

Amir Eskanlou

U.S. Permanent Resident

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[LinkedIn](#) — [Google Scholar](#) — [GitHub](#)

Professional Summary

Interdisciplinary Materials Scientist specializing in metallurgical processing, materials modeling, and surface chemistry. Expertise in *ab initio* materials modeling, molecular dynamics, machine learning, and advanced surface/material characterization. Led projects developing experimentally validated, intelligent frameworks for reagent design in critical minerals recovery – integrating metallurgical processing, AI/ML, and DFT computations as well as metallurgical circuit design and optimization under uncertainty. Proven record of managing cross-functional industry collaborations, securing funding, and translating early-stage research into industry adoption.

Professional Skills

- Programming: Python, MATLAB, Bash, Julia
 - Linux & High-Performance Computing (HPC)
 - Density Functional Theory (VASP, Quantum ESPRESSO)
 - Molecular Dynamics (LAMMPS, ASE, OVITO)
 - Machine Learning (Gaussian Processes, Neural Networks, Random Forest, PCA)
 - Thermodynamic Modeling (CALPHAD; phase stability, transformations, multicomponent properties)
 - Global Uncertainty Quantification (DGSA)
 - Surface Chemistry: Surface Thermodynamics, Wetting, Surface Tension, and Adsorption
 - Surface Characterization: FTIR; XPS; SEM/EDS; AFM; UV-Vis; Zeta Potential; Spectrophotometer
 - Electrochemistry: Redox, Thermodynamics, Mechanism, and Kinetics at Electrode/Electrolyte Interfaces
 - Solution Chemistry: Solubility, Titration, Saturation, Dilution, Equilibrium & Kinetics
 - Powder Characterization: XRD; XRF; Optical Microscopy
 - Scientific Communication (technical writing, presentations)
 - Critical Thinking & Problem Solving
 - Project Management & Cross-Functional Collaboration
 - Teamwork & Leadership
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Professional Experience

Postdoctoral Scholar & Research Scientist, Stanford University, Stanford, CA July 2024 – Present

- Developed an AI-guided reagent discovery framework to accelerate selective mineral processing in collaboration with Bidra Innovation Ventures and OCP Group.
- Achieved **90%** demetallization of phosphate ore through selective carbonate removal using ML-guided integrated optimization of grinding and flotation for an OCP-sponsored project.
- Improved phosphate recovery by **5%** by identifying loss mechanisms through process mineralogy of tailings and translating findings into recovery enhancement strategies for OCP.
- Collaborated with a multidisciplinary team to develop an AI-driven, uncertainty-aware optimization workflow using a POMDP framework to improve mineral processing performance and robustness under feed and process variability.
- Led sensitivity analysis of global lithium supply-chain data to support upstream battery-material investment planning for Toyota.

Research Assistant, Penn State, University Park, PA

Aug 2021 – June 2024

- Developed and experimentally optimized a novel reagent system for pyrite, coal, and quartz mixtures with varying compositions.
- Reduced particle-induced hydroxyl radical generation by **75–90%**, lowering toxicity and improving selectivity in a U.S. CDC-sponsored research project.

Research Assistant, West Virginia University, Morgantown, WV Jan 2019 – July 2021

- Developed a novel eco-friendly process and selective reagent strategy that achieved **85%** rare earth element recovery and **90%** phosphorus recovery from phosphatic clay for the Florida Industrial & Phosphate Research Institute.
- Designed an experimental protocol that reduced crud formation in rare earth solvent extraction by **34%–65%** across multiple feedstocks in a U.S. DOE NETL-sponsored project.

Process Engineer, NIPEC, Tehran, IRAN March 2017 – Dec 2018

- Developed and implemented a techno-economic simulator for the Chehel-Koreh copper processing plant to support process evaluation and decision-making.
- Led troubleshooting and optimization efforts for SAG mill and flotation circuit performance in collaboration with plant teams.

Process Engineer, SABA BATRI (Li-ion Battery Manufacturer), Tehran, IRAN March 2016 – Feb 2017

- Designed and implemented a froth flotation process for graphite recovery from spent lithium-ion batteries, achieving **90%** recovery.

Research Assistant, Tarbiat Modares University, Tehran, IRAN Sept 2013 – Feb 2016

- Designed, built, and pilot-tested an optimized column flotation cell based on phenomenological modeling of bubble loading and hydrodynamics.

Education

- **Ph.D. in Energy & Mineral Engineering**, Penn State 2024
- **Ph.D. Minor in Computational Materials Science**, Penn State 2024
- **M.Sc. in Mineral & Metallurgical Processing**, West Virginia University 2021
- **M.Sc. in Mineral & Metallurgical Processing**, Tarbiat Modares University 2016
- **B.Sc. in Minerals Engineering**, Bahonar University 2013

Training & Certifications

- **Emerson Consequential Scholars** — Stanford Technology Ventures Program Feb – May 2026
- **Mentoring Fundamentals** — Stanford University 2025
- **Computational Materials Science (CMS3-FAST)** — NSF Summer School, Texas A&M University 2024
- **Density Functional Theory for Experimentalists** — NSF Summer School, Cornell University 2023
- **Python for Data Science and Machine Learning Bootcamp** — Udemy (Oct 2023)

Selected Funding (Co-PI)

- **Awarded**
 - OCP, *Process Mineralogy of Tailings for Phosphate Recovery* — **\$500K** (2024–2026)
 - OCP, *Intelligent Controlled Grinding and Selective Flotation for Demetallization* — **\$1M** (2025–2027)
- **Under Review**
 - Stanford Woods, *Mine-Waste Detoxification and Metal Extraction* — **\$500K** (2026–2028)
 - Stanford Energy, *Optimization of Comminution Energy and Processing* — **\$100K** (2026–2027)

Selected Publications (2024–2026)

- Eskanlou *et al.* (2026). *Gaussian process regression for metallurgical processing data*. *Minerals Engineering*.
- Xu *et al.* (2026). *AI-driven optimization under uncertainty for material processing*. *Sus. Earth Res. Comm.*
- Eskanlou & Arnold (2025). *Surface chemistry of quartz – DFT and experiment*. *Hazardous Materials*.
- Eskanlou & Arnold (2024). *Surface chemistry of pyrite – DFT and experiment*. *Hazardous Materials*.
- Eskanlou *et al.* (2024). *Optimization of phosphate flotation – AIMD and experiment*. *App. Surf. Sci.*
- Eskanlou *et al.* (2021). *Effect of metal ions on phosphate flotation – DFT and experiment*. *App. Surf. Sci.*

Complete list of publications: [Google Scholar](#)

Leadership

- Lead Hacker, *ionX Reagent Technologies*, Stanford Hacking for Defense Lean Launchpad Spring 2026
 - Chair and Vice Chair, Flotation Committee, SME Mineral & Metallurgical Processing Division 2022–2024
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Awards

- **SME:** Ramani Award (2023); Young Award (2020)
- **Penn State:** Fuel Science Award (2023)
- **WVU:** InSPIRe Award (2021)