Air Force SBIR/STTR

Innovation

Air Force SBIR/STTR Innovation Story

SBIR Topic Number:
AF06-274

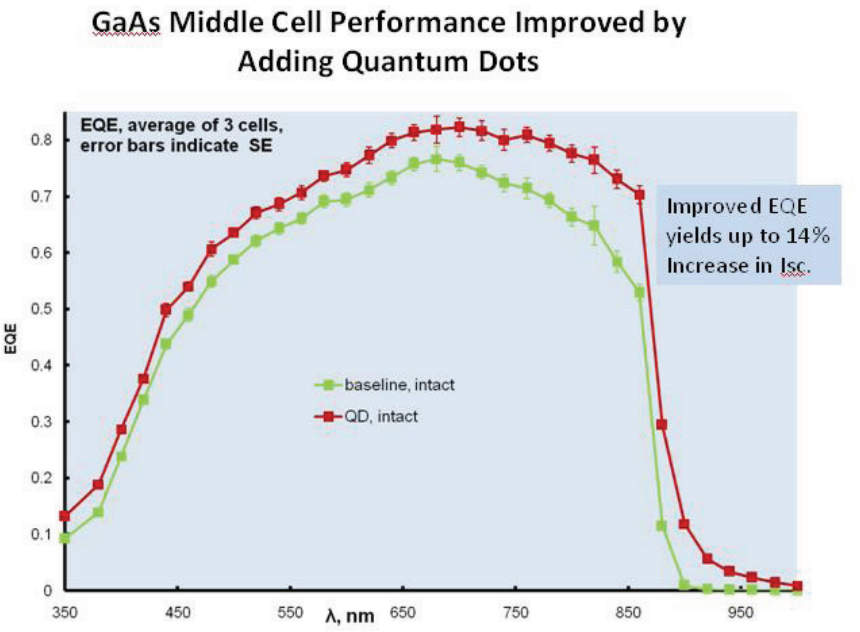
SBIR Title:
Next Generation Solar Cells Based on Nanostructures

Contract Number:
FA9453-07-C-0054

SBIR Company Name:
NewCyte, Inc., Oberlin, OH.

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.



Ultra-High Efficiency Multijunction Solar Cells Using Quantum Dots

- The Air Force needs higher efficiency solar cells to reduce solar array mass, stowed volume, and cost for its space missions
- NewCyte has improved both the beginning of life (BOL) and end of life (EOL) performance of the gallium arsenide (GaAs) middle cell, which is the weak link in terms of BOL efficiency and radiation resistance
- NewCyte has been able to determine the number of layers of indium gallium arsenide (InGaAs) quantum dots, their size, and the location of the aggregate of layers within the base region of the cell that optimize both efficiency and radiation damage resistance
- A gain of 15% in output power can be expected at the end of a typical 15-year geostationary orbit (GEO) mission with essentially little or no increase in cell cost and no change at all in array design or mechanical performance

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Air Force Requirement

Higher efficiency solar cells are needed to reduce solar array mass, stowed volume, and cost for Air Force space missions. Conventional crystalline multijunction solar cells are currently limited in efficiency by the complexity of adding more junctions to increase absorption of the solar spectrum, and the necessity to match lattice parameter and current for each junction.

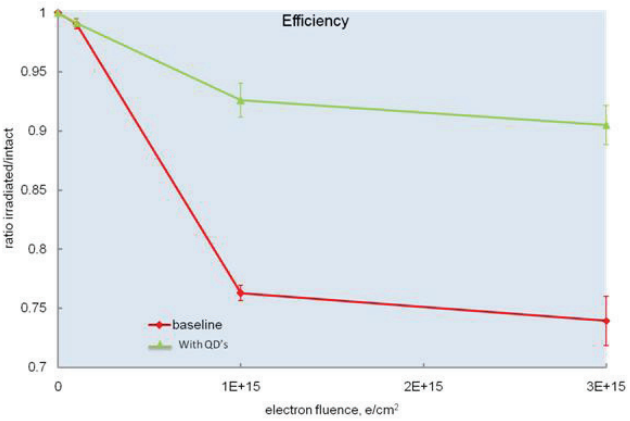
This SBIR topic focuses on the development of very high-efficiency, next-generation solar cells based on the utilization of nanostructures.

SBIR Technology

Triple junction solar cells (TJC) for space satellites are in critical need of improved end of life (EOL) performance, particularly for missions in which the solar array is exposed to electron and proton radiation damage.

There are two ways to gain an EOL performance improvement: increased initial efficiency and greater resistance to radiation damage. The gallium arsenide (GaAs) middle cell of the TJC stack is the weak link in the cell both in terms of initial (beginning of Life, or BOL) efficiency and radiation resistance.

GaAs Middle Cell Radiation Resistance (1MeV electrons) Improved by Adding Quantum Dots



NewCyte has improved both the BOL and the EOL performance of the GaAs middle cell. These gains will translate directly into improved TJC EOL performance.

BOL efficiency and radiation damage resistance of GaAs solar cells for space application have been improved by the incorporation of indium gallium arsenide (InGaAs) quantum dots in the base region of the cell. NewCyte has been able to determine the number of layers of quantum dots, their size, and the location of the aggregate of layers within the base region of the cell that optimize both efficiency and radiation damage resistance.

Potential Air Force Application

Improved BOL and EOL performance for space triple junction solar cells will immediately enable enhanced Air Force missions.

A gain of 15% in output power can be expected at the end of a typical 15-year geostationary orbit (GEO) mission with essentially little or no increase in cell cost and no change at all in array design or mechanical performance.

Company Impact

"The Phase II contract that enabled this very significant gain in capability for military space systems will also translate to vastly increased sales opportunities for terrestrial applications of concentrator solar power systems," states Dr. Dennis Flood, Executive Vice President of NewCyte. "The company plans to license this new technology for space solar cells to existing producers to accelerate its entry into the space power market."

U.S. AIR FORCE

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