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Optimization of the growth of 1.3-μm InAs Quantum Dots structures with InGaAs Insertion Layers

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We have systematically studied the effect of an $In_xGa_{1-x}As$ insertion layer (IL) on the optical properties of InAs quantum dots structures. The light-emission energy E of self-assembled quantum dots (QDs) is determined by the complex interplay of parameters such as In compositions, positions and thicknesses of InGaAs IL. Insertion of an InGaAs IL into the InAs QD structures led to a red shift of 91 meV relative to the InAs QD without InGaAs IL at room temperature. The emission wavelength of the InAs QDs was tuned from 1.18 to 1.3 μm by using the InGaAs IL. Furthermore, the full width at half maximum of the photoluminescence (PL) peak of about 40 meV remained constantly despite the temperature variation ranging from 20 to 220 K. It is attributed to the large energy-level spacing between the ground states and the first excited states of 57 meV. Our results show that the InGaAs IL is useful for obtaining high quality InAs QD structures for device with a 1.3 μm operation at room temperature.