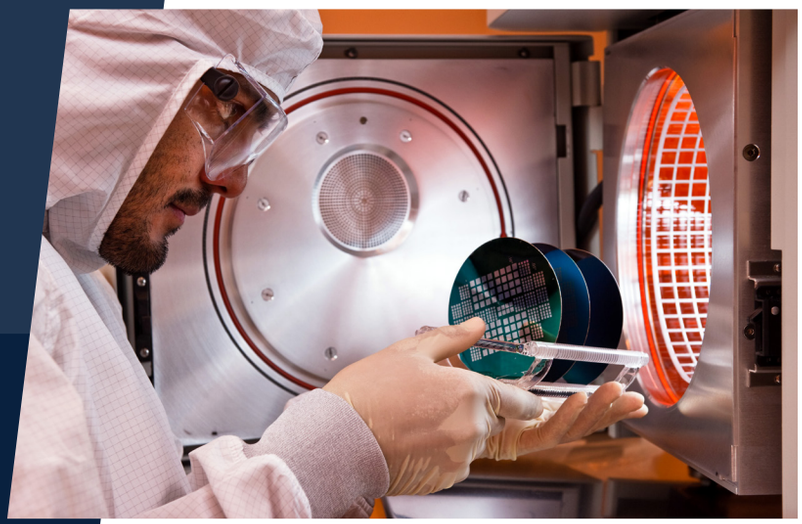
Supporting microelectronics research and innovation from the lab to fabrication



Founded in 1895, the University of Notre Dame's Department of Electrical Engineering is one of the oldest in the nation. Its researchers have built their current programs on more than a century of experience leading advances in the study of electricity, circuits, and electrical devices. Over the past four decades, work on semiconductors and microelectronics has emerged as a key research strength of the University.

Notre Dame has a long history of engagement with the Semiconductor Research Corporation (SRC), a not-for-profit research and development consortium consisting of leading semiconductor companies. In addition, Notre Dame faculty have made significant contributions over a fifteen-year span with the leadership of and technical engagement in three SRC-funded research centers, including:

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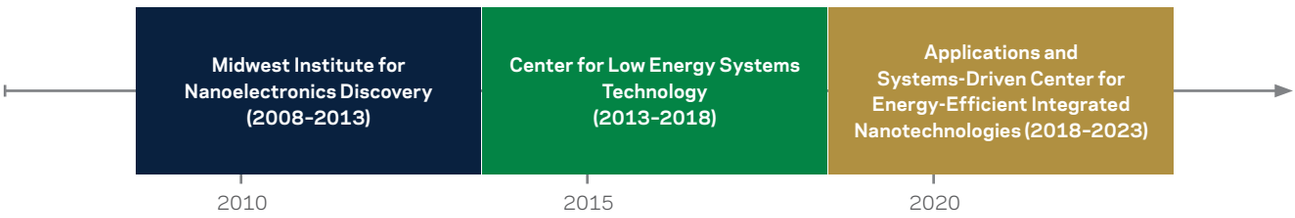

Strong Partnerships

Notre Dame has built on its distinctive history and strength in cutting-edge microelectronics research through collaborations with other leading research institutions in Indiana, including Purdue University and Indiana University. It also engages in ongoing research partnerships with government agencies, including the Defense Advanced Research Projects Agency (DARPA) and the National Science Foundation (NSF), along with leading technology manufacturers, such as IBM, Lockheed Martin Corporation, and Texas Instruments.

Collaborative and Interdisciplinary Environment

Notre Dame Nanoscience and Technology (NDnano) is a University center that promotes interdisciplinary nanoscience and nanotechnology research. NDnano has 65 faculty affiliates from the College of Engineering and 22 faculty affiliates from the College of Science. NDnano encourages collaboration and supports faculty affiliates' research. NDnano also offers undergraduate research opportunities to promote scholarship and engagement in nanoscience and nanotechnology.

MICROELECTRONICS AT NOTRE DAME

Core Research Facilities

The Notre Dame Nanofabrication Facility provides a 9,000-square-foot cleanroom that houses a comprehensive suite of tools for material, device, and integrated circuit research, teaching, and prototyping. Examples of the state-of-the-art capabilities include chemical mechanical polishing, wafer thinning, packaging and assembly, molecular beam epitaxy, lithography, dielectric deposition, plasma processing, and wet-chemical processing.

The Notre Dame Integrated Imaging Facility serves faculty and students with an Electron Microscopy Core that integrates a unique bundle of state-of-the-art FEI instrumentation. This includes a Magellan 400 field emission scanning electron microscope, Helios G4 Ux DualBeam, Spectra 300 scanning transmission electron microscope, Talos F200i transmission electron microscope, Leica Automatic Plunger Freezer EM GP2, and a Leica EM UC7 Ultramicrotome.

Signature Research Areas

High-Frequency High-Power Wide Bandgap Semiconductors: Researchers at the University work on developing novel technologies for power electronics, including the use of wide bandgap materials such as silicon carbide (SiC) and gallium nitride (GaN) in power devices. Areas of research include the development of high-frequency power converters, high-efficiency power amplifiers, and power electronics for renewable energy systems.

5G/6G and Wireless Research: Notre Dame faculty are conducting research into the development of next-generation wireless technologies to improve the performance, reliability, and security of wireless networks. Research areas include spectrum utilization, distributed antenna systems, millimeter wave communications, and massive MIMO systems. Additionally, Notre Dame leads 29 partner universities through SpectrumX, a $25 million NSF Spectrum Innovation Center focused on the transformation of spectrum management.

Heterogeneous Integration, Materials, Devices, and Interconnects: Researchers investigate new technologies for microelectronics and nanoelectronics, including the development of 2D and 3D integration techniques, advanced interconnect technologies, and the exploration of new materials and heterostructures for transistors, memory, detectors, and energy converters.

Photonics: Notre Dame's photonics research includes areas like quantum cascade lasers, nonlinear optics, nanophotonics, biophotonics, quantum optics, fiber optics, optoelectronics, photovoltaics, and frequency combs. Potential applications include remote explosives detection, chemical analysis, quantum sensing, and communications and healthcare technologies.

Bioelectronics and Medical Diagnostics: Researchers at the University work on developing novel technologies for the diagnosis and treatment of diseases, including the use of biosensors, microfluidics, and wireless communication. Areas of research include the development of wearable and implantable devices for continuous health monitoring, diagnostic tools for early disease detection, and personalized medicine.

Microelectronics Workforce Development

The University supports national and regional efforts to promote U.S. leadership in semiconductors and microelectronics. The graduation of engineers and scientists with the capability to innovate in manufacturing and technology is critical to the success of this nationwide effort. Students in Notre Dame's Integrated Circuits Fabrication Course fabricate a 5000-transistor circuit. The circuit, which plays the Notre Dame fight song, was designed in an undergraduate VLSI (very large scale integration) course. Notre Dame is committed to building national and regional partnerships to alert students to career opportunities in microelectronics that meet society's needs.