Millisecond-range liquid phase recrystallization for III-V/Si heteronanojunction fabrication

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The downscaling and stressor technology of Si based devices are extending the performance of the silicon channel to its limits. One promising solution for the performance progress which can overcome those limits is the integration of different functional optoelectronic elements within one chip.
We have developed a compact, CMOS compatible and fully integrated solution for the integration of III-V compound semiconductors with silicon technology for optoelectronic applications. The III-V nanostructured semiconductors are synthesized in silicon based matrixes using the combination of ion beam implantation and millisecond flash lamp annealing (FLA) techniques via ***millisecond range liquid phase epitaxy*** [1, 2]. In this paper we will present investigations of the microstructural, optical and electrical properties of InAs and InP nanostructures formed in silicon and on SOI wafers. The growth evolution of the III-V nanostructures during FLA and the influence of the annealing parameters on their crystallographic orientation, shape and size will be explored. Conventional selective etching was used to form the n-III-V/p-Si heterojunction. The current-voltage measurement confirms the heterojunction diode formation between *n-type* III-V quantum dots and *p-type* Si. The main advantage of our method is its integration with large-scale silicon technology, which also allows its application for the fabrication of Si-based optoelectronic devices.

[1] S. Prucnal, et al. NanoLett. **11**, 2814 (2011).
[2] S. Prucnal, et al. Nanotechnology, **23,** 485204 (2012).