SHEDDING NEW LIGHT ON SEMICONDUCTOR NANOSTRUCTURES

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Abstract

The standard technique for the growth of semiconductor nanostructures like quantum dots is based on island formation driven by heteroepitaxial misfit strain and will be exemplified for the silicon-germanium system. Strain engineering is at present also the method of choice in silicon based photonics for the near-infrared region, which holds the promise to integrate electronic and photonic functionalities on a silicon platform. For the realization of photonic devices for the mid-infrared wavelength range i.e. to extend further the wavelength range of quantum dot systems a novel technique has emerged which is based on the heteroepitaxy of immiscible semiconductor materials like II-VI and IV-VI compounds which crystallize in different crystallographic phases. In this growth technique narrow gap semiconductor quantum wells are transformed by annealing into nanocrystal like quantum dots. These dots, embedded in wide gap semiconductors, exhibit a remarkable small size distribution and act as bright emitters with a substantially higher efficiency than quantum wells of the same material. Even at room temperature infrared emission from these narrow gap semiconductor quantum dots is observed, and the so far longest wavelength emission of any quantum dot laser was achieved.


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