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Improved Transparent Conductive Oxide for Silicon Heterojunction Cells

AzTE Case #M16-121P

Inventors

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Background

Silicon heterojunction (SHJ) technology can provide high solar cell efficiency and low cost in high volume manufacturing. Transparent conductive oxides (TCOs), a component in SHJ cells, can help achieve good conductivity and electrical contact with metals for transferring current. However, optimizing TCO layers in SHJ solar cells requires a tradeoff between losses arising from optical, recombination, and series resistance effects. Therefore, there is a need to design an optimal SHJ configuration that minimizes losses in TCOs and maintains electrical properties.

Invention Description

Researchers at ASU have developed a new method to improve the optical response of SHJ cells by using ITO/SiO_x:H stacks and developed a way to integrate the stacks with Cu plating. The technology comprises a SiO_x:H film on the front of the cell to serve as a second antireflection (AR) coating to allow thinner TCOs that absorb less light. Meanwhile, hydrogen treatment from SiO_x:H from post-deposition annealing maintains the conductivity of the thin TCO. At the rear side of the cell, a thin-ITO/SiO_x:H/Ag film serves as a superior rear mirror compared to conventional films. Overall, the researchers developed a method to reduce optical losses in TCOs without compromising conductivity.

Potential Applications

- Silicon heterojunction solar cells
- Transparent conductive oxides
- Thin-film optoelectronics

Benefits and Advantages

- **Effective –** The method uses front and back side films that give excellent front-side conductivity and superior rear-side reflection, attributing to a high efficiency
- **Innovative –** The design gives a way to incorporate the ITO/SiO_x:H stacks with copper plating and using ITO/SiN_x/SiO_x triple layer AR coatings, leading to improved performance and reduced optical losses

Intellectual Property Status:

Pending

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