U.S. Department of Energy
Categorical Exclusion Determination Form

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Proposed Action Title: Power Nitride Doping Innovation Offers Devices Enabling SWITCHES (PNDIODES) Program (FOA No. DE-FOA-0001691)

Program or Field Office: Advanced Research Projects Agency - Energy (ARPA-E)

Location(s) (City/County/State): AZ, CA, CT, IL, MD, MO, NC, NM, NY, PA

Proposed Action Description:

The PNDIODES program seeks to develop transformational advances in the process of "selective area doping" (adding a specific impurity to a semiconductor to change its electrical properties) using wide-bandgap (WBG) semiconductors, gallium nitride (GaN), and its alloys. The doping process will enable high-power vertical GaN power electronic devices used in consumer electronics, power supplies, automotive, ship propulsion, and aerospace. The PNDIODES Program is composed of 7 small-scale research and development projects conducted by universities, non-profit entities, for-profit entities, and federal laboratories. If successful, the developed doping technologies will address the major obstacle experienced by most of the teams in the ARPA-E SWITCHES program (producing sufficiently high-quality and reliable doped regions in GaN and its alloys to create viable high-power, high-performance transistors) and allow for arbitrarily placed doped regions with low leakage currents (<1e-9 A), a significant improvement over the state-of-the-art.

All of the PNDIODES projects (listed in Attachment A) are covered by this Determination and fit within the class of actions identified under the DOE Categorical Exclusions identified below and do not involve any extraordinary circumstances that may affect the significance of the environmental effects of the projects. This assessment was based on a review of the proposed scope of work and the potential environmental impacts of each project. Project tasks for all of the projects under the PNDIODES Program will be conducted in accordance with established safety and materials/waste management protocols and pursuant to applicable Federal, State, and Local regulatory requirements.

Categorical Exclusion(s) Applied:

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

B3.15 - Small-scale indoor research and development projects using nanoscale materials

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)

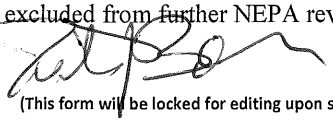
☑ The proposal fits within a class of actions that is listed in Appendix A or B to 10 CFR Part 1021, Subpart D.

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: 

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Date Determined: 8/25/17

Attachment A: Projects in the PNDIODES Program (FOA No. DE-FOA-0001691)

Prime Recipient	Project Title	Categorical Exclusion
Arizona State University	Effective Selective Area Doping for GaN Vertical Power Transistors Enabled by Innovative Materials Engineering	B3.6; B3.15
Sandia National Laboratories	High Voltage Re-grown GaN P-N Diodes Enabled by Defect and Doping Control	B3.6
JR2J, LLC	Laser Spike Anneal Technology for the Activation of Implanted Dopants in Gallium Nitride	B3.6
Yale University	Regrowth and Selective Area Growth of GaN for Vertical Power Electronics	B3.6
The Research Foundation for State University of New York, on behalf of SUNY Polytechnic Institute	Demonstration of PN-junctions by Implant and Growth techniques for GaN	B3.6
Adroit Materials, Inc.	Selective Area Doping for Nitride Power Devices	B3.6; B3.15
University of Missouri: Columbia	High quality GaN FETs through transmutation doping and low temperature processing	B3.6