National Science and Technology Council (NSTC) Call for Proposals

Taiwan Chip-based Industrial Innovation Program (Taiwan CbI): Key Technologies for Integrating Next-Generation Semiconductor Materials and Devices FY2026-2028

1. Background and Objectives

As conventional CMOS technologies approach scaling limits, global semiconductor research is shifting toward Beyond-CMOS concepts and emerging materials. Large-area semiconductor materials offer significant potential in band engineering, interfacial behavior, and novel device architectures. However, challenges remain in achieving high-quality large-area growth, ensuring process compatibility, maintaining electrical stability, and establishing robust metrology. Domestic industry likewise faces gaps in materials introduction, advanced process verification, and device evaluation.

The Taiwan Chip-based Industrial Innovation Program (Taiwan CbI) aims to establish core research capabilities for next-generation semiconductor materials and device integration. The program supports academic research on materials growth and behavior, process integration, device operation, and metrology development, thereby connecting materials–process–device–validation workflows. Through interdisciplinary collaboration and experimental verification, this program seeks to establish a research foundation that aligns with industrial needs and enhances long-term competitiveness in Beyond-CMOS and next-generation semiconductor technologies.

2. Research Themes

The program solicits innovative academic proposals within open research directions centered on fundamental questions of materials behavior and device

operation, while addressing key metrology and process-related gaps relevant to future manufacturing. Proposals should connect fundamental science with anticipated industrial requirements and contribute to long-term exploration of new materials or device architectures. The program encompasses two major themes:

I. **Semiconductor Materials, Process Integration, and Device Behavior**: Research focuses on large-area semiconductor and 2D materials under diverse process conditions, environmental settings, or device architectures. Topics include: materials growth and structural control, interfacial and band structure characteristics, carrier transport mechanisms, device operation physics, stability, compatibility, and electrical performance under advanced process conditions. Proposals are encouraged to integrate materials science, process development, and device operation, extending from fundamental understanding to process validation, prototype device fabrication, or performance assessment. Outputs should support feasibility evaluation for incorporating new materials or architectures into future advanced processes.

II. **Multi-Scale Characterization, Metrology, and Data Analytics**: This theme emphasizes strengthening characterization capabilities across structure, interface, defects, and device operation. The program encourages the development of metrology workflows that meet industrial relevance with improved stability, reproducibility, throughput, or process compatibility. The integration of theoretical modeling, simulation, or data analytics is also supported to enhance the speed and reliability of data interpretation, facilitating a comprehensive assessment of materials properties, process influences, and device behavior.

3. Proposal Preparation Guidelines

This call is goal-oriented. Proposals must clearly articulate the research concept, technical focus, feasibility, and the linkage between scientific exploration, process implementation, and downstream applications.

I. Research Objectives and Core Questions: Define the key scientific or technological issues to be addressed, such as materials behavior, process effects, device operation, or metrology capabilities. The proposal should demonstrate forward-looking and innovative ideas and their potential contributions to next-generation semiconductor technologies.

II. Research Plan and Technical Roadmap: Provide a three-year research plan describing major research thrusts, expected outcomes, milestones, and validation methods. Plans may involve materials characterization, process integration studies, device prototypes, or new metrology approaches. Multiple research paths may be proposed to reflect uncertainties and allow flexibility.

III. Positioning and Performance Indicators: Explain the proposal's position within domestic and international technological developments, including its relevance to Beyond-CMOS materials, process technologies, or novel device architectures. Present quantitative or qualitative indicators for assessing research progress, such as materials quality, process behavior, device performance, or metrology capability. For interdisciplinary or complex process-related work, describe team roles and assessment methods.

IV. Industrial Needs and Application Potential: Discuss potential applications in advanced processing, metrology, or device development. Explain how the research addresses current industrial needs in materials introduction, process compatibility, or metrology methods. If the work involves prototype development or process-relevant workflows, describe feasibility, expected stability, and practical value.

4. Application, Review, and Funding

I. Eligibility and Funding Structure: Applicants must comply with NSTC regulations on project funding. The program adopts a single integrated project structure, typically comprising of 2–4 sub-projects led by an overall PI. Each sub-project PI must have a substantive research role. The proposal should clearly describe

responsibilities and integration mechanisms across sub-projects. Annual funding is expected to range from NT$5 million to NT$20 million, with final amounts determined by review results and budget availability.

II. Submission Procedure: Submit the full proposal through the NSTC online system using the required templates. The proposal must follow the format and page limits of the NSTC CM03 Proposal Form. In the online system, select: Project Type: Research Projects – Rolling Review. Program Category: Strategic Program. Research Type: Integrated Project. NSTC Division: NSTC Department of Natural Sciences and Sustainable Development. Discipline Code: M9201 – Advanced Semiconductors. Sub-discipline Code: choose M920102 – Key Component Materials or M920101 – Metrology Technologies, depending on research content.

III. Review and Funding Decision: Review consists of preliminary written evaluation followed by a panel meeting. As a strategic program, decisions are final and no appeal mechanism is provided. Projects are funded for three years in principle. Continuation each year depends on performance evaluations. After approval, the project counts toward the PI's project quota; sub-project PIs are not counted. PI and sub-project PIs may receive a monthly PI allowance of up to NT$30,000 and NT$20,000, respectively, with only one allowance claimable at a time.

IV. Review Criteria: Evaluation considers academic merit, technical feasibility, integration quality, and alignment with program objectives. Key criteria include:

(1) Ambition, forward-looking vision, and technical challenge.

(2) Relevance to global semiconductor development trends.

(3) Novelty, potential for breakthroughs, and scientific contributions.

(4) Applicability to advanced processing, materials development, or metrology.

(5) Clarity and appropriateness of the technical roadmap and performance indicators.

(6) Execution capability of the PI and team.

(7) Interdisciplinary integration and potential for academia-industry

collaboration.

V. Project Implementation and Evaluation

NSTC will conduct periodic evaluations. Teams must provide progress reports and attend review meetings. Evaluation results directly influence the following year's funding and continuation decisions.

Teams must also participate in dissemination activities, technology promotion, and related NSTC-designated events. If annual budgets are not approved by the Legislative Yuan or are partially reduced, NSTC may adjust funding accordingly. Projects may be reduced or terminated for failure to comply with reporting requirements or inadequate performance.

VI. Additional Provisions

Contracting, fund disbursement, extensions, amendments, financial reporting, and submission of deliverables must comply with the NSTC Regulations on Research Project Grants, related financial principles, and relevant laws. Unspecified matters will follow the same regulations.

VII. Contact Information

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