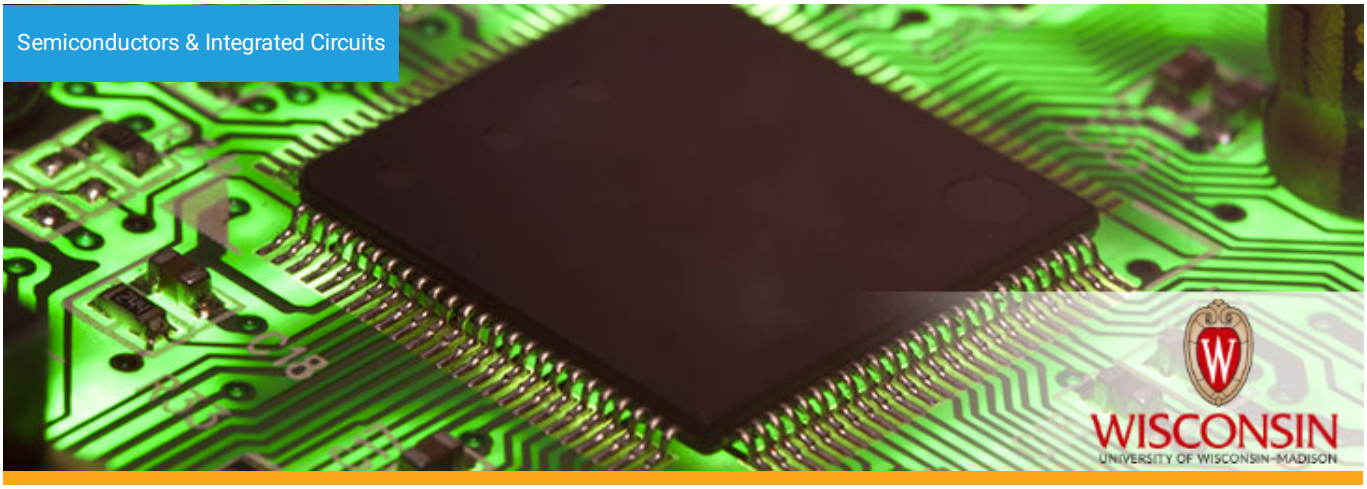

Improved Fabrication of Strained Silicon Multilayer Structures

View U.S. Patent No. 7,229,901 in PDF format.

WARF: P04286US

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The Wisconsin Alumni Research Foundation (WARF) is seeking commercial partners interested in developing a new approach for creating a strained layer of silicon.

Overview

Chips made of strained silicon (Si) have higher electron mobility than chips made of unstrained Si, enabling the fabrication of faster semiconductor devices. Current methods of producing strained Si rely on the creation of a “virtual” substrate through dislocation motion; however, this process leads to rough surfaces and defects in strained Si layers, both of which can adversely affect device performance.

The Invention

UW-Madison researchers have developed a new approach for creating a strained layer of silicon that takes advantage of the commercial availability of silicon-on-insulator (SOI) substrates. A layer of silicon-germanium (SiGe) is grown on an SOI substrate. Because germanium has a larger lattice constant than Si, the SiGe layer is compressively strained as it grows. A layer of unstrained Si is formed on top of the SiGe layer, potentially followed by another compressively strained SiGe layer and another Si layer. Next, the structure is lithographically patterned to open access holes to the buried SOI layer, and the SOI layer is preferentially etched to release the multilayer structure. Release of the multilayer structure partially relaxes the SiGe layer(s) and elastically strains the Si layer(s). The fully released multilayer structure can then be mounted on the flat or curved surface of a selected substrate to form specific devices.

Applications

- Development of improved electronic devices
- Production of defect-free, strained substrates of other semiconductors and materials
- Manufacture of devices composed of adjacent layers of Si and SiGe under different strain states

Key Benefits

- Strained silicon has higher electron mobility than unstrained silicon, enabling the development of faster semiconductor devices.
- Process may be repeated to achieve greater levels of strain in the final film.
- Allows close control of the strain in the grown layers
- Unlike previous methods, does not result in dislocation defects
- Grown films are completely released, allowing the multilayer structures to be mounted on selected substrates.

Additional Information

- Max Lagally

Related Intellectual Property

- View Continuation Patent in PDF format.

Tech Fields

- Semiconductors & Integrated Circuits : Design & fabrication

For current licensing status, please contact Jeanine Burmania at jeanine@warf.org or 608-960-9846