Room Temperature and Solventless Fabrication of Air-Stable and Electronic Passivation of Silicon Surfaces

Technology #15531

Applications

Passivation of silicon surfaces is of key importance in the semiconductor and photovoltaic industries. The chemical and electrical passivation of silicon surfaces are of particular interest for applications including flexible electronics, photovoltaics (PVs), high-density memory storage and (bio)sensors.

Problem Addressed

The surface recombination of minority carriers is one of the major efficiency loss mechanisms in photovoltaics. This high-quality electronic passivation layer reduces the number and cross section of recombination sites on the semiconductor's surface which can increase overall efficiency in applications such as photovoltaics.

Technology

The rate of surface recombination of minority carriers is quantified by the surface recombination velocity. For silicon-based PV applications, a desirable recombination velocity is around 10cm s^{-1}, which corresponds to a surface defect density on the order of 10^{-5}. This technique uses a wet chemical reaction to form an organic molecular passivation layer starting with a chemical etching step of silicon oxide to obtain H-terminated Si surfaces. After chemical etching, the passivation is carried out in a single chemical vapor deposition (CVD) chamber, with the reactants delivered in a gas phase. The resulting passivation layer is stable in air, with about 10% loss in the minority carrier lifetime and the lowest surface recombination velocity is less than 10 cm s^{-1} over 200 hours of air contact.

Advantages

- Simplified reaction scheme
- Inexpensive reactants
- Excellent long-term stability
- Decreases minority carrier combination

Categories For This Invention:

Electronics & Circuits
Semiconductors & Integrated Circuits
Semiconductor Manufacturing
Energy
Solar
Photovoltaics

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Intellectual Property:

Fabrication and passivation of silicon surfaces
Issued US Patent
9,656,294

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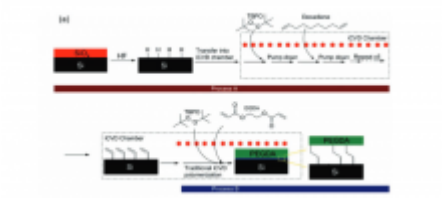
Publications:

Organic Vapor Passivation of Silicon at Room Temperature
Advanced Materials
Volume 25, Issue 14, Pages 2078-2083
A Cooler Way to Protect Silicon Surfaces
MIT News
February 13, 2013

External Links:

Gleason Lab
http://web.mit.edu/gleason-lab/
Photovoltaic Research Lab
http://pv.mit.edu/

Image Gallery:



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