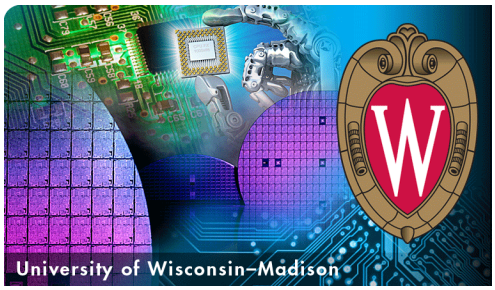

Reusable Virtual Substrates for Growing Semiconductor Devices

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WARF: P130206US01

View U.S. Patent No. 9,064,774 in PDF format.

The Wisconsin Alumni Research Foundation (WARF) is seeking commercial partners interested in developing faster and cheaper methods for making virtual substrates having thick, highly relaxed metamorphic buffer layers.

OVERVIEW

'Virtual substrates' comprise an underlying growth substrate and one or more metamorphic buffer layers (MBLs) made of semiconductor alloy. The MBL is graded so that its lattice constant initially matches the underlying growth substrate, but transitions to a second lattice constant at its surface, where a semiconductor device subsequently will be grown.

In this way, the use of MBLs allows a variety of high-quality semiconductor devices (e.g., quantum cascade lasers) to be grown, even though the devices may be lattice-mismatched to the underlying growth substrate. Ideally, MBLs should have the properties of high strain relaxation and low threading dislocation. Unfortunately, achieving both goals at the same time is difficult.

Different epitaxy processes have been used to grow MBLs with varying degrees of success in mitigating threading dislocation. Still, residual strain remains a problem in these structures.

THE INVENTION

UW–Madison researchers have developed improved virtual substrates using hydride vapor phase epitaxy (HVPE). HVPE is a well-known technique that enables thick layers of semiconductor to be grown in short periods of time.

The virtual substrates comprise several layers. The underlying GaAs substrate has a certain lattice constant. Over this, an MBL is grown via the HVPE process. The MBL is sufficiently thick to avoid warping. It is compositionally graded so that its lattice constant matches the underlying substrate, but transitions to a different lattice constant at its surface where the semiconductor device will be grown.

The MBL surface can be polished and reused to grow multiple semiconductor devices.

THE WARF ADVANTAGE

Since its founding in 1925 as the patenting and licensing organization for the University of Wisconsin-Madison, WARF has been working with business and industry to transform university research into products that benefit society. WARF intellectual property managers and licensing staff members are leaders in the field of university-based technology transfer. They are familiar with the intricacies of patenting, have worked with researchers in relevant disciplines, understand industries and markets, and have negotiated innovative licensing strategies to meet the individual needs of business clients.

APPLICATIONS

- High-speed transistors
- Optical electronics, photodetectors and photodiodes
- Transparent substrates for light-emitting diodes (LEDs) and lasers
- Solar energy technologies

KEY BENEFITS

- HVPE is faster and cheaper than other epitaxial growth methods.
- Thicker layers maximize strain relief and minimize threading dislocation.
- Avoids warping
- Higher growth temperatures reduce work-hardening effects.

ADDITIONAL INFORMATION

Related Technologies

WARF reference number P110156US01 describes a method for growing a quantum cascade laser on metamorphic buffer layers to achieve shorter emission wavelength and increased continuous wave efficiency.

Tech Fields

Semiconductors & Integrated Circuits - Components & materials

CONTACT INFORMATION

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