

SBIR Topic Number:
AF04-029

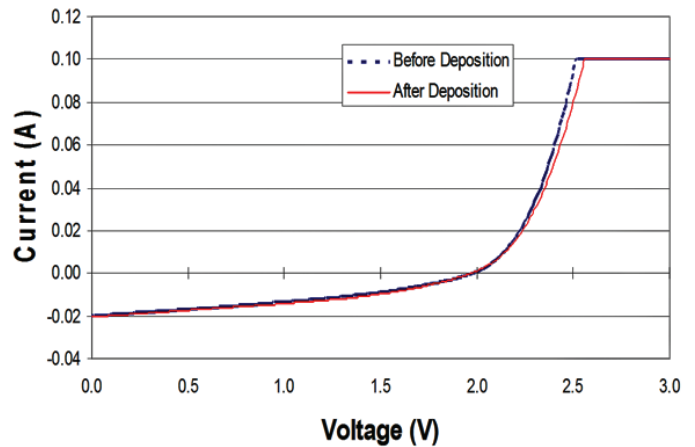
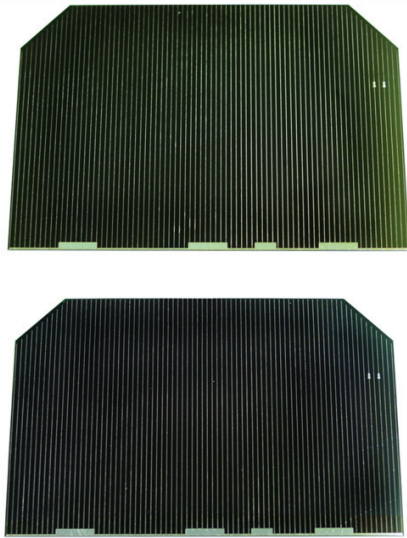
SBIR Title:
Radiation-Resistant,
Solar-Cell Coverglass

Contract Number:
FA9453-05-C-0039

SBIR Company Name:
Blue Wave
Semiconductors, Inc.,
Columbia, MD

Technical Project Office:
AFRL Space Vehicles
Directorate, Kirtland AFB,
NM

This Air Force SBIR/STTR Innovation Story is an example of Air Force supported SBIR/STTR technology that met topic requirements and has outstanding potential for Air Force and DoD.



Left (Top) – Advanced triple junction (ATJ) solar cell before Blue Wave’s radiation-resistant coating; Left (Bottom) – ATJ solar cell after Blue Wave’s radiation-resistant coating. Right – Current-Voltage curves of the solar cell before and after Blue Wave’s radiation-resistant coating.

Radiation-Resistant Optical Coatings for Satellite Solar Arrays

- The Air Force requires high performance, broadband coatings on satellite solar arrays to protect the coverglass and the underlying solar cell in high radiation orbits
- Blue Wave Semiconductors has developed a combinatorial library of radiation-resistant materials and compatible processes for coating on the coverglass, as well as directly on the solar cell
- This technology can reduce darkening of solar cell coverglasses, thus potentially lengthening the lifetime of the solar cell, allowing for longer space missions
- Being optically transparent, this technology can also be applied to space-based optics, windows, and optoelectronic components

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Air Force Requirement

The End-of-Life (EOL), power-generation performance of satellite solar arrays suffers due to radiation-induced darkening of coverglass materials. The Air Force requires high performance, broadband coatings that protect the coverglass and the underlying solar cell in high radiation orbits.

The Air Force requires that these new materials maintain a high degree of spectral broadband transmissivity, withstand intense ultraviolet (UV) exposure, have high thermal emissivity, and have a matchable index of refraction.

SBIR Technology

Blue Wave Semiconductors, Inc., has developed a combinatorial library of radiation-resistant materials for coating on coverglass, as well as directly on solar cells, particularly advanced triple junction (ATJ) solar cells based on InGaP/GaAs/Ge. Blue Wave studied the radiation resistance of advanced coating materials in addition to optical, structural, mechanical, and electrical properties.

Taking a combinatorial approach to the problem, Blue Wave was able to study these properties for materials of various compositions and the coating process compatibility with coverglass and ATJ solar cell structures. The result is compositionally tuned bandgap materials, which allows the customer to optimize mechanically robust coatings with desirable optical, electrical, and radiation resistance (1 MeV electron irradiation and UV exposure) properties on the coverglass and on the advanced high quantum efficiency (QE >30%) triple junction solar cell.

Potential Air Force Application

Blue Wave's technology has been proven to reduce the radiation-induced darkening in solar cell coverglass. The potential impact that this technology would have is lengthening the lifetime of the solar cell without making many changes to the current technology. This cost effective coating would allow satellites to be operational longer and allow for longer space missions.

Beyond solar cell applications, Blue Wave's radiation-resistant coating can be applied to other components. Being optically transparent, this technology can be applied to space-based optics and windows.

Company Impact

Dr. R. D. Vispute, CEO/CTO, Blue Wave, states, "The SBIR program has been very beneficial to Blue Wave as it allowed us to establish a solid foundation for technology development of advanced coating materials and processes. The opportunity has permitted us to extend our facility's capabilities to do high quality materials research which, in turn, has allowed us to develop a library of materials for various applications. We now work with a variety of corporate partners to provide material coatings for the space electronics industry and high voltage capacitor materials for the energy storage industry. In addition, this SBIR opportunity has allowed Blue Wave to obtain a U.S. patent for depositing transparent and radiation-hard coatings and films for electronics applications."

Blue Wave Semiconductors is a diversified technology and manufacturing company, which provides leading edge semiconductor solutions to its customers worldwide. Blue Wave is primarily focused on developing processing tools, deposition systems, and thin films and coating materials for microelectronics and nanoelectronics. It specializes in reliable wafer-heating systems, as well as turn-key solutions for Physical Vapor Deposition (PVD), Electron Beam Evaporation (EBE), and Hot-Filament Chemical Vapor Deposition (HFCVD) systems. In addition, Blue Wave provides electronic and optical device solutions to the R&D community and microelectronic industry.



SBIR/STTR

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