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MOCVD growth of GaSb/GaAs quantum dots

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Abstract content
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Quantum dots (QDs) formed through the creation of Gallium Antimonide (GaSb) nanostructures in a Gallium Arsenide (GaAs) matrix have some unique and appealing properties that are being continually exploited. This system has a type-II band alignment, providing strong spatial confinement for holes, and only binding electrons via the Coulomb interaction, leading to optical properties different from type-I QDs, such as a long radiative lifetime, a dot-shape dependent oscillator strength, and a large tunability of emitted/absorbed photons. It has been found recently that GaAs based p-i-n solar cells containing layers of GaSb quantum dots/rings fabricated by Molecular Beam Epitaxy showed improved efficiency at longer wavelengths of up to 1.5 μm. In order to improve this device functionality there is a need to understand the formation of these dot structures in order to control/tune their structural properties and therefore improve their optical and electrical properties. A Metal Organic Chemical Vapor Deposition (MOCVD) system provides a set of deposition conditions that would allow one to systematically study the QD formation.
In this work we show the fabrication of GaSb QDs in a GaAs matrix using MOCVD. Tributylarsenic, Triethygallium (TEGa), and Trisdimethyaminoantimony (TDMASb) were used as arsenic, gallium, and antimony sources, respectively. We studied the influence of TDMASb/TEGa ratio and growth temperature on the size, morphology and density of the QD structures. We also studied the optical properties of the capped QD structures by photoluminescence spectroscopy.

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