38% Efficient Low-Cost Six-Junction GaAs/InP Solar Cells Using Double Epitaxial Lift-Off, Phase I Project

SBIR/STTR Programs | Space Technology Mission Directorate (STMD)

ABSTRACT

Double epitaxial lift-off (D-ELO) in conjunction with semiconductor bonding will be leveraged to produce 38% efficient six-junction solar cells. These solar cells will enable optimal performance for future NASA missions that require solar cells with high specific power, high power conversion efficiency, and lower cost than the incumbent solar cell technology. High efficiency is enabled by the use of six AM0 spectrum-matched subcell junctions. A reduction in mass compared to incumbent technology is enabled by removal of the thick semiconductor substrates while a cost savings compared to incumbent technology is enabled by the recovery and subsequent reuse of the expensive semiconductor substrates via the D-ELO process.

ANTICIPATED BENEFITS

To NASA funded missions:

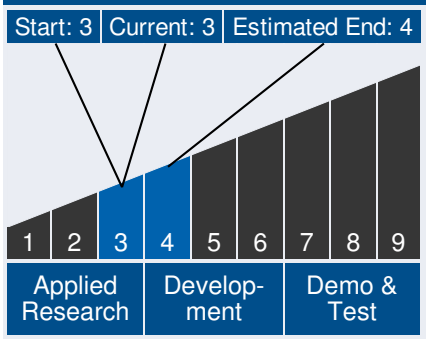
Potential NASA Commercial Applications: Thin, flexible, high efficiency ELO solar cells are attractive for next-generation spacecraft power and SEP systems. Arrays based on the proposed solar cells will be suitable for NASA missions ranging from near-Earth to deep space. Lockheed Martin, Space Systems Loral, and Boeing have shown great interest in MicroLink?s work and in future applications of low mass, flexible photovoltaic module technologies that can support NASA?s SEP program as a replacement for the solar cells in existing spacecraft.

To the commercial space industry:

Potential Non-NASA Commercial Applications: Customers in the aerospace industry share NASA?s desire for cost-effective spacecraft systems and components. MicroLink is a manufacturing organization with the goal of commercializing the technologies it develops through R/R&D programs. To that end, MicroLink has engaged in discussions with several manufacturers of commercial satellites which have taken particular interest in MicroLink's ELO technology for the potential

Table of Contents

Technology Maturity



Management Team

Program Executives:

- Joseph Grant
- Laguduva Kubendran

Program Manager:

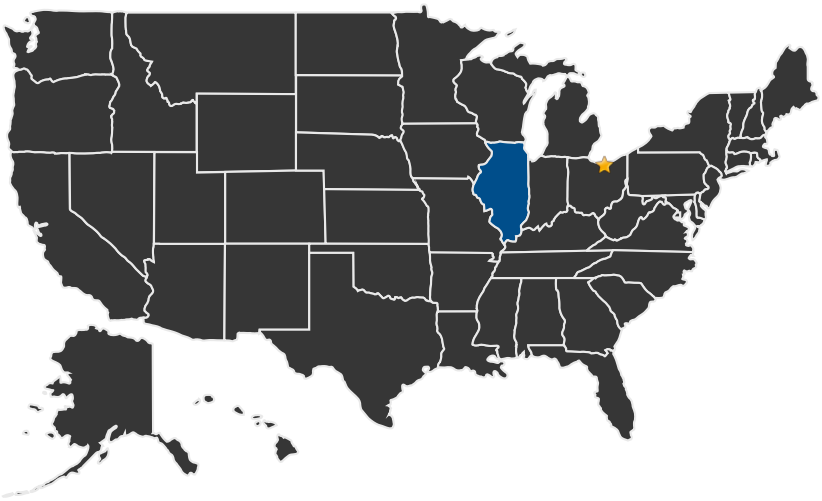
- Carlos Torrez

Continued on following page.

38% Efficient Low-Cost Six-Junction GaAs/InP Solar Cells Using Double Epitaxial Lift-Off, Phase I Project

of reducing the cost of space solar cells while improving the efficiency compared to commercially available Ge-based solar cells. The low mass and high specific power of such photovoltaic modules with a durable polymer film replacing the traditional rigid coverglass also make them excellent for powering unmanned aerial vehicles (UAVs). Finally, attractive military and civilian applications involving mobile solar electric power are derived from the ability to recharge batteries in remote locations.

U.S. WORK LOCATIONS AND KEY PARTNERS



U.S. States With Work

Lead Center:
Glenn Research Center

Other Organizations Performing Work:

- MicroLink Devices, Inc. (Niles, IL)

PROJECT LIBRARY

Presentations

- Briefing Chart
  - (http://techport.nasa.gov:80/file/23542)

Management Team *(cont.)*

Principal Investigator:

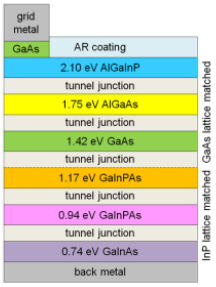
- Alex Kirk

Technology Areas

Primary Technology Area:
Space Power and Energy Storage (TA 3)
└ Power Generation (TA 3.1)
  └ Solar (TA 3.1.3)

38% Efficient Low-Cost Six-Junction GaAs/InP Solar Cells Using Double Epitaxial Lift-Off, Phase I Project

IMAGE GALLERY



38% Efficient Low-Cost Six-Junction GaAs/InP Solar Cells Using Double Epitaxial Lift-Off, Phase I

DETAILS FOR TECHNOLOGY 1

Technology Title

38% Efficient Low-Cost Six-Junction GaAs/InP Solar Cells Using Double Epitaxial Lift-Off, Phase I

Potential Applications

Thin, flexible, high efficiency ELO solar cells are attractive for next-generation spacecraft power and SEP systems. Arrays based on the proposed solar cells will be suitable for NASA missions ranging from near-Earth to deep space. Lockheed Martin, Space Systems Loral, and Boeing have shown great interest in MicroLink?s work and in future applications of low mass, flexible photovoltaic module technologies that can support NASA?s SEP program as a replacement for the solar cells in existing spacecraft.