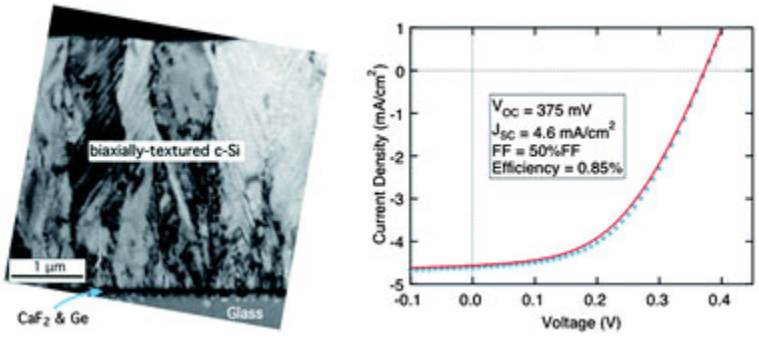
Docket #: S11-027

Highly Oriented Crystalline Silicon Film for Photovoltaic Cells

Stanford researchers have patented a low cost, textured crystalline silicon (c-Si) photovoltaic film fabricated via scalable, ion beam assisted deposition (IBAD) on display glass. Crystalline silicon (c-Si) is a nearly ideal photovoltaic (PV) material, but expensive and energy intensive silicon wafer fabrication makes up nearly half the cost of a typical photovoltaic module. In order to reduce PV cost, the inventors used a template seed layer of calcium fluoride (which has a close lattice match with silicon) to grow biaxially textured heteroepitaxial c-Si on glass, a low cost substrate. This process method controls the grain boundary alignment to improve microelectronic efficiency and performance. IBAD is a well-established, room-temperature technique that is amenable to a variety of substrates and process scaling. This technology could be used to coat large area and long length substrates with high performance c-Si to help achieve low-cost solar cells.



Stage of Research:
The inventors have fabricated a proof-of-concept epitaxial film c-Si solar cell with an open circuit voltage of 375 mV.

Applications

- c-Si film with end user applications in:

    - Photovoltaics
    - Electronic and optoelectronic devices, integrated circuits, optical sensors
    - Magnetic devices
    - Displays

Advantages

- **High performance** photovoltaic material- polycrystalline silicon thin film with highly oriented low-angle boundaries have **reduced dislocation density** and **increased carrier lifetime**
- **Scalable & Versatile** - low temperature process is compatible with a variety of substrates (stainless steel, alloys, plastics and glass) and large area substrates
- **Low fabrication cost** compared to silicon wafer fabrication

Publications

- Groves, James R., Joel B. Li, Bruce M. Clemens, Vincenzo LaSalvia, Falah Hasoon, Howard M. Branz, and Charles W. Teplin. "Biaxially-textured photovoltaic film crystal silicon on ion beam assisted deposition CaF 2 seed layers on glass." *Energy & Environmental Science* 5, no. 5 (2012): 6905-6908.

Patents

- Published Application: 20120288673
- Published Application: 20150197844
- Issued: 9,873,938 (USA)

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