Docket #: S13-466

Laser liftoff of epitaxial thin film structures

Electronic devices made from single crystal thin films attached to inexpensive support substrates offer reduced material costs compared to wafer-based devices; however, scalable and inexpensive processes for producing these single crystal film structures have remained elusive. Stanford researchers have demonstrated a new approach for fabricating these structures that is orders of magnitude faster, and enables more freedom in the selection of other device layers. In this approach, an epitaxial film is grown on a single crystal template and is then separated from its growth surface by laser-driven delamination. It is applicable to all semiconductor electronic and optoelectronic devices, such as solar cells, light emitting diodes (LEDs), and transistors.

Stanford process makes high-performance solar cells cheaper

Stage of Research

- Reduced to practice
- Demonstrated damage-free removal of an epitaxial single crystal GaAs film from its GaAs growth substrate using a laser that is absorbed by a smaller-band-gap, pseudomorphic layer grown between the substrate and the GaAs film. The liftoff process transfers the GaAs film to a flexible polymer substrate, and the transferred GaAs layer is indistinguishable in structural quality from its growth substrate

Applications

- Applicable to all semiconductor, electronic and optoelectronic devices, such as solar cells, light emitting diodes (LEDs), and transistors

Advantages

- Uses lower materials cost, and faster processing times
- Enables the rapid separation of epitaxial III-V materials and devices from a III-V growth substrate
- Allows for reuse of the growth substrate
- Enables more freedom in the selection of other device layers
- GaAs wafers can be on a cost competitive basis with Si and other semiconductors
- Improves upon current practice of selective etching

Publications

- Garrett J. Hayes, Bruce M. Clemens (2014) Laser Liftoff of GaAs Thin Films ArXiv, arXiv:1408.1977.

Patents

- Published Application: WO2015077779
- Issued: 9,698,053 (USA)

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