Advanced Antireflection Coatings for High-Performance Solar Energy Applications

Integrated technologies significantly increase efficiency

Antireflection coatings are a critical element of high-performance photovoltaic (PV) devices, as they are responsible for coupling light from the cover glass into the top layer of the solar cell. MicroLink Devices, Inc. has explored several techniques to improve antireflection coatings for both triple- and quadruple-junction solar cells to enhance cell efficiency.

In Phase II, MicroLink developed multilayer dielectric antireflection coatings that incorporated lanthanum titanate ($LaTiO_3$) films to achieve significantly improved optical coupling between the cover glass and cell at the ultraviolet and infrared ends of the spectral range of interest. The company also refined a fabrication process to oxidize the aluminum (Al)-containing window layer, reducing light absorption at the short end of the spectral range of interest and providing extra usable photons to the cell. These integrated innovations increase the light coupling between the cover glass and cell, achieving high-performance efficiency in next-generation PV devices containing four or more junctions. These new coatings are expected to increase relative efficiency by at least 7 percent and absolute efficiency by 2.5 percent.

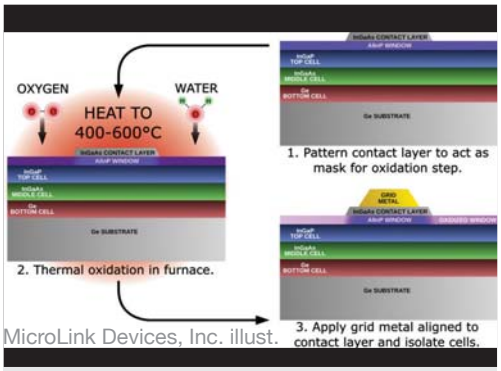
Applications

NASA

- Multijunction germanium (Ge)-based solar cells
- Inverted metamorphic solar cells with more than four junctions
- Next-generation solar cells
- Solar cells in unmanned aerial vehicle (UAV) platforms

Commercial

- Multijunction Ge-based solar cells
- Inverted metamorphic solar cells with more than four junctions
- Next-generation solar cells
- Solar cells in UAV platforms
- Power generation for military field deployments and supplementary mobile devices



MicroLink Devices, Inc. illust.

Phase II Objectives

- Develop and refine antireflection coatings incorporating $LaTiO_3$ as an intermediate refractive index material
- Investigate wet/dry thermal oxidation of Al-containing semiconductor compounds as a means of forming a more transparent window layer with equal or better optical properties than its unoxidized form
- Develop a fabrication process that allows integration of the oxidized window layer and maintains the necessary electrical properties for contacting the solar cell
- Conduct an experimental demonstration of the best candidates for improved antireflection coatings

Benefits

- Enables a new generation of lightweight, high-efficiency solar cells and panels
- Increases the efficiency of solar arrays used in NASA space applications
- Increases the availability of electrical power to satellites
- Improves solar cell performance in UAVs

Firm Contact

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