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Google Scholar link: <https://scholar.google.com/citations?hl=en&user=JrAodXcAAAAJ>

Professional Summary

Process Development Engineer | Iowa State University | Ames | Iowa

August 2024 – December 2024

Materials Scientist with Ph.D. training and over five years of research experience in advanced metallic materials, alloy synthesis, thermomechanical processing, and microstructure–property relationships. Experienced in designing and conducting experimental research involving rare-earth-containing alloys, high-temperature processing, casting, extrusion, rolling, heat treatment, and advanced materials characterization. Proficient in powder X-ray diffraction (XRD), SEM, EBSD, EDS, XRF, mechanical testing, and statistical analysis to investigate phase evolution, crystallographic transformations, and structure–property relationships. Demonstrated success collaborating with multidisciplinary teams at Ames National Laboratory and Iowa State University to develop advanced materials for high-temperature structural and energy applications, resulting in peer-reviewed publications, award-winning research, and scalable manufacturing technologies.

Professional Experience

Graduate Research Assistant | Ames National Laboratory | Iowa State University June 2022 – December 2025

Designed and optimized aluminum alloy compositions and processing routes, establishing scalable pathways for producing thermally stable, high-strength aluminum alloys. Achieved UTS of 390MPa and high temperature (~300°C) UTS of 150MPa which is higher than aircraft grade AA2618.

- Designed and validated a novel aluminum alloy with ~200% improvements in strength, ductility, and thermal stability, contributing to the successful acquisition of approximately \$1 million in follow-on funding from the U.S. Department of Energy (DOE) for my supervisor and research collaborators.
- Developed and optimized casting, extrusion, rolling, and heat-treatment processes for Aluminum–Cerium alloys, achieving significant microstructural refinement and process stability that doubled yield strength and hardness while improving overall mechanical performance.
- Conducted mechanical testing, including tensile, hardness, and fatigue evaluations, to establish structure–property–process relationships that guided alloy design and process optimization. Identified homogeneous microstructures as a key factor in enhancing mechanical property retention and thermomechanical performance.
- Performed microstructural and phase analysis using SEM, EDS, and XRD to assess phase stability, solidification behavior, and processing effects.

Research Assistant | Iowa State University | Ames | Iowa

May 2025 – August 2025

Contributed to the development of a continuous hot-roll manufacturing process for nanograin NdFeB permanent magnets, a technology recognized with the R&D 100 Award for eliminating dysprosium dependence and reducing magnet production costs.

- Manufactured NdFeB permanent magnets through powder processing, including ball milling, MQUF powder packing, can welding, and hot-roll processing.
- Optimized hot-roll processing parameters, increasing magnet coercivity by approximately 3% and improving overall magnetic performance.
- Evaluated copper grain-boundary diffusion in MQUF powders and quantified its effects on coercivity and magnetic properties.
- Collaborated with interdisciplinary researchers to develop process optimization strategies that improved microstructural uniformity and magnetic property consistency.
- Conducted magnetic characterization and process-performance analysis to establish relationships between processing conditions, microstructure, coercivity, and magnetization.

- Supported the advancement of a rare-earth magnet manufacturing technology that reduces reliance on critical materials while maintaining high magnetic performance.

Process Development Engineer | Iowa State University | Ames | Iowa

August 2024 – December 2024

Conducted semiconductor device fabrication and process integration research, developing thin-film, lithography, and metallization processes for sensor and photodetector applications while utilizing cleanroom manufacturing techniques and advanced characterization methods.

- Acquired hands-on experience in CMOS fabrication processes, including thin-film deposition, diffusion, CVD, photolithography, RCA cleaning, wet/dry oxidation, and wet/dry etching.
- Led the design and development of fabrication process flows for electrochemical sensors utilizing PDMS replication, e-beam deposition, and optical spectroscopy for device characterization.
- Developed and integrated MOCVD growth, photolithography, and metallization processes for Ga₂O₃ photodetectors, establishing process – structure – property relationships through optical and electrical performance evaluation.
- Designed and fabricated custom shadow masks for electroplating and photomasks for lithographic pattern transfer, enabling precise device fabrication and process optimization.
- Collaborated with multidisciplinary research teams to develop and characterize semiconductor and sensor devices, supporting process integration and performance enhancement.

Founder / Technical Lead – Leadecks Mechanical Limited | Nairobi | Kenya

June 2019 – December 2021

Developed a prototype system for detecting leakages in petroleum pipelines and domestic water supply networks in Kenya.

- Designed and implemented sensor-based flow monitoring using MATLAB, micro-sensors, and Arduino microcontrollers to detect anomalies in real time.
- Simulated fluid flow to evaluate pressure head and volumetric flow across pipeline sections and identify leakage signatures.
- Led prototype testing, validation, and early-stage commercialization efforts.

Graduate Research Assistant | Polytechnique Montréal, QC, | Canada

August 2017 – May 2019

Performed computational modeling of the effects of fluid-structure dynamics on steam generator tube.

- Investigated tube-wear mechanisms in steam generators due to flow-induced vibrations.
- Analyzed turbulence effects on flutter and dynamic stability of tubes under operational conditions.
- Applied CFD tools to simulate fluid-structure interaction and predict critical wear zones.
- Validated computational models with experimental data and sensitivity analyses.

Student Intern | East African Breweries Limited | Kenya

April 2015 – June 2015

In my second co-op, I worked directly on the processing floor, applying priority sequencing rules (First-Come, First-Served and First-In, First-Out) to improve operational reliability and maintenance planning.

- Applied FCFS and FIFO principles to improve predictive maintenance planning and scheduling efficiency.
- Designed and executed structured root cause analyses of material wear mechanisms, enabling earlier detection and prevention of equipment degradation.
- Developed and presented actionable wear-prevention and maintenance recommendations, contributing to improved equipment reliability and reduced unplanned downtime.

Student Intern | Cooper Motor Cooperation (CMC) Limited | Kenya

June 2014 – August 2014

Participated in motor vehicle service and maintenance activities facilitating company's customers service efficiency.

- Facilitated client onboarding enabling timely and efficient service delivery.

- Performed servicing and engine testing on Volkswagen motor vehicles to verify mechanical integrity, performance, and compliance with quality standards.

Other Experience

Visiting Volunteer Scholar | Iowa State University |

March 2026 – Present

Conduct advanced materials research focused on developing and optimizing high-performance Al-Ce alloys through thermomechanical processing, microstructural characterization, and mechanical property evaluation.

- Conduct research on Al-Ce alloys, focusing on thermomechanical processing, microstructure evolution, and elevated-temperature mechanical performance.
- Analyze structure–property relationships using advanced characterization and mechanical testing techniques to guide alloy and process optimization.
- Collaborate with faculty and researchers to develop high-performance aluminum alloys for lightweight and energy-efficient engineering applications.
- Contribute to ongoing publications, technical reports, and research initiatives related to rare-earth-modified aluminum alloys.

Production Operator | DSM-Firmenich | United States

April 2026 – July 2026

Contributed to safe and efficient manufacturing operations in a high-volume production environment by supporting process execution, quality assurance, and continuous improvement initiatives.

- Operated and monitored industrial production equipment in compliance with GMP, safety, quality, and operational standards.
- Supported continuous improvement initiatives to enhance production efficiency, reduce waste, and improve workplace safety.
- Performed process inspections, documentation, and quality checks to ensure product consistency and regulatory compliance.
- Collaborated with maintenance and operations teams to troubleshoot process issues and minimize downtime.

Education

PhD. Materials Science and Engineering | Iowa State University of Science and Technology | USA | **2022 - 2025**

MSc. Fluid Structure Interactions | Polytechnique Montreal | QC, Canada | **2017 – 2019**

BSc. Mechanical Engineering | Kenyatta University | Nairobi, Kenya | **2011 – 2017**

Technical Skills

- Use of materials characterization techniques including SEM, EDS, XRD, DSC, Vickers Microhardness, and XRF.
- Mechanical testing - tensile tests
- Optical Spectroscopy
- Optical Microscopy
- Methods of material processing and solidification control (casting, extrusion, sintering, and rolling).
- Expertise in metals and composites.
- Alloy composition optimization and processing.
- Physical metallurgy of aluminum alloys, copper alloys, and large forgings.
- Fractography and failure mode analysis.
- Materials specifications, continuous improvement and compliance (ASTM, ISO).
- AutoCAD, inventor, ArchiCAD and SolidWorks.
- Manufacturing process development and technical documentation
- Data analysis and interpretation (MATLAB, Simscape, Origin).
- Magnet manufacture and property enhancement
- Photolithography, thin film deposition, CVD, MOCVD, RCA cleaning.

- Wet/dry oxidation, wet/dry etching,
- Metallization, process integration.
- Cleanroom Manufacturing.

Leadership and Awards

- **TMS Light Metals Award (2025)** for contributions to Al-Ce Alloy research and processing.
- **Successfully Mentored four undergraduate researchers** during my Ph.D. training, providing hands-on instruction in alloy processing and thermomechanical heat treatment of Al-Ce alloys.
- **Recipient of the U.S. Department of Energy (DOE) / Ames National Laboratory International Student Scholarship (2022–2025).**
- **STOP Grant Scholarship recipient (Fall 2025)**, Department of Materials Science and Engineering, Iowa State University.

References

Prof. Jun Cui | **Department of Materials Science and Engineering | Iowa State University** | cuijun@iastate.edu

Dr. Ouyang Gaoyuan | **Ames National Laboratory Scientist II** | gaoyuan@iastate.edu