Research & Innovation Capabilities



SOUTH DAKOTA MINES

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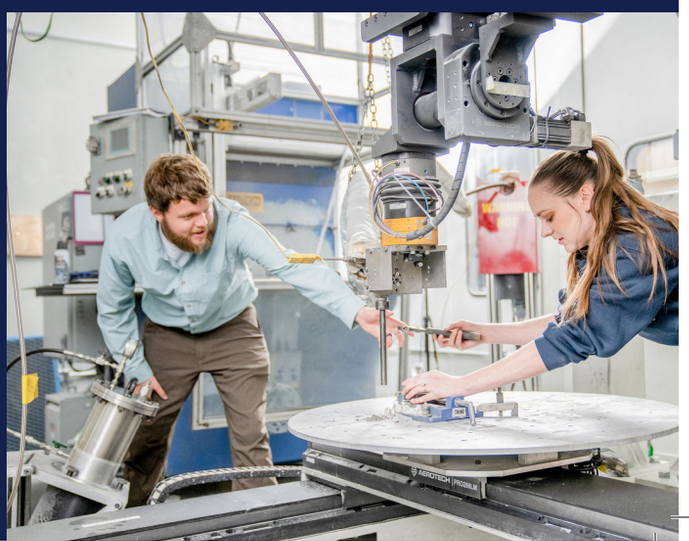
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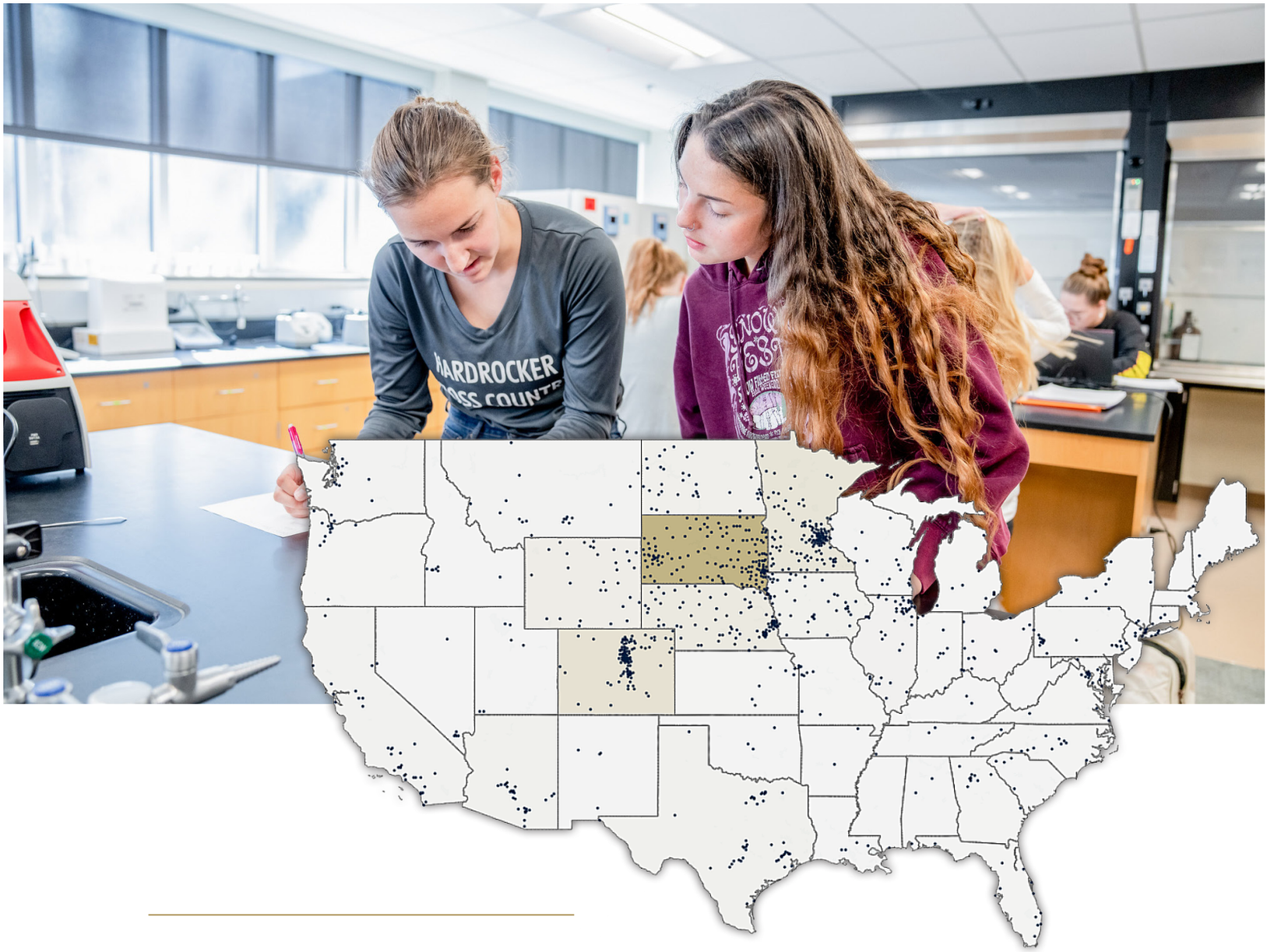
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South Dakota Mines is building the future of science and engineering education by preparing career-ready graduates, accelerating research and innovation, and expanding access to an exceptional STEM education. Through an agile culture and strong partnerships with industry, government, and communities, the university is advancing technologies, strengthening the workforce, and earning national recognition as a leader in solving complex challenges.

• indicates where our U.S. students are from

Enrollment & Research

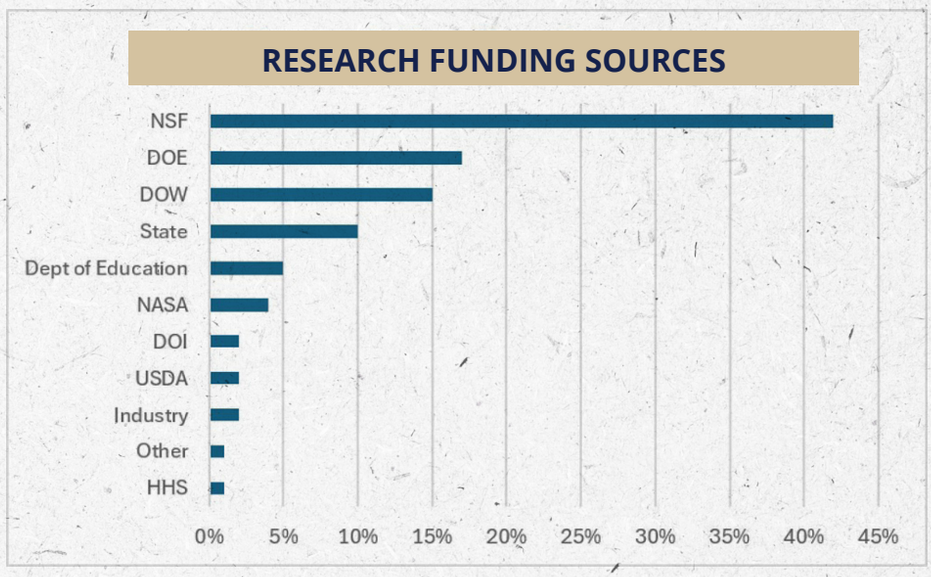
FALL 2026 ENROLLMENT

1,971
BACHELOR'S DEGREE

206
MASTER'S DEGREE

134
PHD

RESEARCH FUNDING SOURCES



$32,352,487
FY26 AWARDS

$24,981,541
FY26 EXPENDITURES

AY2025 UNDERGRADUATE OUTCOMES

388
BACHELOR OF SCIENCE GRADUATES

94%
PLACEMENT RATING

$76,805
AVERAGE STARTING SALARY

AY25 GRADUATE OUTCOMES

143
GRADUATES (MASTER'S AND PHD)

98%
AVERAGE STARTING SALARY

Advanced Materials & Additive Manufacturing

South Dakota Mines delivers advanced manufacturing, additive manufacturing, and advanced materials solutions for industry. Through research, prototyping, testing, pilot-scale manufacturing, and workforce development, the university helps solve industrial and national security challenges.

CORE CAPABILITIES & APPLICATIONS

Additive Manufacturing & Digital Engineering

Metal additive manufacturing, polymer additive manufacturing, design for additive manufacturing, digital twins, computational modeling, process monitoring, and advanced manufacturing analytics

Applications: rapid prototyping, low-volume production, aerospace and defense components, tooling, repair and sustainment, distributed manufacturing, qualification and certification, and lifecycle management.

Advanced Materials Processing & Manufacturing Systems

Materials processing, manufacturing systems engineering, process optimization, production engineering, digital engineering, quality systems, industrial automation, and integrated manufacturing

Applications: advanced production systems, aerospace and defense manufacturing, industrial process optimization, digital manufacturing, smart factories, supply chain resilience, production scale-up, and technology transition.

Advanced Materials Design & Synthesis

Materials synthesis, materials design, chemical processing, solid-state chemistry, solution-based synthesis, nanomaterials fabrication, crystal growth, surface engineering, and scalable materials production

Applications: energy storage materials, catalysts, semiconductors, functional nanomaterials, quantum materials, environmental remediation technologies, electronic materials, and advanced manufacturing feedstocks.

Computational Materials Modeling & Simulation

Atomistic and molecular modeling, computational quantum chemistry, molecular simulation, and first-principles prediction of advanced materials properties

Applications: materials discovery and design, property prediction, performance optimization, structure-property analysis, and accelerated development of advanced materials.

Functional & Smart Materials

Electrical, magnetic, optical, and thermal materials; embedded sensing technologies

Applications: industrial sensing, communications systems, autonomous platforms, embedded monitoring technologies.

Materials Characterization & Testing

Microscopy, spectroscopy, mechanical testing, thermal analysis, failure analysis

Applications: product validation, qualification testing, process verification, materials performance analysis.

Polymer & Composite Manufacturing

Polymer processing, thermoplastics, thermoset composites, pilot-scale production

Applications: lightweight systems, aerospace and autonomous systems components, industrial products, specialty materials.

Prototype Development & Pilot Manufacturing

Prototype fabrication, pilot-scale manufacturing, manufacturability testing

Applications: startup support, low-volume production, technology maturation, product commercialization.

Advanced Materials & Additive Manufacturing

Quantum Materials & Next-Generation Functional Materials

Quantum materials, two-dimensional (2D) materials, photonic materials, semiconductor materials, nanostructured materials, metamaterials, and engineered electronic and optical systems

Applications: quantum computing, secure communications, advanced sensing, photonics, microelectronics, next-generation computing systems, quantum networking, and national security technologies.

Repair Technologies & Surface Engineering

Cold spray, plasma surface engineering, advanced coatings, materials joining

Applications: component repair, lifecycle extension, corrosion resistance, performance enhancement, sustainment operations.

Structural & High-Performance Materials

Metals, alloys, ceramics, composites, quantum materials, photonic materials, nanostructured materials, and extreme-environment materials

Applications: aerospace and defense systems, industrial tooling, infrastructure materials, wear- and corrosion-resistant systems, energy systems, advanced electronics, photonics, and high-performance industrial components.



ACADEMIC PROGRAMS

Chemical Engineering (BS)

Chemical & Biological Engineering (PhD)

Chemical & Biological Sciences (MS, PhD

Chemistry (BS)

Civil & Environmental Engineering (BS, MS, PhD)

Computer Engineering (BS)Computer Science (BS)

Computer Science & Engineering (MS)

Data Science & Engineering (BS, PhD)

Geological Engineering (BS, MS, PhD)

Geology (BS, MS, PhD)

Electrical Engineering (BS, MS, PhD)

Industrial Engineering & Engineering Management (BS, MS)

Materials Engineering & Science (MS, PhD)

Mechanical Engineering (BS, MS, PhD)

Metallurgical Engineering (BS)

Mining Engineering & Management (BS, MS, PhD)

Nanoscience & Nanoengineering (MS, PhD)

Advanced Materials & Additive Manufacturing

RESEARCH CENTERS, LABORATORIES, & FACILITIES

Arbegast Materials Processing and Joining Lab (AMP)

A multidisciplinary research facility focused on solving advanced metals and manufacturing challenges through state-of-the-art processing, joining, repair, and additive manufacturing technologies. Researchers develop, analyze, and optimize manufacturing processes and materials systems directly relevant to aerospace, defense, industrial manufacturing, and national security applications.

Center for Microphysiological Systems (CMS)

CMS advances research in microfluidic fabrication, tissue engineering, cell culture, and characterization of soft materials, including rheological, thermal, surface, colloidal, and molecular measurements. CMS supports in vitro studies of biomaterials, tissue engineering, regenerative medicine, drug delivery, cancer biology, and biomedical device evaluation.

Center for Solid-State Electric Power Storage (CEPS)

Develops next-generation solid-state batteries, advanced energy storage materials, and scalable manufacturing approaches for transportation, defense, and energy applications.

Composites and Polymer Engineering Lab (CAPE)

The CAPE Laboratory is a multidisciplinary research and education facility specializing in polymers, composites, advanced manufacturing systems, and pilot-scale processing technologies. CAPE supports industry collaboration from materials development through prototype fabrication, scale-up, and validation.

Composite & Nanocomposite Advanced Manufacturing- Biomaterials Lab (CNAM-Bio)

Supports advanced manufacturing and engineered materials development involving composite and nanocomposite systems.

Cyber-Physical Systems (CPS) Laboratory

Microscopy, spectroscopy, mechanical testing, Develops integrated hardware and software systems that combine sensing, computing, communications, and autonomous control. Research focuses on robotics, embedded systems, autonomous vehicles, resilient infrastructure, and secure industrial automation.

Engineering and Mining Experiment Station (EMES)

This centralized, multi-user analytical facility provides comprehensive materials characterization, testing, and validation services supporting manufacturing, aerospace, defense, mining, environmental, and advanced materials industries.

Machine Learning and Intelligent Systems Lab

Develops advanced methods for combining, analyzing, classifying, and forecasting complex multimodal data across space and time.

Machine Shop & Prototype Fabrication Facility

Precision machining, custom tooling, instrumentation fabrication, prototype development, and research equipment support.

Nanoscience & NanoFabrication Labs

Supports fabrication and characterization of nanoscale materials, thin films, semiconductor devices, and advanced electronic materials.

Quantum Materials Institute

The Institute is a growing research and workforce development initiative focused on advancing quantum computing, secure quantum communications, and next-generation photonics technologies.

South Dakota Center for Advanced Research in Materials, Operations, and Resilience (SD-ARMOR)

Focused on advancing resilient manufacturing, cybersecurity, and secure supply chains through applied research in advanced materials, AI, and operational technologies.

2DBEST Center

This lab develops advanced two-dimensional nanomaterials and coatings to control biofilm growth and prevent corrosion.

Advanced Materials & Additive Manufacturing

INDUSTRY PARTNERS

Army Research Lab, Solvus Global, Nalas Engineering, TRI Austin, Battelle, RPM & Associates, VRC Metal Systems, Ellsworth Air Force Base, Arris Composites, Avient, Continental Structural Plastics Johns Manville, Viaflex, 9T Labs

CASE STUDIES

MOBILE COLD SPRAY REPAIR FOR THE FLIGHTLINE

Challenge

Military aircraft maintenance often requires transporting components to centralized repair facilities, increasing downtime and logistical complexity.

Solution

South Dakota Mines partnered with Ellsworth Air Force Base, Wright-Patterson Air Force Base, and VRC Metal Systems to develop and deploy the Air Force's first Mobile Cold Spray System (MCSS) capable of performing repairs directly on the flightline.

Impact

The system enables expeditionary repair capabilities, accelerates maintenance operations, and enhances mission readiness by bringing additive manufacturing to the point of need.

ADDITIVE MANUFACTURING FOR DEFENSE SUSTAINMENT

Challenge

Repairing damaged B-1 bomber components traditionally required lengthy maintenance periods, disassembly, and sourcing replacement parts from salvaged aircraft.

Solution

South Dakota Mines researchers worked with Ellsworth Air Force Base personnel to apply cold spray additive manufacturing technology directly to damaged B-1 components, restoring the original geometry and performance of the parts.

Impact

The repair reduced aircraft downtime from approximately eight weeks to a matter of hours and avoided repair costs exceeding $500,000, improving readiness for the U.S. Air Force.

Advanced Materials & Additive Manufacturing

COMMERCIALIZING SOLID-STATE BATTERY TECHNOLOGY

Challenge
Commercializing solid-state battery technologies requires overcoming technical and manufacturing barriers to produce safer, higher-performance energy storage systems at scale.

Solution
South Dakota Mines researchers developed patented solid-state battery technologies and partnered with Critical Resources Limited to evaluate and advance their commercial development.

Impact
The partnership accelerates the commercialization of next-generation battery technologies while demonstrating South Dakota Mines' ability to translate advanced materials research into solutions that strengthen domestic manufacturing, energy security, and national defense.

RESTORING B-52 ENGINE COWLINGS THROUGH ADDITIVE REPAIR

Challenge
Replacing aging aircraft components is costly and can negatively affect aircraft availability.

Solution
Using mobile cold spray technology developed through South Dakota Mines collaborations, teams repaired and restored 11 B-52 engine cowlings rather than replacing them.

Impact
The technology extended component life, reduced replacement costs, and demonstrated the scalability of additive repair technologies across multiple Air Force platforms.

SMART COMPOSITE MATERIALS FOR PROTECTIVE EQUIPMENT

Challenge
Protective equipment provides limited real-time information about structural integrity and exposure to hazardous conditions.

Solution
Researchers in the CAPE Laboratory developed polymer and composite materials with embedded sensing, diagnostic, and communications capabilities for use in protective systems.

Impact
These advanced materials have potential applications in helmets and protective gear for military personnel, first responders, firefighters, and athletes, improving safety through enhanced situational awareness.

Aerospace & Defense

South Dakota Mines delivers applied research, advanced manufacturing, autonomous systems, critical materials expertise, and workforce development that support aerospace, defense, and national security missions.

CORE CAPABILITIES & APPLICATIONS

Advanced Manufacturing & Aerospace Sustainment

Laser additive manufacturing, cold spray repair technologies, advanced coatings, materials joining, digital manufacturing

Applications: laser additive manufacturing, cold spray repair technologies, advanced coatings, materials joining, digital manufacturing, energetic materials processing and characterization.

Autonomous Systems, Sensors & AI

Unmanned aerial systems (UAS), robotics, AI-enabled systems, sensing technologies, autonomous operations

Applications: autonomous defense platforms, infrastructure monitoring, intelligent sensing systems, operational readiness, remote operations, mission support technologies.

Advanced Materials & Lightweight Systems

Metals, alloys, ceramics, composites, polymer systems, extreme-environment materials

Applications: aerospace structures, lightweight defense systems, protective materials, blast-resistant materials, resilient concrete systems, hardened infrastructure, wear- and corrosion-resistant systems, and high-performance industrial components.

Critical Minerals & Strategic Resources

Mineral processing, chemical synthesis, biotechnology, materials characterization, metallurgy, resource engineering

Applications: domestic supply chain resilience, defense-critical materials, aerospace manufacturing inputs, strategic resource development, energy and national security systems.

Digital Engineering & Smart Manufacturing

Automation, process optimization, digital manufacturing systems, CNC integration

Applications: Industry 4.0 systems, advanced production environments, industrial automation, resilient manufacturing ecosystems.

Energetic Materials, Protective Systems & Resilient Infrastructure

Energetic materials, combustion science, explosives characterization, blast effects, protective materials, resilient concrete systems, infrastructure durability, and extreme-environment performance

Applications: munitions and energetics development, propulsion and combustion systems, blast-resistant structures, military installation resilience, protective infrastructure, hardened facilities, airfield and transportation infrastructure, critical infrastructure protection, expeditionary construction, and infrastructure performance in extreme operational environments.

Materials Characterization & Testing

Microscopy, spectroscopy, thermal analysis, mechanical testing, failure analysis

Applications: aerospace qualification testing, product validation, process verification, root-cause investigation, performance analysis.

Prototype Development & Pilot Manufacturing

Prototype fabrication, pilot-scale manufacturing, manufacturability testing

Applications: technology maturation, low-volume production, startup support, product commercialization, defense innovation transition.

Repair Technologies & Surface Engineering

Cold spray, plasma surface engineering, advanced coatings, materials repair technologies

Applications: aircraft and component repair, sustainment operations, corrosion mitigation, performance enhancement, maintenance optimization.

Aerospace & Defense

ACADEMIC PROGRAMS

Aerospace Engineering (minor)
Avionics (minor)
Biology (BS)
Chemical Engineering (BS)
Chemical & Biological Engineering (PhD)
Chemical & Biological Sciences (MS, PhD)
Chemistry (BS)
Civil & Environmental Engineering (BS, MS, PhD)
Computer Engineering (BS)
Computer Science (BS)
Computer Science & Engineering (MS)
Data Science & Engineering (BS, PhD)
Electrical Engineering (BS, MS, PhD)
Geological Engineering (BS, MS, PhD)
Industrial Engineering & Engineering Management (BS, MS)
Materials Engineering & Science (MS, PhD)
Math (BS)
Mechanical Engineering (BS, MS, PhD)
Metallurgical Engineering (BS)
Mining Engineering & Management (BS, MS)
Physics (BS, MS, PhD)



RESEARCH CENTERS, LABORATORIES, AND FACILITIES

Arbegast Materials Processing and Joining Lab (AMP)

The AMP Laboratory is a multidisciplinary research facility focused on solving advanced metals and manufacturing challenges through state-of-the-art processing, joining, repair, and additive manufacturing technologies. Researchers develop, analyze, and optimize manufacturing processes and materials systems directly relevant to aerospace, defense, industrial manufacturing, and national security applications.

Antennas & Microwave Sensing Lab

Develops advanced antenna systems, RF technologies, microwave sensing, and electromagnetic solutions for defense, aerospace, communications, and remote sensing applications. Research supports radar systems, wireless communications, electronic warfare, and next-generation sensing technologies.

Center for Solid-State Electric Power Storage

Develops next-generation solid-state batteries, advanced energy storage materials, and scalable manufacturing approaches for transportation, defense, and energy applications.

Composites and Polymer Engineering Lab (CAPE)

A multidisciplinary research and education facility specializing in polymers, composites, advanced manufacturing systems, and pilot-scale processing technologies.

Aerospace & Defense

Composite & Nanocomposite Advanced Manufacturing-Biomaterials Lab (CNAM-Bio)

Supports advanced manufacturing and engineered materials development involving composite and nanocomposite systems.

Cyber-Physical Systems (CPS) Laboratory

Develops integrated hardware and software systems that combine sensing, computing, communications, and autonomous control. Research focuses on robotics, embedded systems, autonomous vehicles, resilient infrastructure, and secure industrial automation.



Engineering and Mining Experiment Station (EMES)

A centralized, multi-user analytical facility providing comprehensive materials characterization, testing, and validation services supporting manufacturing, aerospace, defense, mining, environmental, and advanced materials industries.

Machine Learning & Intelligent Systems (MLIS) Laboratory

Applies artificial intelligence, machine learning, computer vision, and advanced data analytics to solve complex engineering and operational challenges. Research supports autonomous systems, predictive maintenance, decision support, cybersecurity, and intelligent manufacturing.

Quantum Materials Institute

The Institute is a growing research and workforce development initiative focused on advancing quantum computing, secure quantum communications, and next-generation photonics technologies.

Sanford Underground Research Facility (SURF) Collaboration

SURF partnerships support future applications in national security, autonomy, energy, and advanced materials.

Smart Grid and Energy Research Lab

Develops safe, smart, and sustainable power systems through research in renewable energy integration, rural grid development, energy management, smart meter data, and electric arc protection.

2DBEST Center

This lab develops advanced two-dimensional nanomaterials and coatings to control biofilm growth and prevent corrosion.

Virtual Reality Lab

Advances virtual, augmented, and extended reality technologies, with a focus on cybersickness, usability, and XR development.

Aerospace & Defense

INDUSTRY PARTNERS

Army Research Lab, Battelle, Solvus Global, Nalas Engineering, TRI Austin, Ellsworth Air Force Base, VRC Metal Systems, Sanford Underground Research Facility

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Aerospace & Defense

SMART COMPOSITE MATERIALS FOR PROTECTIVE EQUIPMENT

Challenge
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Solution
Researchers in the CAPE Laboratory developed polymer and composite materials with embedded sensing, diagnostic, and communications capabilities for use in protective systems.

Impact
These advanced materials have potential applications in helmets and protective gear for military personnel, first responders, firefighters, and athletes, improving safety through enhanced situational awareness.

NATIONAL SECURITY FELLOWSHIPS THROUGH STRIKEWERX

Challenge
The Department of Defense requires a highly skilled workforce capable of solving complex national security challenges.

Solution
South Dakota Mines became the first expansion site for the Global Strike National Security Fellowship, placing students in year-long defense projects connected to Ellsworth Air Force Base and Air Force Global Strike Command.

Impact
Students gain security clearances, hands-on experience, and direct exposure to defense innovation while strengthening the regional talent pipeline supporting national security missions.

TACKLING THE NATION'S LITHIUM CHALLENGE

Challenge
U.S. demand for lithium is rapidly outpacing domestic production, increasing reliance on foreign sources and creating a need for sustainable technologies and a skilled workforce.

Solution
Through the NSF-funded Li-SMART program, South Dakota Mines provides undergraduates with interdisciplinary research, fieldwork, industry exposure, and professional development focused on lithium mining, recycling, and technology.

Impact
The program strengthens the STEM workforce, advances sustainable critical-mineral technologies, and supports greater U.S. mineral security. Its research may also be applied to other critical minerals.

DEVELOPING THE SPACESUIT OF THE FUTURE

Challenge
Deep-space travel exposes astronauts to dangerous conditions that can negatively affect their health, creating a need for safer and more advanced spacesuits.

Solution
With NASA EPSCoR funding, South Dakota Mines researchers developed a wearable, wireless body-sensor system that can be remotely powered and integrated into a spacesuit.

Impact
The technology could improve real-time health monitoring and astronaut safety during future deep space missions while advancing NASA's human exploration goals.

Biotechnology & Bioengineering

South Dakota Mines integrates engineering, biology, chemistry, materials science, and advanced manufacturing to develop biotechnology solutions for healthcare, sustainable manufacturing, agriculture, energy, and environmental challenges. Through multidisciplinary expertise, specialized laboratories, and pilot-scale biomanufacturing capabilities, SDM supports industry and government partners across the full innovation pipeline—from discovery and development to scale-up and commercialization.

CORE CAPABILITIES & APPLICATIONS

Agricultural & Environmental Biotechnology

Biomass conversion, carbon utilization, waste-to-value technologies, and bioremediation

Applications: Sustainable agriculture, circular economy technologies, and environmental resilience.

Artificial Intelligence for Biotechnology

AI, machine learning, bioinformatics, and biological data analytics

Applications: Drug discovery, process optimization, predictive biology, and precision biotechnology.

Biomanufacturing & Bioprocess Engineering

Fermentation, microbial process development, scale-up, downstream processing, and sustainable bioproduct manufacturing

Applications: Industrial biotechnology, bio-based chemicals, biopolymers, sustainable manufacturing, and commercialization.

Biomaterials & Biomedical Engineering

Drug delivery systems, nanomaterials, stimuli-response biomaterials, tissue engineering materials, biodegradable polymers, and medical biomaterials

Applications: Healthcare technologies, medical devices, precision therapeutics, regenerative medicine, and advanced drug delivery.

Biomedical Nanotechnology & Targeted Therapeutics

Nanomaterials for drug delivery, stimuli-responsive biomaterials, tissue engineering platforms, and advanced therapeutic systems

Applications: Precision medicine, targeted drug delivery, regenerative medicine, cancer therapeutics, and next-generation healthcare technologies.

Enzyme Engineering & Cell-Free Biotechnology

Enzyme discovery and characterization, enzyme biochemistry and biophysics, synthetic biology, pathway reconstruction, cofactor regeneration, and cell-free biomanufacturing

Applications: Sustainable chemicals and materials, carbon conversion, waste valorization, rapid pathway prototyping, and resilient industrial biocatalysis.

Microbiology & Extremophile Research

Environmental microbiology, synthetic biology, microbial engineering, extremophile discovery, microbial genomics, and sustainable bioprocess development

Applications: Novel bioproducts, industrial biotechnology, carbon utilization, environmental solutions, biosecurity, and sustainable manufacturing.

Biotechnology & Bioengineering

ACADEMIC PROGRAMS

Biomedical Engineering (BS, MS, PhD)

Biology (BS)

Chemical Engineering (BS, MS)

Chemical Engineering: Bioprocess and Biochemical Engineering Specialization (BS)

Chemical & Biological Engineering (PhD)

Chemical & Biological Sciences (MS, PhD)

Chemistry (BS)

Civil & Environmental Engineering (BS, MS, PhD)

Computer Engineering (BS)

Computer Science (BS)

Computer Science & Engineering (MS)

Data Science & Engineering (BS, PhD)

Industrial Engineering (BS)

Materials Engineering & Science (MS, PhD)

Mechanical Engineering (BS, MS, PhD)

Metallurgical Engineering (BS)

Nanoscience and Nanoengineering (MS, PhD)

RESEARCH CENTERS, LABORATORIES, & FACILITIES

Biomedical Imaging & Characterization Lab

Provides advanced microscopy, spectroscopy, materials characterization, and biological imaging capabilities supporting biomaterials development, medical devices, nanotechnology, and biomedical engineering research.

Bioinformatics & Computational Biology

CMS advances research in microfluidic Applies artificial intelligence, machine learning, genomic analysis, and computational modeling to biological research, enabling data-driven discovery in biotechnology, precision medicine, and microbial engineering.

Biomaterials Manufacturing Laboratory

Develops biodegradable polymers, smart biomaterials, and advanced manufacturing methods for biomedical devices, tissue engineering, and controlled drug delivery applications.

Carbon Utilization & Industrial Biotechnology

Develops biological systems that convert biomass, agricultural waste, and greenhouse gases into valuable chemicals, biomaterials, and sustainable products supporting the circular bioeconomy.

CellFe Biomanufacturing Lab

CellFe Labs is an enzyme-centered biomanufacturing laboratory specializing in extremophile biology, synthetic biology, and cell-free systems. The lab discovers robust enzymes and pathways from extremophilic and non-model microorganisms, studies how they function, and engineers them into scalable biomanufacturing processes. These technologies support the production of biopolymers, pigments, and biochemicals; conversion of industrial CO into mineral products; and recovery of metals, rare-earth elements, and zeolite materials from industrial wastes.

Center for Microphysiological Systems (CMS)

CMS advances research in microfluidic fabrication, tissue engineering, cell culture, and characterization of soft materials, including rheological, thermal, surface, colloidal, and molecular measurements. CMS sSupports in vitro studies of biomaterials, tissue engineering, regenerative medicine, drug delivery, cancer biology, and biomedical device evaluation.

Cyber-Physical Systems (CPS) Laboratory

Develops integrated hardware and software systems that combine sensing, computing, communications, and autonomous control. Research focuses on robotics, embedded systems, autonomous vehicles, resilient infrastructure, and secure industrial automation.

Biotechnology & Bioengineering

Composite and Nanocomposite Advanced Manufacturing–Biomaterials Center (CNAM-Bio)

CNAM-Bio, a specialized center at the CAPE Lab, supports stepwise bioprocessing scale-up from flask level to 300 L bioreactors together with downstream processing. The Center's current focus is on microbial biopolymer production, and the processing of biopolymer and biocpomposite products.

Computational Materials Modeling & Simulation

Atomistic and molecular modeling, computational quantum chemistry, molecular simulation, and first-principles prediction of advanced materials properties.

Applications: materials discovery and design, property prediction, performance optimization, structure-property analysis, and accelerated development of advanced materials.

Data-Driven Innovations for Health, Technology, and Society Lab

Applies AI and human-computer interaction to analyze public discourse and develop emotion-aware technologies that support older adults' independence and well-being.

Extremophile Research Facilities

Specialized laboratories supporting microbiology, molecular biology, microbial genetics, biochemical analysis, and extremophile research. These facilities enable discovery and development of novel biological systems from some of Earth's most challenging environments.

Machine Learning and Intelligent Systems Lab

Develops advanced methods for combining, analyzing, classifying, and forecasting complex multimodal data across space and time.

MASON Laboratory

Research focused on extremophile biotechnology, sustainable biomanufacturing, carbon-negative technologies, advanced biomaterials, and biomedical applications. Current efforts include development of smart drug-delivery systems, sustainable biomaterials, and technologies that convert biomass and greenhouse gases into valuable products.

Nanoscience and Biomedical Engineering Facilities

Advanced imaging and characterization capabilities supporting biomaterials, cell biology, biomedical engineering, and next-generation healthcare technologies. Researchers integrate nanotechnology, materials engineering, and biological sciences to create innovative biomedical solutions.

nanomaterials and coatings to control biofilm growth and prevent corrosion.

Sanford Underground Research Facility (SURF) Microbiology Research

Unique access to one of the deepest underground laboratories in the United States, supporting research on subsurface microbiology, novel microorganisms, and biological systems adapted to extreme environments.

2DBEST Center

Develops advanced biomaterials, nanomaterials, tissue engineering platforms, and targeted drug delivery systems for healthcare applications.

Virtual Reality Lab

Advances virtual, augmented, and extended reality technologies, with a focus on cybersickness, usability, and XR development.

Biotechnology & Bioengineering

INDUSTRY PARTNERS

Avera Health, Sanford Health, Medgene Labs, Dakota BioWorx, VRC Metal Systems, IdeaChem, POET, B9Creations

CASE STUDIES

SMART BIOMATERIALS FOR PRECISION THERAPEUTICS

Challenge

Many therapies affect healthy tissues, leading to side effects and reduced treatment effectiveness.

Solution

Dr. Tugba Ozdemir's team develops stimuli-responsive biomaterials and targeted drug delivery systems using biomedical engineering, nanotechnology, and materials science.

Impact

This research advances precision medicine by improving therapeutic effectiveness while reducing side effects.

EXTREMOPHILES FOR SUSTAINABLE MANUFACTURING

Challenge

Industry needs more sustainable manufacturing processes that reduce emissions and waste. Conventional carbon-management technologies often require costly separation, purification, and concentration of CO□ before conversion.

Solution

Dr. Tanvi Govil studies microorganisms from extreme environments to identify biological pathways that enable carbon utilization and resilient bioprocesses. This research led to CarbEnZero, a faculty-founded biotechnology company developing carbon-mineralization solutions for industry. Its technology directly processes dilute, impurity-containing industrial flue gas and combines it with alkaline industrial residues to produce carbonate-rich materials for high-strength concrete, reflective paints, and coatings.

Impact

The work supports carbon-negative technologies and the development of sustainable bioproducts and industrial manufacturing processes. CarbEnZero transforms two industrial waste streams—flue gas and alkaline residues—into valuable mineral products without requiring a separate CO2 concentration step, supporting lower-carbon construction, waste reduction, and circular manufacturing.

AI-DRIVEN EXTREMOPHILE ENZYMES FOR INDUSTRY

Challenge

Industries need new enzymes with specialized functions that can operate reliably under harsh manufacturing conditions.

Solution

Dr. Tanvi Govil and the CellFe Biomanufacturing Lab use computational biology and artificial intelligence to search extremophile genomes, predict enzyme functions, and identify or design promising enzyme candidates. Selected enzymes are then produced and experimentally tested for activity, stability, and industrial performance.

Impact

This work is being translated into a South Dakota biotechnology company dedicated to developing novel, robust enzymes for the agriculture, food, chemical, materials, environmental, and biomanufacturing industries.

Biotechnology & Bioengineering

CORN STOVER TO HIGH-VALUE BIOMATERIALS

Challenge
Agricultural residues are often underutilized despite their potential as feedstocks for sustainable manufacturing.

Solution
Researchers at South Dakota Mines, led by Dr. Rajesh Sani and the MASON Laboratory, partnered with Dakota BioWorx to convert corn stover into biodegradable biomaterials with future medical applications.

Impact
The project advances sustainable biomanufacturing, creates new value streams for agricultural producers, and establishes a pathway from laboratory discovery to pilot-scale production within South Dakota.

EXTREMOPHILES FOR FOOD SECURITY AND ANTIFUNGAL DISCOVERY

Challenge
Crop losses caused by fungal pathogens and aflatoxins threaten global food security.

Solution
Through an NSF-supported initiative, researchers led by Drs. Rajesh Sani and Tanvi Govil are using artificial intelligence and extremophile-derived microorganisms to identify compounds capable of inhibiting fungal growth and toxin production.

Impact
The project could improve food safety, protect agricultural productivity, and expand the use of extremophiles as sources of novel bioactive compounds.

SMART BIOMATERIALS FOR PRECISION MEDICINE

Challenge
Conventional drug delivery methods often result in systemic side effects and reduced therapeutic efficiency

Solution
Dr. Tugba Ozdemir's research focuses on developing stimuli-responsive biomaterials and advanced drug delivery platforms that release therapeutics at specific locations within the body.

Impact
These technologies have the potential to improve patient outcomes while reducing treatment toxicity, supporting advances in precision medicine and regenerative therapies.

PILOT-SCALE BIOMANUFACTURING THROUGH CNAM-BIO

Challenge
Many biotechnology innovations fail because they cannot successfully transition from laboratory experiments to commercial production.

Solution
South Dakota Mines researchers are developing biodegradable "smart" carriers capable of delivering therapeutic agents directly to tumors. The work adapts biopolymer platforms originally developed for sustainability applications to address biomedical challenges.

Impact
By bridging the gap between discovery and commercialization, CNAM-Bio accelerates technology deployment and supports the development of South Dakota's bioeconomy.

CASE STUDIES

CANCER THERAPEUTICS USING BIOPOLYMER PLATFORMS

Challenge
Cancer therapies often affect healthy tissues, causing significant side effects.

Solution
South Dakota Mines researchers are developing biodegradable “smart” carriers capable of delivering therapeutic agents directly to tumors. The work adapts biopolymer platforms originally developed for sustainability applications to address biomedical challenges.

Impact
The project demonstrates how innovations originating in industrial biotechnology can be translated into next-generation healthcare solutions.



Critical Minerals & Materials

South Dakota Mines delivers expertise across the entire critical minerals and materials value chain, from resource discovery and extraction to processing, manufacturing, recycling, and sustainable resource management. Through industry-aligned academic programs and applied research, the university helps build resilient domestic supply chains and the workforce needed to support national security and emerging technologies.

CORE CAPABILITIES & APPLICATIONS

Advanced Materials & Manufacturing

Additive manufacturing, cold spray technologies, surface engineering, materials joining, polymer composites and nanocomposites, and process development

Applications: aerospace and defense components, industrial manufacturing, sustainment and repair, high-performance materials.

Battery Materials & Energy Storage

Battery materials development, energy storage technologies, materials characterization, recycling processes

Applications: electric vehicles, grid-scale energy storage, renewable energy systems, energy security.

Biotechnology for Critical Mineral Recovery

Biomining, bioleaching, metal-tolerant microorganisms, microbial and enzyme-based separations, and recovery of critical minerals from unconventional resources and industrial wastes

Applications: Rare-earth element recovery, mine-waste valorization, coal-ash processing, selective metal recovery, and sustainable mineral production.

Chemical & Biological Processing for Critical Minerals

Applied chemistry, biotechnology, microbial engineering, metal extraction and recovery, selective separations, bio-inspired materials synthesis, resource valorization, process optimization, and sustainable metallurgical technologies

Applications: rare earth recovery, lithium and critical battery materials, mine waste remediation, resource-efficient extraction, secondary resource utilization, clean energy supply chains, and advanced materials manufacturing.

Computational Materials Modeling & Simulation

Atomistic and molecular modeling, computational quantum chemistry, molecular simulation, and first-principles prediction of advanced materials properties

Applications: materials discovery and design, property prediction, performance optimization, structure-property analysis, and accelerated development of advanced materials.

Critical Minerals Exploration & Resource Assessment

Geological mapping, resource characterization, geospatial analysis, ore deposit modeling, mineral exploration technologies

Applications: critical mineral discovery, resource evaluation, strategic mineral development, mine planning, domestic supply chain development.

Critical Minerals Recycling & Circular Economy

Resource recovery, recycling technologies, waste stream valorization, sustainability assessment

Applications: battery recycling, secondary resource recovery, supply chain resilience, environmental sustainability, and tailings reuse/recovery.

Energetic Materials, Protective Systems & Resilient Infrastructure

Energetic materials, combustion science, explosives characterization, blast effects, protective materials, resilient concrete systems, infrastructure durability, and extreme-environment performance

Applications: munitions and energetics development, propulsion and combustion systems, blast-resistant structures, military installation resilience, airfield and transportation infrastructure, critical infrastructure protection, expeditionary construction, and infrastructure performance in extreme operational environments.

Critical Minerals & Materials

Extractive Metallurgy & Materials Production

Metal extraction (hydrometallurgy, pyrometallurgy), refining, alloy development, powder metallurgy, high-temperature processing

Applications: strategic metals production, defense materials, advanced manufacturing feedstocks, specialty alloys.

Materials Characterization & Performance Testing

Microscopy, spectroscopy, thermal analysis, mechanical testing, corrosion evaluation, failure analysis

Applications: product qualification, process verification, lifecycle assessment, materials validation.

Mining & Mine Design

Mine design, mine ventilation, geomechanics, mine optimization, environmental stewardship, mine health and safety

Applications: surface and underground mining operations, and sustainable mining practices.

Mineral Processing & Beneficiation

Comminution, classification, concentration (flotation, gravity separation, magnetic separation, electrostatic separation), process optimization

Applications: critical mineral processing, concentrate production, value-added mineral products.

Quantum Information Science & Emerging Technologies

Quantum materials, quantum networking, secure communications, photonics, advanced computing technologies

Applications: next-generation computing, secure communications, sensing technologies, advanced defense systems, future digital infrastructure.

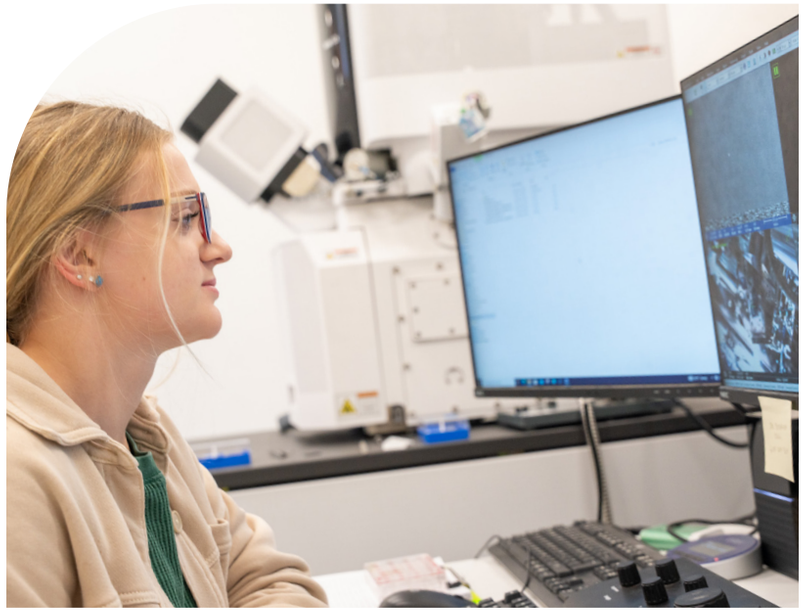
Water, Environmental & Sustainable Resource Management

Water treatment, mine reclamation, environmental monitoring, resource stewardship

Applications: responsible resource development, regulatory compliance, environmental remediation, sustainable operations.

ACADEMIC PROGRAMS

Biology (BS)
Chemical & Biological Sciences (MS, PhD)
Chemical Engineering (BS, MS)
Chemical & Biological Engineering (PhD)
Chemistry (BS)
Civil & Environmental Engineering (BS, MS, PhD)
Computer Engineering (BS)
Computer Science (BS)
Computer Science & Engineering (MS)
Data Science & Engineering (BS, PhD)
Geological Engineering (BS)
Geology (BS)
Geology & Geological Engineering (MS, PhD)
Geology, Geological Engineering, & Mining Engineering (PhD)
Industrial Engineering (BS)
Materials Engineering & Science (MS, PhD)
Mechanical Engineering (BS, MS, PhD)
Metallurgical & Ceramic Engineering (BS)
Mining Engineering & Management (BS, MS, PhD)



Critical Minerals & Materials

RESEARCH CENTERS, LABORATORIES, AND FACILITIES

Arbegast Materials Processing & Joining Lab (AMP)

The AMP Laboratory develops advanced manufacturing and materials processing technologies including cold spray, additive manufacturing, materials joining, and surface engineering that support strategic materials production, repair, sustainment, and defense applications.

Center for Solid-State Electric Power Storage

Develops next-generation solid-state batteries, advanced energy storage materials, green recycling of critical metals, and scalable manufacturing approaches for transportation, defense, and energy applications.

Center for Sustainable Solutions

The Center for Sustainable Solutions develops innovative technologies and strategies for resource recovery, water management, environmental stewardship, carbon utilization, and circular economy solutions that support long-term critical mineral and materials supply chain resilience.

CellFe Biomanufacturing Lab

The CellFe Biomanufacturing Lab applies extremophile microbiology, enzyme biotechnology, and bioprocess engineering to critical-mineral recovery. The lab studies metal-tolerant microorganisms from deep-subsurface and other extreme environments, including microbial resources associated with the Sanford Underground Research Facility, to identify biological mechanisms for metal mobilization, binding, and selective recovery. Current research focuses on developing microbial and enzyme-based technologies to recover rare-earth elements and other critical metals from coal ash, mine wastes, and unconventional mineral resources.

Composites and Polymer Engineering Lab (CAPE)

CAPE supports the development and scale-up of advanced materials, polymers, composites, and manufacturing technologies that complement critical minerals processing and value-added materials production.

Engineering and Mining Experiment Station (EMES)

This is a centralized, multi-user analytical facility providing comprehensive testing, characterization, and research services for mining, minerals, metallurgy, advanced materials, environmental systems, and industrial applications.

Geochemistry Laboratories

The Geochemistry Laboratories provide advanced chemical and isotopic analysis of rocks, minerals, soils, water, and other geologic materials to support mineral exploration, resource characterization, environmental monitoring, and critical mineral development. Research helps industry evaluate ore deposits, optimize resource recovery, and ensure responsible resource management.

GRC Center for Electrochemical Energy Storage (CEES)

Develops advanced energy storage materials for next-generation energy storage, green recycling of critical battery metals, lithium extraction from geothermal brines and spodumenes, and scalable battery manufacturing for transportation, defense, and industrial applications.

Hydrometallurgy/Pyrometallurgy Laboratory

The lab develops chemical extraction and recovery processes for critical minerals and metals from ores, concentrates, recycled materials, and unconventional feedstocks. Research supports rare earth element recovery, battery materials, strategic metals production, and sustainable resource recovery.

Critical Minerals & Materials

Machine Shop & Prototype Fabrication Facility
Precision machining, custom tooling, instrumentation fabrication, prototype development, and research equipment support.

Mineral Processing Laboratory

This lab provides testing and process development for crushing, grinding, flotation, gravity separation, and mineral beneficiation. Research supports critical mineral recovery, process optimization, technology scale-up, and the commercialization of innovative mineral processing solutions.

Mine Optimization Laboratory
From operations research to machine learning applications, the Mine Optimization Laboratory works to develop solutions for challenges at the mine planning and operational stages. Focus areas include mine scheduling optimization, safety and health integration, predictive analytics, and economic optimization.

Mine Ventilation Laboratory
The Mine Ventilation Laboratory investigates airflow, air quality, and environmental conditions in underground mines and other subsurface facilities. Research supports the design of ventilation systems, control of respirable dust, diesel emissions, gases, and heat, as well as mine emergency preparedness, ventilation-on-demand, and the integration of advanced sensing and modeling technologies. The laboratory develops innovative solutions that improve worker health and safety, increase energy efficiency, and enable the sustainable extraction of mineral resources.

Mining Hub

The Mining Hub brings together multidisciplinary expertise in mineral exploration, mining, mineral processing, extractive metallurgy, and sustainable resource development to support applied research, workforce development, and industry collaboration across the critical minerals value chain.

Powder Metallurgy Laboratory
The Powder Metallurgy Laboratory develops advanced metal powders, alloys, and powder processing technologies for high-performance manufacturing applications. Research supports additive manufacturing, defense materials, lightweight components, and next-generation materials for aerospace, energy, and industrial markets.

Pyrometallurgy Laboratory
The Pyrometallurgy Laboratory investigates high-temperature extraction, refining, and processing technologies for metals and advanced materials. Research supports critical mineral processing, alloy development, metal recycling, and the production of high-purity materials for defense, manufacturing, and energy applications.

Rock Mechanics & Geomechanics Laboratories

The Rock Mechanics & Geomechanics Laboratories investigate the physical and mechanical behavior of rock and geologic materials under a range of environmental and loading conditions. Research supports mine design, underground construction, tunneling, slope stability, subsurface energy development, and the safe, efficient extraction of critical mineral resources.

Quantum Materials Institute
Advances research in quantum computing, secure quantum communications, photonics, quantum materials, and workforce development for emerging technology sectors.

Smart Grid and Energy Research Lab
Develops safe, smart, and sustainable power systems through research in renewable energy integration, rural grid development, energy management, smart meter data, and electric arc protection.

Virtual Reality Lab
Advances virtual, augmented, and extended reality technologies, with a focus on cybersickness, usability, and XR development.

Critical Minerals & Materials

INDUSTRY PARTNERS

RESPEC, Caterpillar, VRC Metal Systems, Solvus Global, RPM Innovations, Falcon Plastics, Raven, Nucor, Dakota Gold, Hexagon, Cargill, Coeur Wharf, Pete Lien & Sons, Peabody, Prairie Eagle Mining, Agnico Eagle, Nevada Gold Mines, Freeport McMoran, Nissan, Honda, Nth Cycle, Critical Resources

CASE STUDIES

EXTENDING THE SERVICE LIFE OF B-1 BOMBERS THROUGH COLD SPRAY REPAIR

Challenge

The U.S. Air Force faced costly and time-intensive repairs to aging B-1B Lancer aircraft. Damaged fuselage panels often required replacement, reducing aircraft availability and increasing sustainment costs

Solution

Researchers and students from South Dakota Mines collaborated with Air Force personnel to apply cold spray technology, an advanced additive manufacturing process that deposits metal particles at high velocity to restore damaged components. The technology was used to repair broken fuselage hinge assemblies and aircraft skin components rather than replacing them entirely.

Impact

- Reduced repair costs by approximately $225,000 per aircraft panel repaired.
- Improved aircraft readiness by returning assets to service more quickly.
- Demonstrated a scalable sustainment approach that supports Department of Defense modernization efforts and strengthens domestic advanced manufacturing capabilities.

RECOVERING RARE EARTH ELEMENTS FROM COAL MINE WASTE

Challenge

The United States remains heavily dependent on foreign sources for rare earth elements used in defense systems, renewable energy technologies, and advanced electronics. At the same time, coal mine waste presents ongoing environmental liabilities.

Solution

South Dakota Mines researchers developed approaches to extract valuable rare earth elements from coal waste streams, transforming previously discarded material into a potential domestic resource. The work combines expertise in extractive metallurgy, geochemistry, and sustainable resource recovery.

Impact

- Created opportunities to convert environmental waste into strategic mineral resources.
- Advanced technologies that could reduce U.S. dependence on overseas supply chains.
- Supported federal priorities focused on strengthening domestic critical mineral production while improving environmental stewardship.

ADVANCING NEXT-GENERATION BATTERY TECHNOLOGIES

Challenge

Growing demand for electric vehicles and renewable energy systems requires safer, more efficient, and longer-lasting battery technologies. The United States also faces vulnerabilities in battery supply chains.

Solution
South Dakota Mines established research centers focused on advanced battery materials, energy storage technologies, and materials characterization. Researchers investigate novel battery chemistries, materials performance, and pathways to improve storage capacity and durability.

Impact
- Expanded regional and national capabilities in battery innovation.
- Contributed to workforce development in a rapidly growing sector critical to energy security.
- Positioned South Dakota as a participant in the emerging domestic battery ecosystem.

BUILDING A CIRCULAR ECONOMY THROUGH CRITICAL MINERALS RECOVERY

Challenge
Demand for critical minerals continues to increase, while traditional mining faces environmental, economic, and geopolitical challenges. Recovering valuable materials from secondary sources is becoming increasingly important.

Solution
Researchers at South Dakota Mines are investigating methods to recover critical materials from mine waste and other unconventional feedstocks, applying expertise in mineral processing, extractive metallurgy, and sustainability assessment.

Impact
- Supports development of resilient domestic supply chains.
- Reduces reliance on virgin resource extraction.
- Aligns with growing federal initiatives prioritizing critical mineral recovery from waste materials.

DEVELOPING RESILIENT INFRASTRUCTURE FOR EXTREME ENVIRONMENTS

Challenge
Military installations and critical infrastructure must withstand blast events, severe environmental conditions, and long service lives while maintaining operational capability.

Solution
South Dakota Mines researchers investigate high-performance materials, protective systems, resilient concrete technologies, and infrastructure durability to improve structural performance under extreme conditions.

Impact
- Enhances infrastructure resilience for defense and civilian applications.
- Supports development of blast-resistant and hardened facilities.
- Advances materials solutions that improve safety and reduce lifecycle costs.

DEVELOPING SUSTAINABLE CARBON MINERALIZATION TECHNOLOGIES

Challenge
Industrial emissions and mining operations require technologies that reduce carbon emissions while creating beneficial products.

Solution
Researchers developed mineral carbonation technologies that permanently capture carbon dioxide in mineral-based materials while producing useful construction materials and industrial products.

Impact
- Supports carbon utilization and decarbonization.
- Creates value-added products from industrial waste streams.
- Improves sustainability of mining and manufacturing.
- Expands opportunities for circular economy technologies.

Critical Minerals & Materials

IMPROVING RECOVERY OF CRITICAL MINERALS THROUGH ADVANCED MINERAL PROCESSING

Challenge
Many domestic ore bodies contain valuable critical minerals that are difficult to economically recover using conventional processing methods.

Solution
Researchers optimized crushing, grinding, flotation, gravity separation, and beneficiation techniques to improve recovery rates while reducing processing costs.

Impact
- Increased mineral recovery efficiency.
- Reduced operating costs.
- Improved commercial feasibility of domestic deposits.
- Supported development of resilient mineral supply chains.

ENABLING UNDERGROUND RESEARCH AND SUBSURFACE ENGINEERING

Challenge
Understanding rock behavior at depth is critical for mining, underground construction, geothermal energy, and national research infrastructure.

Solution
South Dakota Mines researchers leverage expertise in rock mechanics, geomechanics, geology, and underground engineering while collaborating on projects at the nearby Sanford Underground Research Facility.

Impact
- Improved underground excavation design.
- Enhanced mine safety.
- Supported major national scientific research infrastructure.
- Expanded knowledge of subsurface engineering.

USING DEEP-SUBSURFACE MICROBES TO RECOVER RARE EARTH ELEMENTS FROM COAL ASH

Challenge
Coal ash contains rare-earth elements and other critical metals, but they are trapped within a complex mineral matrix. Conventional recovery methods can require concentrated chemicals, high energy inputs, and multiple processing steps.

Solution
Dr. Tanvi Govil and the CellFe Biomanufacturing Lab are developing a biological process specifically for critical-metal recovery from coal ash. After soluble calcium is removed, the remaining ash is treated using metal-tolerant microorganisms and enzymes from deep-subsurface and other extreme environments, including microbial resources associated with the Sanford Underground Research Facility. These biological systems are evaluated for their ability to release and selectively recover rare-earth elements and other critical metals from the ash.

Impact
- Applies South Dakota's unique deep-subsurface microbial resources to a critical-minerals challenge.
- Converts coal ash from an industrial waste into a potential domestic source of rare-earth elements.
- Develops a lower-severity biological alternative to conventional chemical extraction.
- Supports domestic critical-mineral supply chains and new waste-to-resource technologies.

Healthcare & Healthcare Support

South Dakota Mines delivers engineering, technology, manufacturing, environmental, and data-driven solutions for healthcare systems, medical manufacturers, public health organizations, and healthcare technology companies. Through research, workforce development, and industry partnerships, the university advances healthcare innovation, infrastructure, medical products, and public health outcomes.

CORE CAPABILITIES & APPLICATIONS

Advanced Materials & Biomaterials

Metals, polymers, composites, ceramics, coatings, nanomaterials, surface engineering

Applications: implants, prosthetics, medical devices, surgical instruments, antimicrobial surfaces, healthcare equipment, regenerative medicine technologies, wound healing materials, tissue engineering scaffolds, targeted drug delivery systems, and cancer treatment technologies.

Biomedical Sciences

Biochemistry, molecular and cellular biology, genetic analysis, biomolecular characterization, systems biology, biotechnology, analytical biosciences, and data-driven health research

Applications: early disease diagnosis, precision health, therapeutic target discovery, personalized medicine, healthcare technologies, clinical research, population health, and advanced biomedical solutions.

Biotechnology & Bioprocess Systems

Microbiology, bioprocessing, molecular analysis, fermentation technologies

Applications: pharmaceutical manufacturing, biologics production, diagnostics development, biotechnology commercialization, therapeutic research.

Computational Materials Modeling & Simulation

Atomistic and molecular modeling, computational quantum chemistry, molecular simulation, and first-principles prediction of advanced materials properties

Applications: materials discovery and design, property prediction, performance optimization, structure-property analysis, and accelerated development of advanced materials.

Environmental Health & Water Quality

Water treatment, contaminant monitoring, environmental remediation, sustainability technologies

Applications: drinking water safety, PFAS mitigation, healthcare facility infrastructure, public health protection, environmental monitoring, community resilience.

Healthcare Data Analytics & Artificial Intelligence

Data science, machine learning, predictive analytics, modeling and simulation, cyber-physical systems

Applications: healthcare operations optimization, patient outcome analysis, medical imaging analysis, predictive maintenance, digital health technologies, decision-support systems.

Healthcare Infrastructure & Facility Systems

Energy systems, infrastructure engineering, sustainability, resilience planning

Applications: hospitals, healthcare facilities, emergency preparedness, resilient utility systems, sustainable operations, facility modernization.

Materials Characterization & Testing

Microscopy, spectroscopy, chemical analysis, thermal analysis, mechanical testing

Applications: medical product validation, quality assurance, regulatory testing support, failure analysis, product development.

Medical Devices & Healthcare Technologies

Sensors, instrumentation, embedded systems, electronics, software development, advanced manufacturing

Applications: diagnostic equipment, patient monitoring systems, wearable technologies, rehabilitation devices, telehealth systems, medical device prototyping and testing.

Healthcare & Healthcare Support

Medical Manufacturing & Product Development

Additive manufacturing, process optimization, automation, quality systems, product development

Applications: medical device manufacturing, rapid prototyping, healthcare supply chain support, product validation, technology commercialization.

Occupational Health & Workplace Safety

Industrial engineering, ergonomics, process improvement, risk assessment

Applications: healthcare workforce safety, workplace design, injury prevention, operational efficiency, healthcare logistics and workflow optimization.

Pharmaceutical Compound Discovery & Development

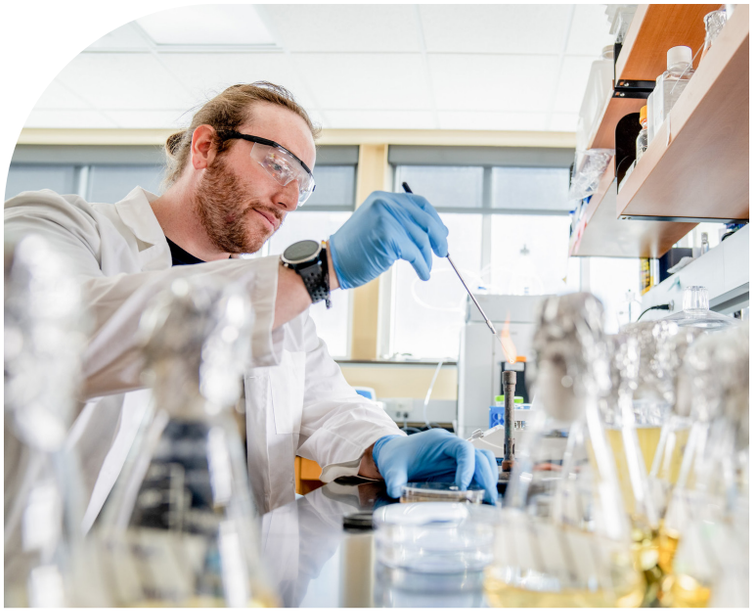
Natural-product libraries, bioactive-compound screening, chemical profiling, compound identification, dose-response testing, lead selection, and early-stage pharmaceutical development

Applications: New antibiotics, treatments for drug-resistant infections, antifungal medicines, anti-infective compounds, therapeutic natural products, and pharmaceutical lead development.

Regenerative Medicine, Tissue Engineering & Cancer Research

Biomaterials, tissue engineering, drug delivery systems, bioactive polymers, cancer biology, molecular therapeutics, nanomedicine, tumor microenvironment research, regenerative medicine

Applications: wound healing technologies, tissue regeneration, advanced wound dressings, biomaterial scaffolds, targeted drug delivery, cancer diagnostics, cancer therapeutics, precision medicine, tumor modeling, translational biomedical research, and next-generation treatment development.



ACADEMIC PROGRAMS

Biology (BS)

Biomedical Engineering (BS, MS, PhD)

Chemical & Biological Sciences (MS, PhD)

Chemical Engineering (BS, MS)

Chemical Engineering: Bioprocess and Biochemical Engineering Specialization (BS)

Chemical & Biological Engineering (PhD)

Chemical & Biological Sciences (MS, PhD)

Chemistry (BS)

Civil & Environmental Engineering (BS, MS, PhD)

Computer Engineering (BS)

Computer Science (BS)

Computer Science & Engineering (MS)

Data Science & Engineering (BS, PhD)

Electrical Engineering (BS, MS, PhD)

Industrial Engineering & Engineering Management (BS, MS)

Materials Engineering & Science (MS, PhD)

Mechanical Engineering (BS, MS, PhD)

Physics (BS, MS, PhD)

Pre-Professional Health Sciences (BS)

Healthcare & Healthcare Support

RESEARCH CENTERS, LABORATORIES, AND FACILITIES

Arbegast Materials Processing & Joining Lab (AMP)

Develops advanced manufacturing, additive manufacturing, coatings, and materials processing technologies applicable to medical devices, implants, healthcare equipment, and precision manufacturing.

Bioinformatics & Computational Biology Laboratory

Integrates biological data analysis, computational biology, genomics, machine learning, and predictive modeling to support biomedical research, diagnostics, and precision healthcare.

Biochemical Engineering Laboratory

Develops bioprocesses for microbial cultivation, fermentation, bioproduct development, and sustainable biomanufacturing. Research supports pharmaceutical production, industrial biotechnology, biologics, and healthcare manufacturing.

Biomedical Computation & Modeling Laboratory

Applies high-performance computing, computational modeling, artificial intelligence, and data analytics to accelerate biomedical discovery, molecular simulation, and precision medicine research.

Cell Culture Lab

Supports in vitro studies of biomaterials, tissue engineering, regenerative medicine, drug delivery, cancer biology, and biomedical device evaluation.



CellFe Biomanufacturing Lab

CellFe Labs is developing a pharmaceutical discovery platform based on bioactive compounds obtained from extreme environments. The lab builds and screens compound libraries, identifies active molecules, and evaluates their potency, selectivity, and therapeutic potential. Current efforts focus on finding compounds active against antibiotic-resistant bacteria and harmful fungi, while building a broader pipeline for discovering new pharmaceutical candidates for human health.

Center for Microphysiological Systems (CMS)

CMS advances research in microfluidic fabrication, tissue engineering, cell culture, and characterization of soft materials, including rheological, thermal, surface, colloidal, and molecular measurements. CMS supports in vitro studies of biomaterials, tissue engineering, regenerative medicine, drug delivery, cancer biology, and biomedical device evaluation.

Healthcare & Healthcare Support

Composite & Nanocomposite Advanced Manufacturing – Biomaterials Lab (CNAMBio)

Supports development of biomaterials, nanocomposites, advanced polymers, and engineered materials systems for healthcare and medical applications.

Composites & Polymer Engineering Lab (CAPE)

Conducts research in polymers, composites, processing technologies, and pilot-scale manufacturing relevant to healthcare products and medical manufacturing.

Data-Driven Innovations for Health, Technology, and Society Lab

Applies AI and human-computer interaction to analyze public discourse and develop emotion-aware technologies that support older adults' independence and well-being.

Engineering & Mining Experiment Station (EMES)

A centralized analytical facility providing advanced materials characterization, microscopy, spectroscopy, chemical analysis, and testing services that support healthcare technologies, environmental health, medical manufacturing, and product development.

Machine Learning and Intelligent Systems Lab

Develops advanced methods for combining, analyzing, classifying, and forecasting complex multimodal data across space and time.



Molecular Biology & Biotechnology Laboratories

Support research in microbiology, biotechnology, molecular systems, and bioprocessing relevant to healthcare and life science industries.

Virtual Reality Lab

Advances virtual, augmented, and extended reality technologies, with a focus on cybersickness, usability, and XR development.

Healthcare & Healthcare Support

INDUSTRY PARTNERS

GE Healthcare, Inanovate, OmegaQuant, Carbon EnZero, Dakota BioWorx, Falcon Plastics, Monument Health, Sanford Research, South Dakota BioTech

CASE STUDIES

SMART BIOMATERIALS FOR PRECISION THERAPEUTICS

Challenge
Conventional treatments often affect healthy tissues, reducing effectiveness and increasing side effects.

Solution
Researchers led by Dr. Tugba Ozdemir are developing stimuli-responsive biomaterials and targeted drug delivery systems designed to deliver therapeutics more precisely.

Impact
This research advances precision medicine approaches that may improve patient outcomes while reducing treatment-related complications.

DOE-FUNDED BIOMEDICAL COMPUTATION RESEARCH

Challenge
Biomedical researchers need more sophisticated computational tools to analyze complex biological systems and accelerate discovery.

Solution
South Dakota Mines researchers secured a $1.49 million Department of Energy award to develop advanced computational approaches supporting biomedical applications.

Impact
The project strengthens interdisciplinary collaboration between engineering and healthcare researchers while expanding South Dakota's biomedical research capabilities.

EXTREMOPHILES FOR SUSTAINABLE HEALTHCARE APPLICATIONS

Challenge
Vaccines, protein therapeutics, and other biologic medicines can lose activity during drying, storage, and temperature changes. Their dependence on continuous refrigeration increases healthcare costs and limits access in rural and remote communities.

Solution

Dr. Tanvi Govil and collaborators are investigating exopolysaccharides produced by microorganisms from extreme environments as sustainable stabilizing materials for biologic medicines. These naturally protective materials are being developed into pharmaceutical formulations that could help preserve sensitive proteins and vaccines during processing, storage, and transportation.

Impact
The research could extend the shelf life of biologic medicines, reduce dependence on refrigerated transportation, and improve access to healthcare products in remote locations. It also creates a novel pharmaceutical application for extremophile-derived materials and supports more sustainable manufacturing of vaccines and protein therapeutics.

EXTREMOPHILE-DERIVED COMPOUNDS TO CONTROL HARMFUL FUNGI AND AFLATOXINS

Challenge
Aflatoxins produced by harmful fungi can contaminate food and create serious human-health risks, including an increased risk of liver cancer. Existing control methods do not always prevent both fungal growth and toxin production.

Healthcare & Healthcare Support

Solution
Through an NSF-supported project, Drs. Rajesh Sani and Tanvi Govil have established a pharmaceutical-style discovery pipeline using bioactive compounds produced by microorganisms from extreme environments. The team has created a collection of extremophile-derived metabolites and a screening system that separately measures inhibition of fungal growth and suppression of aflatoxin production. Chemical profiling and AI-assisted analysis are used to identify and prioritize the active compounds responsible for these effects.

Impact
- Creates specific antifungal and antitoxin compound leads from an underexplored natural source.
- Addresses both fungal growth and aflatoxin production rather than treating them as the same problem.
- Establishes a reusable compound-discovery and screening platform for pharmaceutical research.
- Supports development of new interventions that protect human health and food safety.
- Provides a foundation for future screening against drug-resistant fungi and other healthcare targets.

BIOMATERIALS FROM AGRICULTURAL FEEDSTOCKS

Challenge
Traditional healthcare materials often rely on petroleum-derived inputs and resource-intensive manufacturing methods.

Solution
Researchers associated with CNAM-Bio and Dakota BioWorx are developing technologies that convert agricultural byproducts into high-value biomaterials.

Impact
The work creates opportunities for more sustainable healthcare products while strengthening South Dakota's emerging bioeconomy.

PFAS RESEARCH TO PROTECT PUBLIC HEALTH

Challenge
Communities across the country face concerns regarding PFAS contamination and its implications for long-term health.

Solution
South Dakota Mines researchers are advancing analytical methods and treatment approaches to better understand and address PFAS contamination in environmental systems.

Impact
The research supports evidence-based decision-making to protect drinking water quality and improve public health outcomes.

ADVANCING GERMANIUM DETECTORS FOR PHYSICS AND MEDICAL IMAGING

Challenge
Advanced physics research and precision medical imaging require highly sensitive detectors capable of identifying faint radiation signals with exceptional accuracy.

Solution
Through the NSF-funded Ge-STAR initiative, South Dakota Mines is combining germanium detector testing, advanced modeling, AI, and machine learning to improve detector sensitivity and imaging performance.

Impact
The research could advance dark matter and neutrino experiments, improve medical imaging and diagnosis, prepare students for high-tech careers, and support industry growth in South Dakota.

Information Technology

South Dakota Mines is a STEM-focused research university providing industry and government partners with expertise in cybersecurity, artificial intelligence, data analytics, software engineering, autonomous systems, and advanced computing. The university combines applied research with workforce development to advance innovation and meet evolving technology needs.

CORE CAPABILITIES & APPLICATIONS

Artificial Intelligence, Machine Learning & Data Analytics

Machine learning, predictive analytics, computer vision, deep learning, natural language processing, data engineering

Applications: decision support systems, predictive maintenance, intelligent automation, anomaly detection.

Artificial Intelligence for Biotechnology

Computational biology, microbial genome mining, protein-function prediction, AI-guided enzyme design, biological data integration, and predictive bioprocess modeling

Applications: Novel enzyme discovery, synthetic biology, cell-free biomanufacturing, sustainable product development, agricultural biotechnology, environmental biotechnology, and industrial process optimization.

Cybersecurity & Secure Systems

Cyber defense, network security, secure software development, cyber-physical systems security, digital forensics, risk assessment

Applications: critical infrastructure protection, defense systems security, industrial control systems, threat detection, secure communications, cyber resilience.

Data Science & Advanced Computing

Big data analytics, high-performance computing, statistical modeling, simulation and optimization, data visualization

Applications: scientific computing, digital engineering, operational analysis, logistics optimization, research computing, complex systems modeling.

Autonomous Systems, Robotics & Intelligent Control

Autonomous vehicles, robotics, sensor integration, control systems, AI-enabled autonomy, cyber-physical systems

Applications: unmanned systems, autonomous operations, industrial automation, infrastructure monitoring, defense platforms, smart manufacturing.

Internet of Things (IoT) & Smart Systems

Connected devices, embedded systems, wireless communications, sensor networks, edge computing

Applications: smart infrastructure, industrial monitoring, environmental sensing, asset tracking, predictive maintenance, remote operations.

Software Engineering & Digital Transformation

Software design, application development, cloud computing, systems integration, digital engineering

Applications: enterprise modernization, mission-critical software, workflow automation, digital twins, technology commercialization, operational efficiency.

Quantum Information Science & Emerging Technologies

Quantum materials, quantum networking, secure communications, photonics, advanced computing technologies

Applications: next-generation computing, secure communications, sensing technologies, advanced defense systems, future digital infrastructure.

Modeling, Simulation & Decision Support

Computational modeling, optimization, digital simulations, systems engineering, operations research

Applications: mission planning, supply chain analysis, resource allocation, infrastructure planning, manufacturing optimization, defense readiness.

Information Technology

ACADEMIC PROGRAMS

Chemical Engineering (BS, MS)

Chemical and Biological Engineering (PhD)

Computer Engineering (BS)

Computer Science (BS)

Computer Science & Engineering (MS)

Data Science & Engineering (BS, PhD)

Electrical Engineering (BS, MS, PhD)

Industrial Engineering & Engineering Management (BS, MS)

Mathematics (BS)

Mechanical Engineering (BS, MS, PhD)

Nanoscience and Nanoengineering (MS, PhD)

Physics (BS, MS, PhD)

RESEARCH CENTERS, LABORATORIES, AND FACILITIES

Antennas & Microwave Sensing Laboratory

Develops advanced sensing technologies, wireless communications systems, radar applications, remote sensing, and electromagnetic technologies for defense, aerospace, and commercial applications.

CellFe Biomanufacturing Lab

CellFe Labs is developing an AI-enabled digital platform and physical collection of microorganisms from extreme environments. By connecting environmental, genomic, protein, and biological pathway data, the platform will help identify gene functions, discover enzymes, and develop microbial solutions for agriculture, manufacturing, environmental protection, and other industries.

Cyber-Physical Systems Laboratory

Research intelligent systems that integrate computing, communications, sensing, and control. Faculty and students develop solutions involving autonomous systems, robotics, smart infrastructure, and industrial automation.

Data Science & Engineering Research Laboratories

Develop advanced methods in artificial intelligence, machine learning, data engineering, visualization, predictive analytics, and computational modeling to solve complex engineering, scientific, healthcare, and national security challenges.

Human-Machine Systems Laboratory

Investigates how people interact with intelligent systems to improve decision-making, autonomy, and operational performance. Research supports command and control, human-AI teaming, robotics, advanced manufacturing, and defense operations.

Machine Learning and Intelligent Systems (MLIS) Laboratory

Conducts research in machine learning, artificial intelligence, computer vision, data analytics, predictive modeling, and intelligent decision-making systems.

Robotics Integration Laboratory

Designs, builds, and evaluates robotic systems that integrate advanced sensing, control, automation, and artificial intelligence. Research supports industrial automation, autonomous operations, advanced manufacturing, and defense applications.

Quantum Materials Institute

Advances research in quantum computing, secure quantum communications, photonics, quantum materials, and workforce development for emerging technology sectors.

Sanford Underground Research Facility (SURF) Collaboration

Supports advanced computing, secure communications, quantum science, data analytics, and national security research through collaborative projects and access to unique research infrastructure.

Smart Grid and Energy Research Lab

Develops safe, smart, and sustainable power systems through research in renewable energy integration, rural grid development, energy management, smart meter data, and electric arc protection.

Virtual Reality Lab

Advances virtual, augmented, and extended reality technologies, with a focus on cybersickness, usability, and XR development.

INDUSTRY PARTNERS

Daktronics, Raven, Aerostar, Caterpillar, Hexagon Mining, Midland Scientific

CASE STUDIES

AI-DRIVEN SUPPLY CHAIN OPTIMIZATION

Challenge

Laboratory supply distributors face significant uncertainty in inventory management due to fluctuating demand, supply chain disruptions, labor shortages, and global events. Overstocking increases costs, while stockouts can delay critical research and industrial operations.

Solution

A multidisciplinary senior design team from South Dakota Mines partnered with Midland Scientific Inc. (MSI) to develop artificial intelligence software capable of forecasting product demand. Using machine learning models and predictive analytics, students analyzed historical inventory data to identify trends and improve inventory planning.

Impact

- Improved forecasting accuracy for thousands of products.
- Reduced reliance on manual inventory analysis.
- Enhanced the ability of supply chain managers to anticipate customer needs.
- Provided students with hands-on experience applying AI to commercial business challenges.

ARTIFICIAL INTELLIGENCE FOR CLEAN ENERGY MANUFACTURING

Challenge

Drying biomass feedstocks is one of the most energy-intensive steps in renewable fuel production, accounting for up to 70 percent of the energy required before biomass can be converted into usable products.

Solution

South Dakota Mines partnered with Idaho National Laboratory to develop AI-enabled predictive models that optimize biomass drying processes. Researchers combined physics-informed artificial intelligence with experimental data to evaluate alternative drying methods that capture and reuse waste heat.

Impact

- Reduced energy consumption associated with biomass processing.
- Improved the economic feasibility of renewable fuel production.
- Expanded opportunities for student involvement in AI-driven national laboratory research.
- Demonstrated the application of trustworthy AI in industrial processes.

Information Technology

AUTONOMOUS MINING AND ROBOTICS INNOVATION

Challenge
The mining industry faces increasing pressure to improve worker safety, increase productivity, and reduce environmental impacts while addressing workforce shortages.

Solution
South Dakota Mines partnered with Caterpillar to establish participation in the Cat® Labs MineStar™ Consortium. The collaboration explores autonomous robotic mining systems, advanced software platforms, sensor technologies, and intelligent control systems applicable to both surface and underground environments.

Impact
- Advanced the development of autonomous mining technologies.
- Created experiential learning opportunities for students working alongside industry engineers.
- Positioned South Dakota Mines as a contributor to next-generation industrial automation.
- Strengthened regional economic development through innovation partnerships.

BIOMEDICAL COMPUTATION AND ARTIFICIAL INTELLIGENCE

Challenge
South Dakota sought to strengthen its biomedical research ecosystem and improve its ability to leverage advanced computational methods in healthcare education and discovery.

Solution
South Dakota Mines joined a statewide collaboration led by the University of South Dakota and Sanford School of Medicine to establish a Biomedical Computation Collaboration. Mines researchers contribute expertise in artificial intelligence, advanced computing, and data analytics.

Impact
- Secured $1.49 million in funding to support Mines' participation.
- Expanded the use of computational approaches in biomedical research.
- Increased interdisciplinary collaboration across institutions.
- Created new educational opportunities at the intersection of healthcare and data science.

ADVANCING QUANTUM INFORMATION TECHNOLOGIES

Challenge
The future of secure communications and advanced sensing technologies depends on breakthroughs in quantum materials and quantum-enabled computing systems.

Solution
Through the Quantum Materials Institute, South Dakota Mines conducts research involving quantum materials, photonics, secure communications, and emerging computing technologies. The Information Technology capabilities statement identifies these activities as a strategic area supporting national security and future digital infrastructure.

Impact
- Expanded workforce development in emerging quantum technologies.
- Strengthened South Dakota's role in the national quantum ecosystem.
- Supported research applicable to secure communications and defense applications.
- Positioned students to contribute to next-generation computing industries.

Information Technology

AI AND DATA SCIENCE FOR NATIONAL SECURITY DETECTION SYSTEMS

CHALLENGE
Advanced scientific detectors used in national security and physics research require increasingly sophisticated methods to distinguish rare signals from background noise.

Solution
South Dakota Mines researchers are applying artificial intelligence and machine learning techniques to improve detector sensitivity and accelerate data analysis within the Ge-STAR collaboration focused on germanium detector technologies.

Impact
- Enhanced the performance of next-generation detection systems.
- Improved image reconstruction and signal identification capabilities.
- Expanded applications of AI in scientific computing environments.
- Strengthened the university's role in federally funded, data-intensive research initiatives.

FROM EXTREME MICROORGANISMS TO INDUSTRIAL SOLUTIONS: AN AI-POWERED DISCOVERY PLATFORM

Challenge
Biotechnology and biomanufacturing rely on a limited range of microorganisms and enzymes, many of which perform poorly under extreme industrial conditions. More resilient microbes exist in extreme environments, but their samples and genomic data are fragmented, and many gene functions remain unknown.

Solution
Dr. Tanvi Govil and CellFe Labs are developing an AI-powered platform linked to a physical collection of microorganisms from extreme environments. By integrating environmental, genomic, protein, and pathway data, the platform will predict unknown gene functions and help users identify enzymes and microbial pathways suited to specific industrial conditions and applications.

Impact
- Accelerates microbial discovery while reducing research time and costs.
- Provides companies with candidates matched to specific products and processes.
- Expands applications in agriculture, food, chemicals, materials, carbon management, and environmental protection.
- Creates opportunities for industry-sponsored research, technology licensing, and biotechnology startups.
- Establishes a distinctive South Dakota capability serving companies statewide and nationally.

Equipment Available for Use

FEES APPLY | CONTACT: OIE@SDSMT.EDU

ARBEGAST MATERIALS PROCESSING AND JOINING LAB (AMP)

- LENS Laser Processing System (TRUMPF 3 kW Nd: YAG laser, 3-degree of freedom, environmental chamber)
- VRC Metal Systems Gen III High Pressure Cold Spray System
- ISTIR 10 Friction Stir Welding 5-Axis System
- Maxiem 1530 High Pressure Abrasive waterjet cutting system
- MTS 810 55 kip Material Test System
- MTS 858 5.5 kip Material Test System

CELL CULTURE RESEARCH LAB

- ProOx C21 Oxygen CO2 Single Chamber Controller
- C-Chamber Cytocentric Incubator Subchamber
- Small Syringe Filters connected to C-Chamber
- O2 Sensor model E709
- Sorvall ST 8R Centrifuge
- 1300 Series Class II, Type A2 Biological Safety Cabinet Packages, 120V 50/60Hz
- Thermo Fisher -80 °C Freezer
- 4D-NucleofectorTM Core Unit
- 4D-Nucleofector X-Unit (bottom)

COMPOSITES AND POLYMER ENGINEERING LAB (CAPE)

- Autoclave (4'x8')
- Walk-In Oven
- BlueM Inert Oven
- Twin Screw Extruder - Coperion (M131288)
- Signle Screw Extruder - Davis Standard
- Injection Molding Machine
- Industrial PrePregger for thermoset composites (Litzler/Waeco)
- CAPE Thermoplastic Impregnation Machine
- Gerber Cutting Table
- 100 ton Wabash Platen Hot Press
- Carver Hot Press
- MTS Servo Hydraulic Mechanical Testing System (to 250 KN)
- MTS 810 Mechanical Testing System (to 100 kN)
- Instron High Energy Impact Tester (CEAST 9350)
- Tinius Olsen Impact 104 IZOD Tester
- Flacktek SpeedMixer Centrifugal Mixer
- Faro V3 Laser CMM
- Struers Tegra System Polisher
- Rapid Prototyper FDM400
- Struers Setcom 10-system cutter (sample prep saw)
- TA Instruments ARES G2 Rheometer
- Brookefield Rheometer
- TA Instruments Q200 DSC
- TA Instruments Q800 DMA
- Carl Zeiss AxioImager M1m Upright Microscope
- Composite Braider
- Haas SL30 CNC Lathe
- Fadal VMC6030 CNC Mill
- Forklift Truck, Toyota
- Eppendorf 40 L Bioreactor
- Winpact 300 L Bioreactor
- Continuous (flow-through) Centrifuge

Equipment Available for Use

COMPOSITE AND NANOCOMPOSITE ADVANCED MANUFACTURING–BIOMATERIALS CENTER (CNAM-BIO)

- 3L–260L fermentation and bioreactor systems
- 260L SIP fermentation bioreactor
- 40L Bio-Flo fermentation bioreactor
- Continuous-flow centrifugation systems
- Large-scale filtration systems
- Extraction and purification equipment
- Rotary evaporation systems
- Multiple-temperature shaker incubators
- Downstream processing and separation technologies
- Pilot-scale biomaterials production capabilities

ENGINEERING AND MINING EXPERIMENT STATION (EMES)

- Atomic Force Microscopy (AFM)
- Focused Ion Beam Microscopy (FIB-SEM)
- Gas Chromatography Mass Spectrometry (GC-MS)
- High-resolution 3D X-ray Tomography
- Inductively Coupled Plasma Mass Spectrometry (ICP-MS)
- Nano Indenter
- Optical Emission Spectroscopy (OES)
- Portable and Benchtop XRF Systems
- Raman Microscopy
- Scanning Electron Microscopy (SEM)
- Transmission Electron Microscopy (TEM)
- X-ray Diffractometer (XRD)
- X-ray Photoelectron Spectroscopy (XPS)

INDUSTRIAL ENGINEERING

- 16-Channel Des+4:13ktop DTS EMG/Posture System w/16 EMG sensors & 8 posture sensors
- 15-Channel ECHO Gateway w/ 15x Bioharness 3 Physiological Monitors
- Laser Cutting/Engraving System (32”x18” bed, 4” rotary, 25W & 60W CO2 lasers)

MICROSCOPY LAB

- Nikon Reflected and Transmitted Light Microscope with SC50 Olympus Camera and Imaging Software; Nikon Eclipse Transmitted Light Microscope

VIRTUAL REALITY

- VR ready computers, multiple VR headset, 2D treadmill, in-hour rumble platform.
- VR ready mini towers, 23 VR headsets

Notes



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