

# Amir Eskanlou

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## Experience Highlights

Interdisciplinary Metallurgist and Computational Materials Scientist with 12+ years of research experience and 3+ years of industry experience, specializing in sustainable extraction and processing of critical minerals. Expertise in designing and optimizing selective, energy-efficient, low-waste mineral processing flowsheets; advanced surface/material characterization; and AI-accelerated *ab initio* (DFT-based) modeling for mechanism-driven reagent design/ discovery. Led projects spanning experimentally validated intelligent systems for circuit design and optimization under uncertainty, and the discovery of selective, safer reagents for phosphate beneficiation. Proven record of managing cross-functional research, securing funding, and advancing concepts from early research through testing and validation.

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## Employment

Postdoctoral Scholar, Stanford University, Stanford, California	July 2024 – Present
Research Assistant, Penn State, University Park, Pennsylvania	August 2021 – June 2024
Research Assistant, West Virginia University, Morgantown, WV	January 2019 – July 2021
Process Engineer, NIPEC, Tehran, Iran	March 2017 – December 2018
Process Engineer, SABA BATRI (LIB manufacturer), Tehran, Iran	March 2016 – February 2017

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## Education

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

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## Summer Schools

Density Functional Theory for Experimentalists – NSF Summer School – Cornell University – 2023  
Computational Materials Science (CMS3-FAST) – NSF Summer School – Texas A&M University – 2024

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## Training & Certifications

- The Hacking for Defense (H4D) Lean Launchpad – Stanford Graduate School of Business (March – June 2026)
  - Emerson Consequential Scholars — Stanford Technology Ventures Program (Feb – May 2026)
  - Mentoring Fundamentals — Stanford University (May 2025)
  - Data Analysis with R Programming — Google (Jan 2024)
  - Python for Data Science and Machine Learning Bootcamp — Udemy (Oct 2023)
  - Density Functional Theory — Institut Polytechnique de Paris (May 2023)
  - Responsible Conduct of Research — Collaborative Institutional Training Initiative (CITI) (Apr 2022)
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## Awards & Credentials

- SMEF – Raja V. and Geetha V. Ramani Graduate Award – 2023
  - Penn State EME Department Fuel Science Award – 2023
  - Penn State EME Department Charles B. Manula Memorial Award – 2022, 2023
  - The Penn State Honor Society of Phi Kappa Phi – 2023 – 2024
  - WAAIME Scholarship – 2020, 2021, 2022
  - WVU Statler College Deans' InSPIRe Award – 2021
  - Lewis E. and Elizabeth W. Young Award – 2020
  - Henry DeWitt Smith Graduate Award – 2020
  - First Ranking in M.Sc. Educated Students – Tarbiat Modares University – 2016
  - Second Ranking in B.Sc. Educated Students – Bahonar University – 2013
  - Outstanding Undergraduate Researcher Award – Bahonar University – 2012
  - 2nd place, SME MPD Student Poster Contest – 2022
  - 2nd place, SME Environmental Division Student Poster Contest – 2021
  - 2nd place, SME MPD Student Poster Contest – 2020
  - 3rd place, Graduate Student Research Poster Contest – 2020
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## Research Experience

**Postdoctoral Scholar**, Stanford University, Stanford, California July 2024 – Present

- **AI-Driven Reagent Discovery:** Developed an intelligent reagent discovery framework for selective mineral processing (Bidra Innovation Ventures).
- **Demetallization of Phosphate Ore:** Achieved **90%** demetallization of phosphate ore by selective carbonates removal using ML-driven integrated optimization of grinding (liberation) and selective flotation (OCP).
- **Process Mineralogy of Tailings:** Improved phosphate recovery by **5%** by identifying loss mechanisms through process mineralogy of tailings and translating insights into recovery improvement (OCP).
- **AI-Driven Optimization under Uncertainty:** Collaborated with a team to develop AI-driven uncertainty-aware optimization workflow (using POMDP formulation) to improve mineral processing performance and robustness under feed/process variability (Bidra Innovation Ventures).
- **Supply Chain Modeling:** Collaborated with a team on Strategic planning under uncertainty toward resilient upstream critical mineral investments in Li-Ion battery supply chains (a major car manufacturer).

**Research Assistant**, Penn State, University Park, Pennsylvania Aug 2021–June 2024

- **Reagent Discovery:** Developed and experimentally optimized a novel reagent mix for pyrite, coal, and quartz with varying compositions. Reduced particle-induced hydroxyl radical (toxicity) by **75–90%** (U.S. CDC).

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

- **Phosphate and Rare Earth Recovery:** Achieved **85%** REE and **90%** P recoveries from phosphatic clay by a novel eco-friendly process and selective reagents (Florida Industrial & Phosphate Research Institute).
- **Rare Earth Solvent Extraction:** Developed an experimental protocol to mitigate crud formation in REE solvent extraction (SX) from multiple feed stocks by **34% – 65%** (U.S. DOE NETL).

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

- **Techno-economic Modeling:** Developed and implemented a techno-economic simulator for the Chehel-Koreh copper processing plant. Led a team to troubleshoot and optimize SAG mill and flotation.

**Process Engineer**, SABA BATRI (LIB manufacturer), Tehran, IRAN March 2016 – Feb 2017

- **Graphite Recycling:** Designed and implemented a froth flotation process to recycle graphite from spent lithium-ion batteries – achieved **90%** recovery.

**Research Assistant**, Tarbiat Modares University, Tehran, IRAN

Sept 2013 – Feb 2016

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

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## Funding

Title: *Improving Phosphate Recovery Using Process Mineralogy of Flotation Tailings*

Co-PIs: Amir Eskanlou, Abdellatif ElGhali, Jef Caers

Source: OCP

Award: \$500,000 (awarded)

Period of Performance: 2024–2026

Title: *Demetallization of Phosphate Ore: An Intelligent Framework for Integrated Controlled Grinding and Selective Flotation*

Co-PIs: Amir Eskanlou, Abdellatif ElGhali, Jef Caers

Source: OCP

Award: \$650,000 (awarded)

Period of Performance: 2025–2027

Title: *Unlocking the Value in ‘Fools Gold’: An Intelligent Framework for Simultaneous De-toxification and Metal Extraction of Mine Waste*

Co-PIs: Amir Eskanlou, Erik Sperling, Jef Caers

Source: Stanford Woods Institute for the Environment

Award: \$500,000 (under review)

Period of Performance: 2025–2027

Title: *Towards Sustainable Processing of Critical Minerals: An Intelligent Framework for Simultaneous Optimization of Comminution Energy and Processing Efficiency*

Co-PIs: Amir Eskanlou, Jef Caers, Leora Dresselhaus-Marais

Source: Stanford Precourt Institute for Energy

Award: \$100,000 (under review)

Period of Performance: 2026–2027

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## Teaching Experience

**Fall 2025:** *Introduction to Mineral Processing*, Stanford University – Short course, Instructor

**Fall 2024:** *Computational Materials Research for Mineral Processing*, UM6P – Short course, Instructor

**Spring 2024:** *Combustion Engineering*, Penn State – Grading, Lab lectures, Project instructor

**Spring 2021:** *Mineral Processing*, West Virginia University – Grading, Lab lectures

**Fall 2013:** *Advanced Engineering Math*, Tarbiat Modares University – Grading, Recitation lectures

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## Selected Publications

Eskanlou, A., Zhen Yin, D., and Caers, J.K., 2026. Gaussian process regression for modeling computational and experimental mineral processing data. *Mineral Engineering*.

<https://doi.org/10.1016/j.mineng.2025.110000>

Xu, W., Eskanlou, A., Arief, M.M., Zhen Yin, D., and Caers, J.K., 2025. AI-Driven optimization under uncertainty for mineral processing operations. *Sustainable Earth Resources Comm..*

<https://doi.org/10.48550/arXiv.2512.01977>

- Eskanlou, A. and Arnold, B.J., 2025. An evaluation of quartz as a component of respirable coal dust. *Journal of Hazardous Materials*, 490, p.137873. <https://doi.org/10.1016/j.jhazmat.2025.137873>
- Eskanlou, A. and Arnold, B.J., 2024. An evaluation of pyrite as a component of respirable coal dust. *Journal of Hazardous Materials*, 477, p.135340. <https://doi.org/10.1016/j.jhazmat.2024.135340>
- Eskanlou, A., Arnold, B.J., Foucaud, Y., Badawi, M. and Dzade, N.Y., 2024. Optimizing flotation separation of fluorapatite from Florida waste clay using a multiscale approach. *Applied Surface Science*, 662, p.160067. <https://doi.org/10.1016/j.apsusc.2024.160067>
- Eskanlou, A., Huang, Q., Foucaud, Y., Badawi, M. and Romero, A.H., 2022. Effect of  $Al^{3+}$  and  $Mg^{2+}$  on the flotation of fluorapatite using fatty- and hydroxamic-acid collectors – A multiscale investigation. *Applied Surface Science*, 572, p.151499. <https://doi.org/10.1016/j.apsusc.2021.151499>
- Eskanlou, A., Huang, Q. and Zhang, P., 2022. De-sliming followed by froth flotation for the recovery of phosphorus and enrichment of rare earth elements from Florida waste clay. *Resources, Conservation and Recycling*, 178, p.106049. <https://doi.org/10.1016/j.resconrec.2021.106049>
- Hassas, B.V., Kouachi, S., Eskanlou, A., Bouhenguel, M., Çelik, M.S. and Miller, J.D., 2021. The significance of positive and negative inertial forces in Particle-Bubble interaction and their role in the general flotation kinetics model. *Minerals Engineering*, 170, p.107006. <https://doi.org/10.1016/j.mineng.2021.107006>
- Eskanlou, A. and Huang, Q., 2021. Phosphatic waste clay: Origin, composition, physicochemical properties, challenges, values and possible remedies – A review. *Minerals Engineering*, 162, p.106745. <https://doi.org/10.1016/j.mineng.2020.106745>
- Eskanlou, A., Huang, Q., Chegeni, M.H., Khalesi, M.R. and Abdollahy, M., 2020. Determination of the mass transfer rate constant in a laboratory column flotation using the bubble active surface coefficient. *Minerals Engineering*, 156, p.106521. <https://doi.org/10.1016/j.mineng.2020.106521>
- Eskanlou, A., Chegeni, M.H., Khalesi, M.R., Abdollahy, M. and Huang, Q., 2019. Modeling of bubble loading based on force balance on the particles attached to the bubble. *Colloids and Surfaces A: Physicochemical and Engineering Aspects*, 582, p.123892. <https://doi.org/10.1016/j.colsurfa.2019.123892>

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## Patents

*A method to design column flotation cell with optimum height based on bubble loading parameters.* Intellectual Property Office, State Organization for Registration of Deeds and Properties, Iran.  
ID: 139550140003002972, August 2016.

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## Presentations & Talks

- TMS Annual Meeting, San Diego, CA, *Selective separation of carbonates from phosphate*, 2026.
- AIChE Annual Meeting, Boston, MA, *Accelerated reagent discovery for mineral processing*, 2025.
- Invited Speaker, Stanford Mineral-X, Stanford, CA, *Recovery of REEs from phosphate wastes*, 2024.
- Materials Day, Penn State, University Park, PA, *An evaluation of pyrite toxicity*, 2023.
- Materials Day, Penn State, University Park, PA, *An evaluation of quartz toxicity*, 2022.
- Invited Speaker, IdeaXCHANGE, SME Annual Meeting, Salt Lake City, UT, *Quantum chemistry for selective separation of critical minerals*, 2022.
- SME Annual Meeting, Phoenix, AZ, USA, *Modeling bubble mass loading in froth flotation*, 2020.
- XXIX IMPC, Moscow, Russia, *Bubble loading profile in flotation columns*, 2018.
- Intl. Geosciences Congress, Tehran, Iran, *Effect of bubble loading on hydrodynamics in flotation*, 2016.

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## Professional Membership

2025 – Present: Member, American Institute of Chemical Engineers (AIChE)  
2025 – Present: Member, The Minerals, Metals & Materials Society (TMS)

2018 – Present: Member, Society for Mining, Metallurgy, and Exploration (SME)

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## Professional Services

2023 – 2024: Chair, SME Mineral and Metallurgical Processing Division Flotation Committee  
2022 – 2023: Vice Chair, SME Mineral & Metallurgical Processing Division Flotation Committee  
2023 – 2024: Executive Member, Penn State EME Department Graduate Students Committee  
2021 – 2023: Safety Officer, Penn State Energy and Mineral Engineering Department Safety Committee

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## Academic Services

2026: Reviewer, SURGE Program, Stanford Doerr School of Sustainability  
2020 – Present: Reviewer for:

- *Applied Surface Science* (Elsevier)
  - *Physicochemical Problems of Mineral Processing*
  - *Minerals Engineering* (Elsevier)
  - *Colloids and Surfaces A: Physicochemical and Engineering Aspects* (Elsevier)
  - *Separation Science and Technology* (Taylor & Francis)
  - *Mining, Metallurgy & Exploration* (Springer Nature)
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## Community Services

2020 – Present: Volunteer, Disaster Action Team, American Red Cross  
2020 – Present: Blood Donor, American Red Cross  
2013 – 2018: Blood Donor, Red Crescent Society

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## References

Jef Karel Caers, Professor, Stanford University, [jcaers@stanford.edu](mailto:jcaers@stanford.edu)  
Barbara J. Arnold, Professor, NAE member, Penn State, [bj4@psu.edu](mailto:bj4@psu.edu)  
Osvaldo Bascur, NAE Member, OSB Digital LLC, [osvaldo@osbdigit.com](mailto:osvaldo@osbdigit.com)  
Abdellatif ELGHALI, Professor, Mohammed VI Polytechnic University, [Abdellatif.ELGHALI@um6p.ma](mailto:Abdellatif.ELGHALI@um6p.ma)