Defense Microelectronics Activity (DMEA)
24.4 Small Business Innovation Research (SBIR) Open Topic
Proposal Submission Instructions
Release 1

July 16, 2024: Topics issued for pre-release
August 13, 2024: DMEA begins accepting proposals via DSIP
August 27, 2024: DSIP Topic Q&A closes to new questions at 12:00 p.m. ET
September 10 , 2024: Deadline for receipt of proposals no later than 12:00 p.m. ET

INTRODUCTION

The Defense Microelectronics Activity (DMEA) SBIR/STTR Program is implemented, administrated, and managed by the DMEA Office of Small Business Programs (OSBP). Proposers responding to a topic in this BAA must follow all general instructions provided in the Department of Defense (DoD) SBIR Program BAA. DMEA requirements in addition to or deviating from the DoD Program BAA are provided in the instructions below.

Proposers are encouraged to thoroughly review the DoD Program BAA and register for the DSIP Listserv to remain apprised of important programmatic and contractual changes.

- Full component-specific instructions and topic descriptions are available on DSIP at https://www.dodsbirsttr.mil/submissions/solicitation-documents/active-solicitations. Be sure to select the tab for the appropriate BAA cycle.
- Register for the DSIP Listserv at: https://www.dodsbirsttr.mil/submissions/login.

Specific questions pertaining to the administration of the DMEA SBIR/STTR Program and these proposal preparation instructions should be directed to DMEA Acting SBIR/STTR Program Manager (PM), Mr. Tien Dang, at osd.mcclellan-park.dmea.list.sbir-sttr1@mail.mil.

This release contains an open topic. As outlined in section 7 of the SBIR and STTR Extension Act of 2022, innovation open topic activities—

(A) Increase the transition of commercial technology to the Department of Defense;
(B) Expand the small business nontraditional industrial base;
(C) Increase commercialization derived from investments of the Department of Defense; and
(D) Expand the ability for qualifying small business concerns to propose technology solutions to meet the needs of the Department of Defense.

Unlike conventional topics, which specify the desired technical objective and output, open topics can use generalized mission requirements or specific technology areas to adapt commercial products or solutions to close capability gaps, improve performance, or provide technological advancements in existing capabilities.

A small business concern may only submit one (1) proposal to each open topic. If more than one proposal from a small business concern is received for a single open topic, only the most recent proposal to be certified and submitted prior to the submission deadline will receive an evaluation. All prior proposals submitted by the small business concern for the same open topic will be marked as nonresponsive and will not receive an evaluation.

PHASE I PROPOSAL GUIDELINES

The Defense SBIR/STTR Innovation Portal (DSIP) is the official portal for DoD SBIR/STTR proposal submission. Proposers are required to submit proposals via DSIP; proposals submitted by any other

means will be disregarded. Detailed instructions regarding registration and proposal submission via DSIP are provided in the DoD SBIR Program BAA.

DMEA intends for Phase I to be only an examination of the merit of the concept or technology that still involves technical risk, with a cost not exceeding $ 100,000.00. The technical period of performance for the Phase I effort shall be no more than three (3) months.

A list of the topics currently eligible for proposal submission is included in this section followed by full topic descriptions. These are the only topics for which proposals will be accepted at this time. The topics are directly linked to DMEA's core research and development requirements.

Please ensure that your e-mail address listed in your proposal is current and accurate. DMEA cannot be responsible for notification to companies that change their mailing address, e-mail address, or company official after proposal submission.

Technical Volume (Volume 2)
The technical volume is not to exceed 10 pages and must follow the formatting requirements provided in the DoD SBIR Program BAA. Technical volumes exceeding 10 pages will be deemed non-compliant and will not be evaluated.

Content of the Technical Volume
Read the DoD SBIR Program BAA for detailed instructions on proposal format and program requirements. When you prepare your proposal submission, keep in mind that Phase I should address the feasibility of a solution to the topic. Only UNCLASSIFIED proposals will be accepted.

DMEA will evaluate and select Phase I proposals using the evaluation criteria contained in Section 6.0 of the DoD SBIR Program BAA. Due to limited funding, DMEA reserves the right to limit awards under any topic, and only proposals considered to be of superior quality will be funded.

Cost Volume (Volume 3)
The Phase I Base amount must not exceed $100,000.00. DMEA will conduct a price analysis to determine whether cost proposals, including quantities and prices, are fair and reasonable. Contractors should expect that cost proposals will be negotiated. Costs must be separated and clearly identified on the Proposal Cover Sheet (Volume 1) and in Volume 3.

The on-line cost volume for Phase I proposal submissions must be at a level of detail that would enable DMEA personnel to determine the purpose, necessity, and reasonability of each cost element. Provide sufficient information (a. through h. below) on how funds will be used if the contract is awarded. Include the itemized cost volume information (a. through h. below) as an appendix in your technical proposal. The itemized cost volume information (a. through h. below) will not count against the 10-page limit on Phase I proposal submissions.

a. Special Tooling and Test Equipment and Material: The inclusion of equipment and materials will be carefully reviewed relative to need and appropriateness of the work proposed. The purchase of special tooling and test equipment must, in the opinion of the Contracting Officer, be advantageous to the Government and relate directly to the specific effort. They may include such items as innovative instrumentation and/or automatic test equipment. Title to property furnished by the Government or acquired with Government funds will be vested with the DoD Component; unless it is determined that transfer of the title to the contractor would be more cost effective than

recovery of the equipment by the DoD Component.

b. Direct Cost Materials: Justify costs for materials, parts, and supplies with an itemized list containing types, quantities, price, and where appropriate, purposes.

c. Other Direct Costs: This category of costs includes specialized services such as machining or milling, special testing or analysis, costs incurred in obtaining temporary use of specialized equipment. Proposals, which include teased hardware, must provide an adequate lease versus purchase justification or rationale.

d. Direct Labor: Identify key personnel by name if possible or by labor category if specific names are not available. The number of hours, labor overhead and/or fringe benefits and actual hourly rates for each individual are also necessary.

e. Travel: Travel costs must relate to the needs of the project. Break out travel cost by trip, with the number of travelers, airfare, and per diem. Indicate the destination, duration, and purpose of each trip.

f. Cost Sharing: Cost sharing is permitted. However, cost sharing is not required, nor will it be an evaluation factor in the consideration of a proposal.

g. Subcontracts: Involvement of university or other consultants in the planning and /or research stages of the project may be appropriate. If the offeror intends such involvement, describe the involvement in detail and include information in the cost proposal. The proposed total of all consultant fees, facility leases, or usage fees and other subcontract or purchase agreements may not exceed one-third of the total contract price or cost, unless otherwise approved in writing by the Contracting Officer. Support subcontract costs with copies of the subcontract agreements. The supporting agreement documents must adequately describe the work to be performed (i.e., Cost Volume). At the very least, a statement of work with a corresponding detailed cost volume for each planned subcontract must be provided.

h. Consultants: Provide a separate agreement letter for each consultant. The letter should briefly state what service or assistance will be provided, the number of hours required, and the hourly rate.
Please review the updated Percentage of Work (POW) calculation details included in the DoD Program BAA. DMEA will not accept any deviation to the POW requirements.

Company Commercialization Report (CCR) (Volume 4)
Completion of the CCR as Volume 4 of the proposal submission in DSIP is required. Please refer to the DoD SBIR Program BAA for full details on this requirement. Information contained in the CCR will be considered by DMEA during proposal evaluations.

Supporting Documents (Volume 5)
All proposing small business concerns are REQUIRED to submit the following documents to Volume 5:

1. Contractor Certification Regarding Provision of Prohibition on Contracting for Certain Telecommunications and Video Surveillance Services or Equipment

Please refer to the DoD Program BAA for more information.

PHASE II PROPOSAL GUIDELINES
Phase II proposals may only be submitted by Phase I awardees. Phase II is the prototype/demonstration of the technology that was found feasible in Phase I. DMEA encourages, but does not require, partnership and outside investment as part of discussions with DMEA sponsors for potential Phase II efforts.

The Technical Volume is not to exceed 40 pages and consists of a single PDF file with your firm name, topic number, and proposal number in the header of each page. All documentation should use no smaller than 10-point font on standard 8.5" X 11" paper with one-inch margins and not be in two-column format. Do not include blank pages.

Phase II proposals may be submitted for an amount not to exceed $1,340,000.00. The technical period of performance for the Phase II effort shall be no more than twenty-four (24) months.

Phase I awardees may submit a Phase II proposal without invitation not later than sixty (60) calendar days following the end of the Phase I contract. The Phase II proposal submission instructions are identified in the Phase I contract, Part I – The Schedule, Section H, Special contract requirements, "SBIR Phase II Proposal Submission Instructions."

All Phase II proposals must have a complete electronic submission per the Proposal Volumes area listed in Phase I. Your proposal must be submitted via the submission site on or before the DMEA-specified deadline or it will not be considered for award.

Due to limited funding, DMEA's ability to award any Phase II, regardless of proposal quality or merit, is subject to availability of funds. Please ensure that your proposal is valid for 120 days after submission, and any extension to that time period will be requested by the Contracting Officer.

A Phase II contractor may receive up to one additional, sequential Phase II award for continued work on a project. The additional, sequential Phase II award has the same guideline amounts and limits as an initial Phase II award. Sequential, Phase II proposals shall be initiated by the Government Technical Point of Contact for the initial Phase II effort and must be approved by the DMEA SBIR/STTR Program Manager in advance.

DISCRETIONARY TECHNICAL AND BUSINESS ASSISTANCE (TABA)
DMEA does not provide Discretionary Technical and Business Assistance (TABA).

EVALUATION AND SELECTION
All proposals will be evaluated in accordance with the evaluation criteria listed in the DoD SBIR Program BAA.

Proposing firms will be notified of selection or non-selection status for a Phase I award within 90 days of the closing date of the BAA.

Refer to the DoD SBIR Program BAA for procedures to protest the Announcement.
As further prescribed in FAR 33.106(b), FAR 52.233-3, Protests after Award should be submitted to:

DMEA Acting SBIR/STTR Program Manager (PM):
- Name: Mr. Tien Dang
- Email: osd.mcclellan-park.dmea.list.sbir-sttr1@mail.mil

END

DMEA SBIR 24.4 Topic Index
Release 1

DMEA244-P01	Modeling, Optimization, and Monitoring of Thick SiC Epitaxy Processes Open Topic

DMEA244-P01 TITLE: Modeling, Optimization, and Monitoring of Thick SiC Epitaxy Processes Open Topic

OUSD (R&E) CRITICAL TECHNOLOGY AREA(S): Microelectronics

OBJECTIVE: The DoD is seeking the development of a process control and modeling solution to aide in the start-up and monitoring of a hot-walled Chemical Vapor Deposition (CVD) Silicon Carbide (SiC) epitaxy process, whereby very thick SiC epilayers will be grown on 150mm base wafers. A successful solution will serve to accelerate start-up of new processes, optimize quality of deposited epilayers, maximize wafer throughput where possible, minimize material waste and downtime, and continuously monitor wafer production.

DESCRIPTION: The technology shall provide in-situ process characterization and monitoring of key parameters over the entire duration of the epilayer deposition, which is expected to take several hours per wafer depending on the gas chemistries used. Maximum achievable growth rates are desired while also preserving stable process conditions to avoid unwanted changes to the surface morphology of the epilayer, nucleation of defects, and poor electrical characteristics such as decreased net carrier concentration [1, 2]. Unlike standard process monitoring tools that are limited to feed-forward and feedback, this technology will perform real-time process adjustments account for changing process conditions within the chamber such as fluctuations in temperature, pressure, rotation, or flow rates due to degradation of chamber hardware.

The technology will utilize captured Design of Experiment (DOE) data to determine which process parameters strongly correlate to defect densities and other undesirable film characteristics. The software will find the ideal settings for each control setting to optimize the chamber conditions. Once a particular epi process has been established, the DOE data can then be applied to a wafer-to-wafer Artificial Intelligence (AI) process control algorithm for continued monitoring, precluding the need for test runs or chamber seasoning prior to running various process types/epilayer stacks categorized by dopant, concentration, and layer thickness. A model of the epi process will be output to a workstation accessible to process engineers. This feature serves to improve process engineers' understanding of the growth process and guides efforts to optimize conditions resulting in less wasted material when changes need to be implemented.

The technology should enable unmonitored wafer processing for additional throughput (no human in the loop). The software will have prognostic capability to perform in-situ process modification and may require the implementation of an AI/ML algorithm. Sensor data will be transferred from epi equipment via Semiconductor Equipment Communications Standard-Generic Equipment Model (SECS-GEM) protocol. Other sensor inputs will be integrated as needed. Example process conditions fed through sensor readings include chamber temperature, pressure, gas flows, etc.
All process conditions and trace data should be captured for Advanced Process Control (APC), including Run-to-Run (R2R), Fault Detection and Classification (FDC), and Statistical Process Control (SPC). Process conditions should be compared against resultant defect density in the deposited epilayer.

PHASE I: Conduct a feasibility study and design a software solution.

The solution's architecture, design and operation should be defended against the following metrics:

1. Reduction of waste: fewer runs required to optimize process conditions resulting in fewer scrapped or wasted substrates and other consumables.
2. Cost savings: lower consumable usage, fewer wafers required for start-up and epilayer development.
3. Time savings: accelerate equipment start-up and development.

4. Accuracy of the models to deposited epilayers.
5. Reduction of defect densities in the epilayer through process optimization.
6. Expected efficiencies in production.

The solution should also describe how the software will be implemented into a production wafer foundry environment, including integration into Manufacturing Executive Systems (MES). Time required to train models should be indicated. A supportability model of the developed solution should also be outlined. Expected level of training and skills required for operation should be described. If existing solutions are being leveraged to develop the solution, a description of those tools should be included. Describe the materials, DOEs, etc., required for training the models, including what inspection and metrology data is required: thickness defect mapping and classification, bow, warp, Total Thickness Variation (TTV), etc. The delivered report should define a program plan for follow-on phase development. If any of the above items cannot be fully addressed, the report must include relevant research and rationale that demonstrates their inapplicability to the proposed technique. If adhering to the above items is possible, but not financially feasible, the report must include relevant justification. Finally, the challenges and special considerations for implementing the solution into an existing fabrication facility should be addressed.

PHASE II: Build, test, and implement a functional solution that meets the requirements listed in Phase I. Demonstrate the capability of performance on a commercial single-wafer, hot-walled epi reactor of DMEA's choosing.

The final report should address all steps required and issues encountered during implementation, including recommended hardware for optimal performance at a user facility.

PHASE III DUAL USE APPLICATIONS: This technology could be utilized for DoD and commercial applications requiring the growth of thick SiC epilayers. SiC is a key enabling technology for next-generation DoD systems. Ultra-high power SiC devices will eventually find their way into grid applications and other commercial use cases driven by power efficiency and portability. A detailed commercialization plan should be designed and executed in this phase, including researching potential DoD and commercial applications, marketing to the respective customers, development of relevant prototypes, demonstration of performance, documentation of relevant details, and benefits to end users. Deliver a detailed report that documents the market research methods used, the findings of the market research, potential use cases, and details of prototypes with descriptions, marketing, and other commercialization activities.

REFERENCES:

1. A. Henry, et al. "SiC epitaxy growth using chloride-based CVD", 2012, Physica. B, Condensed matter, (407), 10, 1467-1471.
2. F. La Via, et al. "Mechanisms of growth and defect properties of epitaxial SiC". 2014, Appl. Phys. Rev. 1, 031301

KEYWORDS: SiC, Epitaxy, Modeling, Wafer Manufacturing, Automation

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