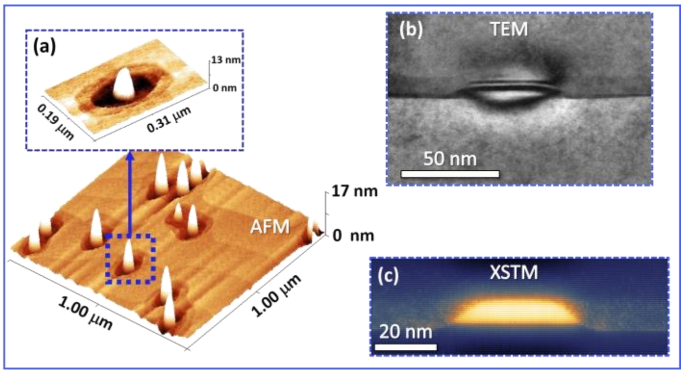

Figure 1: **(a)** AFM of free-standing InAs/InP QDs with detail of a single QD placed in an etched pit [2]. **(b)** TEM and **(c)** XSTM micrographs of a single buried InAs/InP QD in an etched pit [6].

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