

Abstract

“A method of fabricating a semiconductor structure having quantum wires and a semiconductor device including such structure”

A method for the production of a semiconductor structure having self-organised quantum wires is described. The process includes the formation of multi-atomic steps on a (001) oriented semiconductor substrate inclined at an angle toward the [110] direction. Quantum wires are then spontaneously formed in situ along edges of the multi-atomic steps during epitaxial growth of a semiconductor with a larger or smaller lattice constant than the substrate but with a band gap narrower than that of the underlying material. Further deposition of a layer of semiconductor with a lattice constant within 1% of the substrate but with a band gap wider than that of the wire material then buries the quantum wires between this layer and the substrate layers. These layers are free of defects. Crystal and energy level structures of the quantum wire such as linear density, lateral and vertical dimension, and emission wavelength of photoluminescence can be easily controlled by selecting the angle of inclination of the substrate, lattice mismatch and different combinations of materials. A semiconductor laser with the active layer comprising quantum wires made by this method is also disclosed.

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