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PMC-EF2a

(20102)

**U.S. DEPARTMENT OF ENERGY
EERE PROJECT MANAGEMENT CENTER
NEPA DETERMINATION**



RECIPIENT: Microlink Devices

STATE: IL

PROJECT TITLE : High Efficiency, Low-Cost, Multijunction Solar Cells Based on Epitaxial Liftoff and Wafer Bonding; NREL Tracking No. 09-041

Funding Opportunity Announcement Number	Procurement Instrument Number	NEPA Control Number	CID Number
		GO-09-041	GO10337

Based on my review of the information concerning the proposed action, as NEPA Compliance Officer (authorized under DOE Order 451.1A), I have made the following determination:

CX, EA, EIS APPENDIX AND NUMBER:

Description:

B3.6 Siting, construction (or modification), operation, and decommissioning of facilities for indoor bench-scale research projects and conventional laboratory operations (for example, preparation of chemical standards and sample analysis); small-scale research and development projects; and small-scale pilot projects (generally less than two years) conducted to verify a concept before demonstration actions. Construction (or modification) will be within or contiguous to an already developed area (where active utilities and currently used roads are readily accessible).

Rational for determination:

This proposed project is a contract with Microlink Devices (Microlink) to develop and design the fabrication of thin-film materials and photovoltaic devices that would accelerate commercialization and cost effective manufacturing. Microlink would for one year demonstrate the feasibility to accelerate the development of photovoltaic (PV) module technology. The location of the laboratory work would be at Microlink located at 6457 West Howard Street, Niles, Illinois 60714 and University of California, Boelter Hall, 405 Hillgard Avenue, Los Angeles, California 90095. The project would be divided into seven tasks:

Task 1 - Hardware Baseline

Microlink would deliver dual junction InGaP/GaAs epitaxial liftoff (ELO) cells and InP single junction ELO cells. Specifically, three 0.5 x 0.5 cm² single-junction InP ELO solar cells with efficiency >10% under AM1.5D 1-sun illumination conditions. Both the GaAs and InP based ELO cells would be delivered on full 4-inch wafers.

Task 2 – Cell Design Development

Microlink would develop a design for a triple junction wafer-bonded cell that would maximize the efficiency of the cell for AM1.5D illumination at 300x concentration.

Task 3 – Chemical Mechanical Polishing

The chemical mechanical polishing of ELO and non-ELO (before lift-off) of InP surfaces and GaAs surfaces would be investigated with various chemicals such as sodium hypochlorite and citric acid solutions. The optimal composition of the slurry would be investigated for III-V materials. A balance between reduced sub-surface mechanical damage and smooth surface morphology is the target of the study. Verification would consist of AFM measurement at 5 points across the wafer.

Task 4 – Wafer Bonding

Microlink would develop a low-temperature wafer-bonding process to bond 2-inch wafers of InP- and GaAs-based solar cells. The electrical and structural properties of the interface would be used to measure the quality of the interface. Efficiency improvements would be achieved through minimizing the defects at the interface.

Task 5 – Analysis of Bonded Wafers

Microlink would perform optical and electrical analysis of the bonded cells to gain detailed information about the nature of species at the bonded interface. The analysis would be performed on several wafer bonded cells. The analysis would comprise at least X-ray, PL, IR, XRT and C-V measurements.

Task 6 – Reliability of Wafer Bonded Cells

Microlink would perform preliminary reliability measurements of the wafer bonded interfaces by employing thermal

cycling tests and high temperature operation tests of the fabricated solar cells. The tests would consist of 200 cycles between -25 °C and +40 °C, and 500 hours exposure to 80 °C. The effect of thermal cycling on the integrity of the bonded interface would be studied using IR Transmission microscopy. Efficiency of the cells would also be monitored before and after thermal cycling. A triple junction wafer-bonded ELO cells with minimum efficiency of 25% under AM1.5D 1-sun conditions would be used.

Task 7 – Prototype Fabrication

Microlink would fabricate a prototype receiver for concentrator applications using wafer-bonded InGaP/GaAs-on-GaAs/InGaAs-on-InP triple-junction solar cells. Characterization would be performed in a flash tester at 300 suns. Three prototype receivers (metalized ceramic substrates of 1 inch x1 inch) containing InGaP/GaAs-on-GaAs/InGaAs-on-InP wafer-bonded ELO solar cells of area 0.5 x 0.5 cm². The receivers would be capable of operating at intensities of at least 300 suns, fill factors >60%. Wafer bonded ELO cells with efficiencies >25% @ AM1.5D under 1 sun would be used for testing.

Microlink indicates that no new permits are needed for the proposal; no generation of air emissions; hazardous waste would be disposed of properly in accordance to local, state, and federal laws as appropriate contractors PSC or WasteXpress.

This proposal comprises of laboratory operations and actions to promote the research and development of more efficient solar technologies; therefore this project is categorized as Categorical Exclusions B3.6.

NEPA PROVISION

DOE has made a final NEPA determination for this award

Insert the following language in the award:

Note to Specialist :

none

SIGNATURE OF THIS MEMORANDUM CONSTITUTES A RECORD OF THIS DECISION.

NEPA Compliance Officer Signature: _____

NEPA Compliance Officer

Date: _____

12/28/09

FIELD OFFICE MANAGER DETERMINATION

Field Office Manager review required

NCO REQUESTS THE FIELD OFFICE MANAGER REVIEW FOR THE FOLLOWING REASON:

- Proposed action fits within a categorical exclusion but involves a high profile or controversial issue that warrants Field Office Manager's attention.
- Proposed action falls within an EA or EIS category and therefore requires Field Office Manager's review and determination.

BASED ON MY REVIEW I CONCUR WITH THE DETERMINATION OF THE NCO :

Field Office Manager's Signature: _____

Field Office Manager

Date: _____