Eliminating Misfit Dislocations with In-Situ Compliant Substrate Formation
Tech ID: 32661 / UC Case 2021-889-0

BACKGROUND
Growing AlGaAs- or AlInGaP-based LEDs on GaAs requires lattice-matched conditions, meaning the lattice constant of the device layers must be adjusted to match that of the substrate. If this requirement isn’t met, the result is a lattice mismatch which causes misfit dislocations in the AlGaAs or AlInGaP layers. These dislocations cause poor device performance in key areas such as device lifetime and efficiency. All III-V compound-based devices using a hetero-structure face this obstacle, and overcoming this technological barrier would encourage significant progress in the development of the many devices that employ heterostructures.

DESCRIPTION
Researchers at the University of California, Santa Barbara have minimized or entirely prevented the formation of misfit dislocations at the interface of the heterostructure of III-V compound-based devices — even those grown under large lattice mismatch conditions. Unlike traditional methods of growing GaAs on a Si substrate, GaAs is grown on or above a decomposition stop layer of a thin flexible Si layer, where the GaAs is partially relaxed or free relaxed without the formation of misfit dislocations. Thus, both device lifetime and efficiency are improved drastically, with the opportunity to develop novel devices because the heterostructure is grown under a relatively large lattice mismatch condition. This technology enhances the performance and crystal quality of all III-V and II-VI compound-based devices for applications in automobiles, optical integrated circuits (ICs), power grids, computers, robots, smartphones, displays, and more.

ADVANTAGES
▶ Minimizes or entirely prevents the formation of misfit dislocations
▶ Wider available emission wavelength range
▶ Fabricated with common methods

APPLICATIONS
▶ III-V compound devices
▶ LED
▶ Laser diodes
▶ Electronics

PATENT STATUS
Patent Pending

CATEGORIZED AS
▶ Engineering
▶ Engineering
▶ Other
▶ Robotics and Automation
▶ Optics and Photonics
▶ All Optics and Photonics
▶ Energy
▶ Other
▶ Transportation
▶ Automotive

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