

IGEM Grant Report

Progress (due January 1) Annual (due July 31) Final (due August 31)

IGEM Grant #: IGEN26-007

Principal Investigator: Amin Mirkouei

Name/Full Title of Project: "SONO-MSE Process for Permanent Magnets Manufacturing from Idaho-Sourced Minerals"

Submission Date: 12/16/2025

Primary Institution: University of Idaho

*Instructions: Complete each section of this report directly on this template. Completed reports must be limited to **1 page for Progress Reports and 2 pages for Annual or Final Reports in 12 pt Arial or similar font**, excluding the expenditure report. Simple and concise answers will be appreciated, and even bullet lists of information will be sufficient. Reports that do not follow these requirements will be returned for revision. Submit reports by the appropriate due date to HERC@edu.idaho.gov.*

Section 1: Provide a short one paragraph summary describing the project and its goals. This project aims to advance the extraction and processing of Idaho-sourced rare earth elements (REEs) to enable low-cost rare earth metal (REM) production. The primary objective is to validate neodymium-rich mischmetal (Nd-rich MM) as a viable commercial pathway for permanent magnet manufacturing. To achieve this, goal, we will both produce initial samples of Nd-rich MM alloy to use for Nd-rich MM-Fe-B permanent magnets and perform initial techno-economic analysis (TEA) and life cycle assessment (LCA) of the proposed SONO-MSE pathway.

Section 2: Summary of project accomplishments for the reporting period and plans for the upcoming reporting period. (1) Conducted a field trip to Lemhi Pass, Idaho, in July 2025 to collect REE-rich soil and rocks, in collaboration with our industry partner, Idaho Strategic Resources Inc. (2) Crushed the collected REE-rich rocks and mailed the samples to the Analytical Sciences Laboratory at the University of Idaho for lanthanide characterization in August/September 2025. (3) Purchased and received a vacuum induction casting furnace in October 2025, in collaboration with our industry partner, Hydrova Inc. (4) Conducted two rounds of organic acid leaching for REE extraction in November 2025. (5) Integrated a water-cooled copper mold into the newly acquired induction furnace in December 2025.

Section 3: High-level summary of budget expenditures for the period just completed. If budget is underspent at time of report, explain why and plans for expending funds.

Description	Total allocated budget	Total expenses
Salary	44,114.00	18,337.33
Fringe	4,466.00	3,612.68
Travel	6,500.00	393.69
Op exp	23,500.00	851.69
Capital	31,800.00	31,633.81
Tuition	13,226.00	7,012.00
Total	123,606.00	61,840.93

Section 4: Demonstration of economic development/impact, including the following as applicable: patents, copyrights, plant variety protection certificates received or pending; technology licenses signed, start-up businesses created, industry involvement; private sector engagement; jobs created; external funding; any other pertinent information. Future work will integrate organic acid leaching with chloride molten salt electrolysis to

recover mixed REEs and incorporate a water-cooled copper mold to produce Nd-rich mischmetal alloys. A comprehensive life cycle and techno-economic assessment will be conducted to evaluate process viability and guide the transition from laboratory-scale development to pilot-scale commercial production.

Section 5: Number of faculty and student participants as a result of funding, and brief description of student efforts. Two faculty members: Dr. Ami Mirkouei (PI) and Dr. Alex Vakanski (co-PI), and two graduate students: Sneha Pradhananga (Nuclear Engineering) has worked on the project since July 2025, leading overall project activities, participating in soil sample collection and preparation, conducting literature reviews on molten chloride electrolysis for REE extraction, assisting with furnace installation, preparing reports, and performing initial rounds of organic acid leaching. Jonathan Alvarez (Technology Management) has contributed to rock crushing for characterization, laboratory preparation, furnace installation, and is currently integrating the water-cooled copper mold into the furnace.

Section 6: Updated details and/or progress on the long-term sustainability plan for the project and description of future plans for project continuation or expansion. We plan to submit proposals to NSF SBIR and DOE ARPA-E. Upon successful completion of project milestones, our goal is to advance the technology to pilot-scale demonstration, positioning the project to qualify for DOE Loan Programs Office (LPO) funding to construct a full-scale production facility capable of performing the SONO-MSE process for extracting and refining rare earth metals from Idaho-sourced minerals.

Section 7: Expenditure Report – Attach an expenditure report as a separate document showing expenses toward the original budget submitted for this project. The expenditure report does not count toward the page limit. A written summary of budget expenditures should be provided in section 2 of this report. Please check the attached file.

University of Idaho

Itemized Expenditures

From 7/1/2025 through 12/31/2025

Grant: UI8619 - ISBOE HERC: SONO-MSE (ml)

 Index: 855864 - ISBOE HERC: SONO-MSE (ml)

Fund: 228619 - ISBOE HERC: SONO-MSE (ml)

Salaries

E4108 Summer Salary

Mirkouei, Amin	96 Hours	\$6,967.68
Vakanski, Aleksandar	65 Hours	\$4,537.65

E4109 IA/GA Salary

Pradhananga, Sneha	320 Hours	\$7,808.00
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 \$19,313.33

Fringe Benefits

E4280 Faculty CFR Benefit Expense	\$3,394.07
E4282 Student CFR Fringe Expense	\$249.84

 \$3,643.91

Travel

E5360 Personal Vehicle - In-State

8/15/2025	I2341384	Mirkouei, Amin	\$219.69
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E5396 Lodging & Per Diem – In State

8/4/2025	I2341018	Pradhananga, Sneha	\$58.00
8/15/2025	I2341384	Mirkouei, Amin	\$58.00
8/18/2025	I2341531	Richardson, Kathryn A.	\$58.00

 \$393.69

Operating Expenses

E5724 Research Supplies

9/10/2025	Z1101822	Purchase of buckets and lids relate	Doc Ref:	\$155.99
9/10/2025	Z1101822	Refund related to return of one lid	Doc Ref:	(\$12.71)
9/24/2025	Q0137240	McMaster-Carr S Tight tolerance hard wear-resistant		\$136.35
9/24/2025	Q0137240	McMaster-Carr S Tight-Tolerance Hard Wear-Resistant		\$25.34
9/24/2025	Q0137240	McMaster-Carr S Tight-Tolerance Hard Wear-Resistant		\$45.00
9/24/2025	Q0137240	McMaster-Carr S shipping minus discount \$4.43		\$17.36
9/24/2025	Q0137240	McMaster-Carr S tight-tolerance hard wear-resistant		\$15.00
9/29/2025	I0596745	McMaster-Carr Supply Co.		\$0.00
9/29/2025	I0596745	McMaster-Carr Supply Co.		\$0.00
9/29/2025	I0596745	McMaster-Carr Supply Co.		\$0.00
9/29/2025	I0596745	McMaster-Carr Supply Co.		\$0.00
10/1/2025	Q0138093	McMaster-Carr S Tight-Tolerance Hard Wear-Resistant		\$156.80
10/1/2025	Q0138093	McMaster-Carr S shipping minus discount \$3.14		\$10.79
10/2/2025	I0597204	McMaster-Carr Supply Co.		\$0.00
11/26/2025	Q0147319	McMaster-Carr S Multipurpose 110 copper Bar, 2"		\$284.31

11/26/2025	Q0147319	McMaster-Carr S Shipping	\$17.19
12/3/2025	!0603414	McMaster-Carr Supply Co.	\$0.00
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			\$851.42

\$5K or > Capital Outlay

E6850 >5K Medical/Surgery/Lab Equipment

9/22/2025	Q0136712	Hydrova Inc Custom Inert Induction Furnace	\$28,133.81
9/22/2025	Q0136712	Hydrova Inc shipping	\$3,500.00
9/24/2025	B1957893	Hydrova Inc	\$0.00
9/24/2025	B1957893	Hydrova Inc	\$0.00
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			\$31,633.81

Trustee/Benefits

E7140 Tuition and Fees - Grad Assistants

8/21/2025	J1384452	AWA1 for V00944992	\$35.00
8/21/2025	J1384452	GRFT for V00944992	\$866.00
8/21/2025	J1384452	MG1I for V00944992	\$105.00
8/21/2025	J1384452	SHI1 for V00944992	\$1,206.00
8/21/2025	J1384452	TFGR for V00944992	\$4,700.00
8/21/2025	J1384452	VVSF for V00944992	\$100.00
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			\$7,012.00

Totals for 228619

\$62,848.16

Totals for UI8619

\$62,848.16