U.S. Department of Energy
Categorical Exclusion Determination Form

Submit by E-mail

Proposed Action Title: University of Michigan - Benchtop Growth of High Quality III-V Thin Film Photovoltaics through Electrochemical Liquid Phase Epitaxy (ec-LPE)

Program or Field Office: Advanced Research Projects Agency - Energy

Location(s) (City/County/State): Ann Arbor, MI

Proposed Action Description:
The University of Michigan (Michigan) proposes to conduct laboratory based, small-scale, research and development activities to demonstrate a new process for growing epitaxial crystalline III-V semiconductor thin films (electrochemical liquid phase epitaxy (ec-LPE)) as a means of lowering the production cost of solar-grade thin films for photovoltaics.

All project activities will take place at Michigan's laboratory facilities in Ann Arbor, MI.

Categorical Exclusion(s) Applied:

B3.6 - Small-scale research and development, laboratory operations, and pilot projects

For the complete DOE National Environmental Policy Act regulations regarding categorical exclusions, including the full text of each categorical exclusion, see Subpart D of 10 CFR Part 1021.

Regulatory Requirements in 10 CFR 1021.410(b): (See full text in regulation)

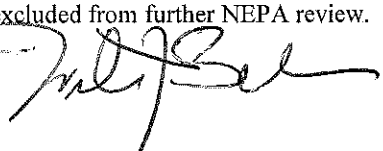
☑ The proposal fits within a class of actions that is listed in Appendix A or B to 10 CFR Part 1021, Subpart D.

To fit within the classes of actions listed in 10 CFR Part 1021, Subpart D, Appendix B, a proposal must be one that would not: (1) threaten a violation of applicable statutory, regulatory, or permit requirements for environment, safety, and health, or similar requirements of DOE or Executive Orders; (2) require siting and construction or major expansion of waste storage, disposal, recovery, or treatment facilities (including incinerators), but the proposal may include categorically excluded waste storage, disposal, recovery, or treatment actions or facilities; (3) disturb hazardous substances, pollutants, contaminants, or CERCLA-excluded petroleum and natural gas products that preexist in the environment such that there would be uncontrolled or unpermitted releases; (4) have the potential to cause significant impacts on environmentally sensitive resources, including, but not limited to, those listed in paragraph B(4) of 10 CFR Part 1021, Subpart D, Appendix B; (5) involve genetically engineered organisms, synthetic biology, governmentally designated noxious weeds, or invasive species, unless the proposed activity would be contained or confined in a manner designed and operated to prevent unauthorized release into the environment and conducted in accordance with applicable requirements, such as those listed in paragraph B(5) of 10 CFR Part 1021, Subpart D, Appendix B.

☑ There are no extraordinary circumstances related to the proposal that may affect the significance of the environmental effects of the proposal.

☑ The proposal has not been segmented to meet the definition of a categorical exclusion. This proposal is not connected to other actions with potentially significant impacts (40 CFR 1508.25(a)(1)), is not related to other actions with individually insignificant but cumulatively significant impacts (40 CFR 1508.27(b)(7)), and is not precluded by 40 CFR 1506.1 or 10 CFR 1021.211 concerning limitations on actions during preparation of an environmental impact statement.

Based on my review of the proposed action, as NEPA Compliance Officer (as authorized under DOE Order 451.1B), I have determined that the proposed action fits within the specified class(es) of action, the other regulatory requirements set forth above are met, and the proposed action is hereby categorically excluded from further NEPA review.

NEPA Compliance Officer: 

Date Determined: 12/12/2014

PROJECT ENVIRONMENTAL REVIEW
MEMORANDUM TO THE RECORD

Lead Organization: University of Michigan

Project Title: Benchtop Growth of High Quality III-V Thin Film Photovoltaics through Electrochemical Liquid Phase Epitaxy (ec-LPE)

Date: December 12, 2014

Approved:
William J. Bierbower
ARPA-E NEPA Compliance Officer

Concurred:
Dr. Jason Rugolo
ARPA-E Program Director

INSTRUCTIONS: Please complete Sections I - V of this memorandum form. Please complete all relevant fields. Where a particular field is irrelevant to the project under review, please indicate "N/A" in the field.

SECTION I. PROJECT INFORMATION

Funding Opportunity Announcement (if any): DE-FOA-0001002: Innovative Development in Energy-Related Applied Science (IDEAS)

Lead Organization: University of Michigan (Michigan)

Other Participants (Subrecipients, Contractors, etc.): N/A

Locations of Work (City, State): Ann Arbor, MI

SECTION II. NEPA ANALYSIS

A. CATEGORICAL EXCLUSION(S) APPLIED

The activities to be conducted under this project fit within the class(es) of actions listed in Categorical Exclusion(s) B3.6 (Small-scale research and development, laboratory operations, and pilot projects). Categorical Exclusion(s) cover(s):

> **B3.6**: Siting, construction, modification, operation, and decommissioning of facilities for small-scale research and development projects; conventional laboratory operations (such as preparation of chemical standards and sample analysis); and small-scale pilot projects (generally less than 2 years) frequently conducted to verify a concept before demonstration actions, provided that construction or modification would be within or contiguous to a previously disturbed or developed area (where active utilities and currently used roads are readily accessible). Not included in this category are demonstration actions, meaning actions that are undertaken at a scale to show whether a technology would be viable on a larger scale and suitable for commercial deployment.

The proposed activities satisfy the elements and requirements of Categorical Exclusion(s).

Michigan proposes to conduct laboratory based, small-scale, research and development activities to demonstrate a new process for growing epitaxial crystalline III-V semiconductor thin films (electrochemical liquid phase epitaxy (ec-LPE)) as a means of lowering the production cost of solar-grade thin films for photovoltaics. Specifically, the Michigan will: (1) research and determine the appropriate thickness for liquid metal film in ec-LPE; (2) assess and select the optimal electrolyte based upon cell material compatibility and temperature range for ec-LPE; and (3) design, develop, and optimize an ec-LPE test cell to demonstrate proof-of-concept.

No modifications will be made to existing facilities to accommodate the proposed work.

B. EXTRAORDINARY CIRCUMSTANCES ANALYSIS (All Categorical Exclusions)

The proposed project will involve the following:

a. Use, handling, storage, transport, or disposal of radioactive, toxic, or hazardous chemicals or materials

☒ Yes ☐ No

b. Use, handling, storage, transport, or disposal of genetically engineered organisms recombinant DNA.

☐ Yes ☒ No

c. Use, handling, storage, transport, or disposal of nanoscale materials

☐ Yes ☒ No

d. Use, handling, storage, transport, or disposal of solid wastes ☒ Yes ☐ No

e. Emissions into the ambient air ☒ Yes ☐ No

f. Release of pollutants/contaminants into water resources ☐ Yes ☒ No

g. Substantial noise pollution ☐ Yes ☒ No

h. Adverse community-based environmental impacts ☐ Yes ☒ No

Comments: Project work will involve the use of hazardous materials such as gallium and aqueous solutions containing dissolved arsenic trioxide. All project work will take place in a laboratory setting and will be performed in accordance with University EH&S Department procedures. Hazardous materials will be stored, collected, and disposed of by the University EH&S Department and in accordance with university permits for hazardous waste disposal. Michigan will train all laboratory employees and students in proper handling of potentially hazardous chemicals and materials. Typical non-hazardous laboratory and office solid wastes (e.g., gloves, paper) may be generated over the course of the project and disposed of in accordance with applicable federal, state, and local requirements. Project work may result in de minimis emissions of evaporated solutions containing dissolved arsenic trioxide into the ambient air. Emissions will be mitigated through the use of laboratory fume hoods; and will be in compliance with existing university permits.

C. INTEGRAL ELEMENTS ANALYSIS (Appendix B Categorical Exclusions Only)

The proposed project will:

a. Threaten a violation of applicable statutory, regulatory, or permit requirements for environment, safety, and health or similar requirements of DOE or Executive Orders.

☐ Yes ☒ No

b. Require siting/construction or major expansion of waste storage, disposal, recovery, or treatment facilities.

☐ Yes ☒ No

c. Disturb hazardous substances, pollutants, contaminants, or petroleum/natural gas products that preexisted in the environment, resulting in an uncontrolled/unpermitted release.

☐ Yes ☒ No

d. Have potential to cause significant impacts on environmentally sensitive resources.

☐ Yes ☒ No

e. For projects involving genetically engineered (GE) organisms, synthetic biology, governmentally designated noxious weeds, or invasive species:

i. Such organisms will be contained and confined in a manner designed and operated to prevent unauthorized release into the environment.

☒ N/A ☐ Yes ☐ No

ii. Activities involving recombinant DNA will be conducted in accordance with NIH Guidelines for Research Involving Recombinant DNA Molecules

☒ N/A ☐ Yes ☐ No

iii. Activities involving GE organisms with pesticidal qualities will be conducted in accordance with the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) (7 U.S.C. § 136 et seq.) and EPA's FIFRA Implementing Regulations (40 C.F.R. Parts 150-189).

☒ N/A ☐ Yes ☐ No

iv. Activities involving GE organisms that may pose a risk to plant/animal health will be conducted in accordance with the APHIS Regulations (7 C.F.R. Part 340).

☒ N/A ☐ Yes ☐ No

v. Activities involving new GE organisms will be conducted in accordance with the Toxic Substances Control Act (TSCA) (15 U.S.C. § 2601 et seq.) and EPA's TSCA Implementing Regulations (7 C.F.R. Parts 700-790).

☒ N/A ☐ Yes ☐ No

Comments:

SECTION III. ADDITIONAL COMMENTS/ANALYSIS

SECTION IV. RECOMMENDATION FOR CONDITION ON AWARD

☐ It is recommended that the following condition be included in the award:

☒ No NEPA-related condition need be included in the award.

SECTION V. RECOMMENDATION FOR CATEGORICAL EXCLUSION

The activities to be conducted under this project fit within the class of activities identified under the Department of Energy Categorical Exclusion(s) identified above.

The review has not identified any extraordinary circumstances related to the specific project that may affect the significance of the environmental effects of the project.

It is recommended that no further review under NEPA is required; however, any changes to the project may require further review.

Please find attached the selectee's completed and signed NEPA Questionnaire.