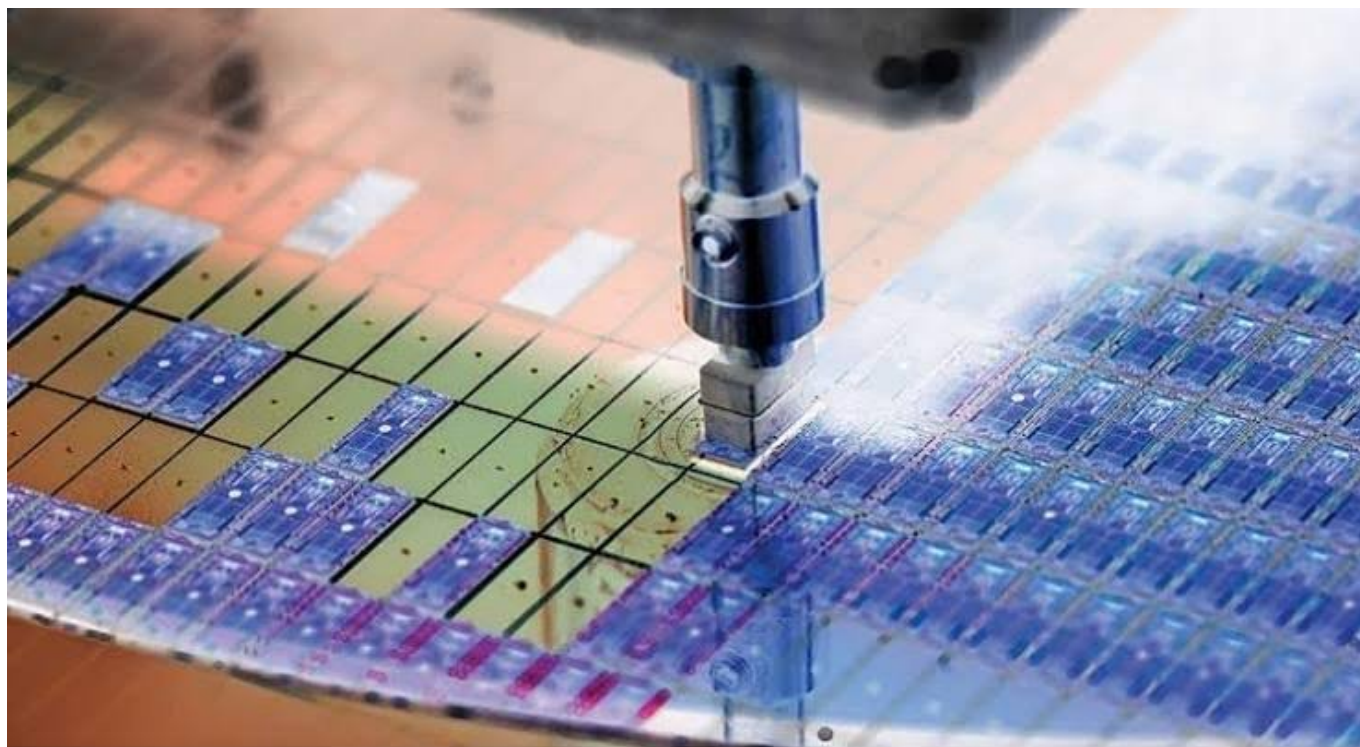


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Penn State and Battalio Partner on \$6 Million Research Program for Advanced Semiconductors and High-Temperature Materials

Two three-year projects will develop next-generation semiconductor platforms and oxidation-resistant refractory alloys for energy, aerospace, transportation, industrial and national security applications.

By **Ankit Kankar** | September 12, 2026



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Penn State and Battalion Advanced Technology Ltd ("Battalion") have entered into two research agreements worth up to \$6 million to develop advanced semiconductor platforms and high-temperature materials that aim to enable next-generation energy, transportation, aerospace and industrial systems while also providing critical capabilities for national security.

Led by researchers at Penn State's Materials Research Institute (MRI), the projects bring together researchers from across the University to address two major materials challenges in technologies that operate under extreme conditions: integrating advanced semiconductors with high-performance substrates that can withstand the conditions and dissipate heat as well as developing durable, oxidation-resistant alloys that can withstand extreme temperature environments including hypersonic flight.

Battalion Advanced Technology Ltd, a U.K. based company focused on advancing next-generation materials for dual-use applications, will provide up to \$1 million per year for each project. The agreements went into effect on July 16 and will run for three years.

"Penn State Materials brings together expertise in semiconductor science, computation, manufacturing and characterisation," said Joshua A. Robinson, director of the MRI and professor of materials science and engineering. "This collaboration allows us to apply that breadth to two complex materials challenges with direct implications for U.S. technological leadership and national security."

U.S. Senator Dave McCormick commented:

"Pennsylvania has the talent, research institutions, and innovative spirit to help America lead in the technologies that will define our economic and national security. This research collaboration, backed by up to \$6 million from Battalion Advanced Technology, will help Penn State advance critical work in semiconductors, aerospace, defence, and other strategic industries while strengthening Pennsylvania's role as a hub for American innovation."

Semiconductor Project Details

The semiconductor project is led by Joan Redwing, distinguished professor of materials science and engineering and of electrical engineering. Her team will explore new ways to integrate gallium nitride, a wide-bandgap semiconductor material that is more versatile than conventional silicon, and related wide-bandgap and ultrawide-bandgap semiconductors with substrates that

offer improved thermal and electrical performance.

These semiconductors can operate at higher voltages, temperatures and power densities than many traditional materials, making them promising for advanced electronics, communications and sensing. Their performance, however, can be limited by the substrates and interfaces on which the semiconductor layers are grown.

The researchers will investigate whether atomically thin interlayers — materials designed to improve how different materials connect and perform together — can help gallium nitride semiconductors integrate more effectively with materials such as diamond and aluminium nitride, relieve stress where the materials meet and reduce defects during semiconductor growth.

The work will combine materials synthesis and characterisation, with the goal of moving beyond conventional approaches for growing crystalline layers. The collaboration draws on the University's interdisciplinary materials research community, as well as specialised facilities and technical capabilities available through the MRI and other University research units.

"By using atomically thin two-dimensional materials as interlayers, we aim to minimise crystalline defects and interfacial thermal resistance while enabling wide-bandgap semiconductor growth on high thermal conductivity substrates that have traditionally been incompatible with direct deposition," Redwing said.

The co-principal investigators on the semiconductor project include Robinson; Adrianus van Duin, distinguished professor of mechanical engineering; and Chen Chen, assistant research professor in MRI.

High Temperature Alloys Project Details

The second project is led by Douglas Wolfe, associate vice president for research and professor of materials science and engineering. It will focus on refractory metal alloys — metals that maintain their strength and stability under extreme heat — for hypersonic and other demanding, high-temperature applications.

Refractory metals such as tungsten, molybdenum and niobium offer high-temperature strength, toughness and thermal conductivity, but oxidation and material loss can limit their use. The researchers plan to develop new alloy compositions and material architecture designed to retain

mechanical performance while forming more stable, protective surfaces during high-temperature exposure.

The team will also investigate functionally graded materials, in which composition or structure changes across a component, and environmental protection systems intended to improve oxidation resistance, thermal compatibility and durability.

"By integrating computational prediction, next-generation manufacturing and rigorous validation, we can accelerate the development of refractory alloys that enable breakthroughs in defence applications, hypersonic, nuclear systems, space exploration and other extreme environmental applications," Wolfe said.

Long-Qing Chen, Evan Pugh University Professor and Hamer Professor of Materials Science and Engineering, and Bed Poudel, research professor of materials science and engineering, are co-principal investigators on the refractory alloy project.

R. Michael Jones, Director of Battalion, commented:

"We are very pleased to be supporting the development of leading innovations with essential dual uses for national security and economic technologies. We are able to work on highly sophisticated solutions immediately through our partnership with Penn State."

Read online: <https://worldbusinesswatch.com/news/13/21/penn-state-and-battalion-partner-on-6-million-research-program-for-advanced-semiconductors-and-high-temperature-materials.html>

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