



Research Areas

Computational Materials Science, Multi-Physics Modeling, Finite Element Method, Machine Learning, Thermodynamic Tensor Modeling, Phase Field Method

Education

Doctor of Philosophy (PhD), Computational Materials Science (Materials Engineering) Silesian University of Technology (SUT), Poland	Oct 2022 – Aug 2026 (expected)
Master of Science, Mechanical Design and Engineering Tribhuvan University (TU), Nepal	Apr 2019 – Oct 2021
Bachelor of Engineering, Mechanical Engineering Tribhuvan University (TU), Nepal	Sep 2012 – Oct 2016

Technical Skills

Finite Element Method	Multi-Physics Simulations, Phase Field Methods in MOOSE Framework
Machine Learning	DNN, CNN, LSTM, Conv-LSTM , U-Net
Tensor Computation	Tensor Decomposition-Reconstruction , Tensor Data-Inpainting
Programming	Python , Bash, Slurm , GUI software/toolkit development

Research Experience

Doctoral Research Works	Oct 2022 - Ongoing
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Multiphysics model for laser processing in HEA with Cross-Attention Transformers

- Coupled Multi-Physics Simulation study of FeCoCrNi HEA undergoing laser treatment
- Multi-component multi-phase microstructural evolution prediction via phase field modeling
- Transformer based parameter-space interpolation framework for prediction of spatio-temporal fields

AI-Based Digital Twins for Laser-Induced Phase Transition in Additive Manufacturing

- Simulation of microstructure evolution under different laser beams for Additive Manufacturing (AM)
- Training of U-Net model to predict meltpool phase from thermal distributions with high accuracy
- Development of [AMTwinLab](#) (Virtual Digital Twin): Webapp for real-time phase prediction during AM

Spatio-Temporal Neural Network Model for Alloy Interface Forecasting

- Developed Conv-LSTM model predicting multi-generational microstructure evolution accurately
- Validated interfacial accuracy using similarity metrics and image analysis techniques
- Forecasted phase changes in Pd-Rh and Cu-Mn alloys successfully using the Model

Phase field modeling of Ti₂Cu IMC growth in multicomponent Cu_x(Ti-6Al-4V)_y due to laser processing

- Modeled laser-induced thermal history in multicomponent Cu_x(Ti-6Al-4V)_y system
- Simulated heterogeneous Ti₂Cu intermetallic grain growth using phase-field modeling
- Analyzed thermodynamic driving force and curvature effects on IMC growth kinetics

Computational Reducibility via Tensor Computation of Microstructure Data

- Generated sparse microstructural datasets via phase field simulations of Ti-Cr alloy
- Applied tensor computation techniques for efficient data reconstruction and compression
- Achieved 28x data reduction while preserving elastic deformation fidelity

Master’s Research: pyMPEALab Toolkit for Accelerating Phase Design in Multi-principal Element Alloys

Apr 2019 – Oct 2021

Supervisors: Dr. Khem Gyanwali (TU, Nepal), Dr. Anil Kunwar (SUT)

- Built a multi-label Neural Network model to predict MPEA/HEA phase structure from elemental composition
- Developed and open-sourced [GUI software](#) toolkits ([pyMPEALab](#) & [IMCATHEA](#)) enabling easy phase prediction
- Applied model to Al- and Nb- doped alloys to correlate phase type with mechanical behavior

Work Experience

Research Assistant

Jan 2023 - Present

Research team member: Project [DECLARMIMA](#), [DENDRITEPHASE](#) funded by [National Science Centre](#), Poland
Project PI: Dr. Anil Kunwar (SUT, Poland)

- Led multi-physics code development for laser-alloy interaction modeling
- Developed ML models for microstructure-property prediction
- Published 7 research papers as main and co-author on materials modeling and simulations

Research Assistant

Jan 2020 – Sep 2022

Institute of Engineering, Thapathali Campus, Tribhuvan University, Nepal

Research team member: Energy Systems Research Laboratory, funded by University Grants Commission Nepal
PI: Dr. Khem Gyanwali (TU, Nepal)

- Developed machine learning models to predict alloy phase in multi-principal element alloys
- Published 3 research papers as first author in the field of machine learning and materials modeling
- Developed and open-sourced an AI-powered GUI Software toolkit to predict alloy's phase

Teaching Assistant

Jun 2021 – Jun 2022

Institute of Engineering, Thapathali Campus, Tribhuvan University, Nepal

Operational Research and Management Science for Undergraduates

- Delivered lectures, tutorials, and code development on Operations Research
- Applied optimization techniques like Network Modeling, Goal Programming, Monte Carlo Simulation.
- Graded final exams and facilitated hands-on learning with Crystal Ball, Excel, Solver

Publications

1. Upadesh Subedi, et al., [Spatiotemporally learning the morphological and dynamic features of Au meltpool under different heat source types with phase-field informed U-Net framework](#), 2026, **Computational Materials Science**
2. Upadesh Subedi, et al., [A non-isothermal multi-phase field approach to model the meltpool and IMC grains interaction in Ti-Au material](#), 2025 **Computational Materials Science**
3. Upadesh Subedi, et al., [Foretelling Microstructural Interface with Multi-Generational Convolutional-LSTM Framework](#). 2025, **Engineering with Computers**
4. Hana Mamo, Upadesh Subedi, et al., [Prototyping Ti2Cu intermetallic grain growth heterogeneously in Ti6Al4V matrix through laser additive manufacturing](#), 2024, **Materials & Design**
5. Upadesh Subedi, et al., [Rapid portabilization of elasto-chemical evolution data for dental Ti-Cr alloy microstructure through sparsification and tensor computation](#), 2024, **Scripta Materialia**
6. Sachin Poudel, Upadesh Subedi, et al., [AlloyManufacturingNet for discovery and design of hardness-elongation synergy in multi-principal element alloys](#), 2024, **Engineering Applications of Artificial Intelligence**
7. S. Liang, C. Wei, A. Kunwar, Upadesh Subedi, et al., [Phase field modelling combined with data-driven approach to unravel the orientation influenced growth of interfacial Cu6Sn5 intermetallics under electric current stressing](#), 2023, **Surfaces and Interfaces**
8. Upadesh Subedi, et al., [State-of-the-Art Review on the Aspects of Martensitic Alloys Studied via Machine Learning](#). 2022, **Metals**
9. Upadesh Subedi, et al., [Automatic Featurization Aided Data-Driven Method for Estimating the Presence of Intermetallic Phase in Multi-Principal Element Alloys](#). 2022, **Metals**
10. Upadesh Subedi, et al., [pyMPEALab Toolkit for Accelerating Phase Design in Multi-principal Element Alloys](#). 2022, **Metals and Materials International**

Under-Review / Submitted

1. M. Dagnaw, S. Poudel, Upadesh Subedi, et al., [Integrating experiments and phase field method through informatics for tailored corrosion performance of additively manufactured steel microstructures](#), 2025, **ChemRxiv, [Under Review: Metals and Materials International, 2026]**
2. Upadesh Subedi, et al., [From Thermodynamic Tensors to Attention-Regularized Surrogates: A Multicomponent Phase-Field Framework for Laser Additive Manufacturing of CoCrFeNi Alloy](#), Submitted June 2026, **Additive Manufacturing**,

Conference Presentations

1. **Upadesh Subedi** (Presenting Author), et al., [Digital Twin for Phase Transition Prediction in Laser-Based Additive Manufacturing: A Phase-Field and U-Net Model Framework](#), (Poster 18), [5th Additive Manufacturing Meeting \(AMM\) 2025](#), Wroclaw University of Science and Technology, Poland
2. **Upadesh Subedi** (Presenting Author), et al., [Temperature dependence of free energies in a phase field model for selective laser melting of tin powder on copper substrate](#) (Pg4,15:10-15:30). [The 5th International Symposium on Phase-Field Modelling in Materials Science](#), Zhejiang University, China
3. A. Kunwar, **Upadesh Subedi**, et al., [Phase field modeling of thermomigration at colder interface of solid state solder joints](#), (Poster 15), [1st INTERNATIONAL CONFERENCE ON MECHANICS OF SOLIDS](#), 2022
4. A. Kunwar, J. Hektor, **Upadesh Subedi**, et al., [Mesoscale Simulations Guiding Data-driven Design of Electronic Materials](#), [2022 TMS Annual Meeting & Exhibition](#)
5. **Upadesh Subedi** (Presenting Author), et al., [pyMPEALab Toolkit for Accelerating Phase Design in Multi-principal Element Alloys](#). 2021, **10th IOE Graduate Conference 2021**, Pulchowk Campus, Nepal

Peer Reviews

Journals/Conferences:

- *npj Computational Materials*, Springer Nature
- *Computational Materials Science*, Elsevier
- *Discover Applied Sciences*, Springer
- *Journal of Materials Science*, Springer
- *Progress in Additive Manufacturing*, Springer
- *Archives of Computational Methods in Engineering*, Springer
- *Computer Modeling in Engineering & Sciences*, Tech Science Press
- 7th International Conference on Metal Material Processing and Manufacturing

Visiting Scholar / Internship

Visiting Scholar

[Department of Materials Engineering, KU Leuven, Belgium](#)

Aug 2023 – Sep 2023

Supervisor: Prof. Nele Moelans

Theme: *Introduction to the phase-field microstructure simulation techniques in Vlaams Supercomputer Centrum (HPC)*

Journal Editorial

• Guest Editor

[Journal of Visualized Experiments](#)

Method Collections: “Computational Methods in Additive Manufacturing for Biomedical Applications”
<https://app.jove.com/methods-collections/4033>

Awards, License & Achievements

- Silesian University, Faculty of Mechanical Engineering, *Departmental Research Grant for Young Scientists* 2023, 2024, and 2025 (€5k).
- Silesian University, Best PhD Student Award 2022/2023 (€8.5k) with funding for an international mobility.
- MSc. Batch 2021, Faculty Topper, Institute of Engineering, Tribhuvan University
- License: Mountain Trekking Guide, Nepal Mountain Academy, Ministry of Culture Tourism & Civil Aviation

Contact

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- **LinkedIn** <https://www.linkedin.com/in/upadesh-s-0b321a15b/>
- **ResearchGate** <https://www.researchgate.net/profile/Upadesh-Subedi>
- **Webpage** <https://sites.google.com/view/subediupadesh>
<https://subediupadesh.github.io/>