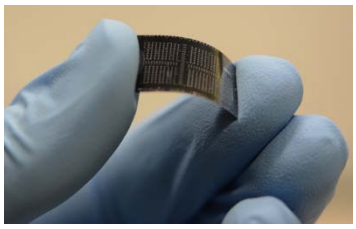
High Mobility Epitaxial Silicon Semiconductor on Flexible Substrate



Summary

A cutting-edge semiconductor device and method that utilizes epitaxially grown silicon on a flexible substrate. This technology improves poor mobility in amorphous silicon flexible semiconductors and allows for fast switching and high current in thin film transistors (TFTs), which are ideal qualities for high performance flexible electronic devices. For this device, a biaxially-textured layer is grown using ion beam assisted deposition (IBAD) on a flexible substrate. Upon the biaxially-textured layer, a germanium layer is grown. A silicon layer is grown on the germanium layer using plasma enhanced chemical vapor deposition (PECVD). The multilayered structure of this semiconductor device allows for the silicon layer to be a single-crystal-like thin film, which contributes to the high performance of this technology.

Competitive Advantages

- Carrier mobility of this technology is 100 times greater than other amorphous silicon flexible devices
- Capable of low carrier concentrations in flexible electronic devices less than 1016 cm^3
- Able to achieve fast-switching and high current for TFTs in high performance flexible electronic devices
- Utilizes roll-to-roll processing, which increases efficiency and lowers the cost of production

Problem Addressed

- Replaces expensive manufacturing processes for low cost, efficient roll-to-roll processing
- Improves the performance of flexible silicon TFTs
- Increases the carrier mobility and performance of flexible silicon semiconductor devices
- Lowers the carrier concentration to controllable levels

Applications

- Sensors
- Photovoltaics
- OLED displays
- Wearable electronics
- Radiation detectors
- Biomedical devices

Patents

- Provisional patent No.: 62/264,417
- Non-provisional patent No.: US2016/065672

Publications

- Selvamanickam, V, et al. (2016) High-Performance Flexible Thin-Film Transistor Based on Single-Crystal-like Silicon Epitaxially Grown on Metal Tape by Roll-to-Roll Continuous Deposition Process. ACS Applied Materials & Interfaces, 8 (43).

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