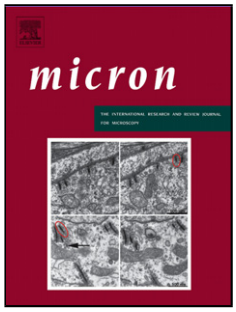

Title: A comparative study of defect formation in GaAs nanocrystals selectively grown on nanopatterned and flat Si(001) substrates

Authors: Roksolana Kozak, Ivan Prieto, Yadira Arroyo Rojas Dasilva, Rolf Erni, Hans von Känel, Gian-Luca Bona, Marta D. Rossell

PII: S0968-4328(18)30195-1
DOI: https://doi.org/10.1016/j.micron.2018.06.018
Reference: JMIC 2579

To appear in: *Micron*

Received date: 23-5-2018
Revised date: 29-6-2018
Accepted date: 30-6-2018

Please cite this article as: Kozak R, Prieto I, Dasilva YAR, Erni R, von Känel H, Bona G-Luca, Rossell MD, A comparative study of defect formation in GaAs nanocrystals selectively grown on nanopatterned and flat Si(001) substrates, *Micron* (2018), https://doi.org/10.1016/j.micron.2018.06.018

A comparative study of defect formation in GaAs nanocrystals selectively grown on nanopatterned and flat Si(001) substrates

Roksolana Kozak[a]*, Ivan Prieto[a,b], Yadira Arroyo Rojas Dasilva[a], Rolf Erni[a], Hans von Känel[a,b], Gian-Luca Bona[c], Marta D. Rossell[a]

[a] *Electron Microscopy Center, Empa - Swiss Federal Laboratories for Materials Science & Technology, Dübendorf, Switzerland*

[b] *Laboratory for Solid State Physics, ETH Zürich, Zürich, Switzerland*

[c] *Empa - Swiss Federal Laboratories for Materials Science & Technology, Dübendorf, Switzerland*

*Corresponding author. Email: roksolana.kozak@empa.ch

Highlights:

- Structural investigation of GaAs crystals grown on two specific nanopatterned Si(001) substrates (namely nanopillars and nanotips) intentionally designed for the monolithic integration of defect-free GaAs.
- Comprehensive characterization of the GaAs/Si interface quality employing a combination of HAADF-STEM, EDX spectroscopy and electron tomography.
- The presence of a high density of planar defects and misfit dislocations in both GaAs/Si heterostructures confirm the plastic strain relaxation of the GaAs crystals.
- Elastically relaxed strained GaAs crystals grown on patterned Si substrates may be achieved by producing atomically flat surfaces and smaller tip openings to ensure substrate compliance.

Abstract

Crystal defects present in GaAs nanocrystals ~15-50 nm in diameter and grown by metal organic vapor phase epitaxy on top of two different nanopatterned Si(001) substrates (nanopillars and nanotips with ~40-80 nm openings embedded in a SiO_2 matrix) and on a planar substrate, have been investigated by