SELF-ORGANIZED InGaAs QUANTUM DOTS FOR ADVANCED APPLICATIONS IN OPTOELECTRONICS

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Abstract

We report on fabrication of quantum dot (QDs) heterostructures for applications in optoelectronics. Different kinds of QDs are used: (i) three-dimensional quantum dots obtained by Stranski-Krastanow or Volmer-Weber growth of three-dimensional QDs in the InAs-GaAs material system, (ii) two-dimensionally-shaped QDs formed by submonolayer insertions in the InAs-GaAs and similar systems, (iii) GaAs clusters formed on corrugated (311)A AlAs surface, (iv) and quantum dots obtained by spinodal decomposition and activated spinodal decomposition in InGaAs-GaAs and InGaAsN-GaAs materials system. Formation of uniform in size and in shape QDs is possible in all approaches and is governed, mostly, by thermodynamics. The application of QDs opens a completely unique flexibility in device engineering. Ultrahigh modal gain can be achieved in ultradense arrays of very small quantum dots in wide gap matrices. 1.3-1.7 μm emission can be achieved using InAs-GaAs QDs. Recent advances in growth made it possible realization of GaAs 1.3 μm CW VCSEL with ~0.7 mW output power and long operation lifetime.