Boise State University: Nuclear Perspective

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Population: ≈710k in Treasure valley, ≈225k Boise

It’s technically illegal to ride a merry-go-round on Sunday.

Idaho law forbids a citizen to give another citizen a box of candy that weighs more than 50 pounds.
Boise State University

Idaho’s largest & fastest growing research enterprise

Metropolitan University, minutes from downtown

Boise Junior College (1932-1965)
Boise College (1965-1968)
Boise State College (1969-1974)
Boise State University (1974-Present)

Enrollment
>24,000
College of Engineering

- Founded in 1996
- Offers Degrees in
  - Mechanical Engineering (B.S., M.S., and Ph.D.)
    - Expanding to include two PhD programs in Systems Engineering
  - Civil Engineering (B.S. & M.S.)
  - Organizational Performance and Workplace Learning (M.S.)
  - Electrical and Computer Engineering (B.S., M.S., M.Engr, & Ph.D.)
  - Materials Science & Engineering (B.S., M.S., M.Engr., & Ph.D.)
  - Construction Management (B.S.)
Our Vision is to: Be a leader of inclusive excellence, empowering world-class students to solve global challenges of enduring significance through materials innovation

Founded in 2004 with a generous gift from the Micron Foundation
MSMSE Student Enrollment Growth

- (¶) Enrolled Students - BS
- (¶) Total enrolled graduate students
- (¶) Enrolled Students - PhD

Inception of PhD program
## MSE PhD Program

### Outstanding Students
- Interdisciplinary program offers opportunities to work with Chemistry, Physics, ME, policy and more!
- All (≈60) PhD & MS students are fully funded with graduate research assistantships ($25K+)
- 120 Undergraduate students (many research opportunities)
- Offer options for Manuscript based dissertation or thesis

### World Class Facilities
- Over $4 million in new infrastructure and equipment since 2013
- Partnerships with Micron, INL, CAES provide many student and research opportunities
- Micron Center for Materials Research Building ($50M investment) plans to open in the Fall of 2020
Micron Center for Materials Research Building

- 3-story research facility
- 97,000-ft²
- >40 research laboratories
- 250-seat lecture hall
- Two 80-seat classrooms
- Work space for faculty, staff and students
- Broke ground in May, 2018
- Opens the summer of 2020
CAES is a research, education, and innovation consortium that solves regional energy challenges that have national impact.
Key Research Capabilities:
Accelerated Development of Fuels and Materials

- Materials Science & Engineering is core capability
  - Interdisciplinary
  - BS, M.Eng, MS, PhD
- Microscopy and Characterization Suite (MaCS – CAES)
- Advanced Materials Lab (Boise State and CAES)
- NRC license and nuclear fuel fabrication capability
- 2D Materials: printing, ink synthesis
- Computational MSE
- Idaho Microfabrication Laboratory
- Thin Film Research (Atomic Layer Deposition)
- Boise State Center for Materials Characterization (BSCMC)
Existing Collaborative Projects/Funding: Accelerated Development of Fuels and Materials

- Air Corrosion Studies on Zirconium-Based Materials (Jaques)
- Investigation of Irradiation Damage within Nuclear Graphite (Ubic)
- Micro-Scale Technique to Evaluate Grain Boundary Cohesion of Irradiated Alloys (Jaques)
- Method Development for Transverse Rupture Strength Determination of Doped-Polycrystalline UO₂ Fuel Concepts (Jaques)
- Effects of High Dose on Laser Welded, Irradiated AIUSI 304SS (Wu)
- Novel Materials for Metal to Ceramic Transitions (HiFunda LLC, Jaques)
- Chemistry Characterization: Fuel Stoichiometry, Fission Gas Diffusion, Cladding Interfaces (Hurley)
- Synthesis and Characterization of Gadolinium Oxide by Atomic Layer Deposition (Graugnard)
Key Research Capabilities: Instrumentation, Information, and Controls

- Embedded Systems
- Cyber Lab for Industrial Control Systems (CLICS)
- Big Data
- Materials for extreme environments
- Sensors research is widespread across campus
  - Advanced Materials Lab (Boise State and CAES)
  - Advanced Nanomaterials and Manufacturing Lab
  - 2D Materials: printing, ink synthesis
  - Computational MSE
  - Idaho Microfabrication Laboratory
  - Thin Film Research (Atomic Layer Deposition)
Existing Collaborative Projects/Funding: Instrumentation, Information, and Controls

- In-Pile Instrumentation Program with INL (Jaques, Estrada, Kandadai et. al) DOE:
  - Cross cutting: MSE/AM/M&S
    - Radiation tolerant fibers
    - High temperature irradiation resistant thermocouples
    - Mechanical property sensors
    - Thermal property sensors
    - Electrochemical sensors
    - Imaging large scale structure

- Development of Nuclear Grade Nanoparticle Ink Syntheses Capabilities for Advanced Manufacturing of Nuclear Sensors (Estrada)

- Additive Manufacturing of Thermal Sensors for In-Pile Thermal Conductivity Measurement (Estrada)

- Integrated silicon/chalcogenide glass hybrid plasmonic sensor for monitoring of temperature in nuclear facilities (Mitkova, NEUP)
Key Research Capabilities: Advanced Nuclear Systems

- CAES EPI (Energy Policy Institute) – Economic Analysis of SMR for NuScale: Geoff Black
- Embedded Systems: Sin Ming Loo
- Systems Engineering interest – Mechanical Engineering: Don Plumlee
Areas of Collaboration - Existing and Potential

- Nuclear Energy
  - Accident tolerant fuels
  - In-pile instrumentation
  - Materials for extreme environments
  - MaCS
- Cyber-security
  - PhD in computing, certificates
  - Research
- Advanced Manufacturing
- Energy Policy Institute
- Energy water
- Innovative Energy systems
  - Electro-chemical Materials
Welcome to Boise!