



INSTITUTE OF
MATERIALS
PROCESSING

Michigan
Technological
University

Annual Report

July 1, 2023–June 30, 2024
FY24

P.G. Sanders, Incoming Director
S.L. Kampe, Departing Director
Erin Syth, Research Coordinator

1 October 2024

Mission Statement

The Institute of Materials Processing (IMP) mission is to effectively support and promote a unique suite of materials processing facilities such that they will be functional and available to provide a competitive advantage for faculty-led research, to support instructional and outreach activities, and to enable a “maker-culture” for student creativity, prototyping, and entrepreneurship. Towards enhancing Michigan Tech’s portfolio of materials processing capabilities, IMP is also motivated to assist and support non-member faculty and units in the establishment of new capabilities and material processing functionalities.

Summary of FY24 Activities

a. In FY24, IMP held an election to select a new director. Paul Sanders was voted in as the IMP Director in the spring of 2024, with 43 of 65 members voting. A part-time Research Coordinator (0.75 FTE shared with GMES), Erin Syth, was hired to provide additional pre-proposal and post-award member support as well as support the development of the institute. Beyond pre- and post-award proposal support, Syth generated an IMP promotional flier for external partners, served on the VPR hiring committee, supported a collaboration among IKEA, Linnaeus University of Sweden, and MTU researchers, facilitated a tour of the foundry with the Upper Midwest Association for Campus Sustainability, as well as facilitated the MTU’s member registration to the following consortiums: Defense Industrial Base Consortium, Maritime Sustainment Technology and Innovation Consortium, and National Center for Manufacturing Sciences.

IMP had a strong leadership presence in the Advanced Materials and Manufacturing (AMM) Tech Forward Initiative. The AMM Tech Forward initiative was successful in assembling a strong network of researchers across campus that represent both breadth and depth in materials and manufacturing related activities at Michigan Tech. The establishment of this network provides the potential for new membership, collaborative activities, and a stronger link to complementary activities on campus. In particular, stronger links have been established with the Michigan Tech Aerospace Research Center (MARC), the Henes Center for Quantum Phenomena (CQP), and the Hardwood Mass Timber Institute (HMTI) (administered by the Great Lakes Research Center (GLC)).

IMP has also supported efforts by Dr. Lei Pan in his current, relatively large research programs on lithium battery reclamation, as well as his efforts to secure a federally sponsored Center for Critical and Strategic Minerals at Michigan Tech.

i. The governance and administration of IMP is guided by a charter. The charter describes the selection and duties of the director, qualifications for membership, resource (IRAD) allocation philosophy, and summarizes the strategic goals of the center. Specifically, an elected Director will serve a 3-year term and administer the activities of the center, including allocation of resources (IRAD), recruiting, and reporting.

ii. Voting membership to IMP is defined as any Michigan Tech faculty or staff member who submits an IRAD-generating proposal through the center or is a significant participant (defined in the charter) on an

externally funded grant. An affiliate membership level has been established to welcome other members of the university community that do not meet these qualifications but have an interest in materials processing and/or the facilities for non-research purposes (e.g., instruction, outreach, recruitment, etc.).

iii. In FY24, 13 new members joined the institute, bringing membership to 65 members in 14 units across campus; including BME, CEGE, ChEng, ECE, GMES, MAE, MMET, MSE, BioSci, Chem, Physics, SS, GLRC, and COB.

iv. Support for member involvement with the institute was primarily executed through proposal submission assistance, post-award management, and investment in new campus capabilities and existing facilities, as well as cost-share for facility use fees, advancing the research of our members.

v. Funds were directed towards activities that will serve to sustain the use and functionality of the existing facilities (including maintenance contracts and high-cost and unplanned maintenance needs), the acquisition and establishment of new capabilities, and any activities that will serve to increase the interdisciplinary user base of the facilities. IMP regularly contributes to yearly cost sharing requests from ACMAL to support yearly maintenance contracts, and to member requests for cost-share in support of an REF, MRI, or similar equipment-focused proposals.

b. See Appendix A

Budget Overview

a.

FY24 IMP Budget Summary	
Income	
2023 Carry Forward	\$8,630
IRAD	\$152,156
Total	\$160,786
Major Expenditures	
Research Engineer Salary (Hein)	\$34,750
Other Technical Staff Salary	\$2,537
Graduate Student Stipend	\$4,189
Undergraduate Hourly	\$234
Fringes	\$14,853

Equipment	
Gleeble (Mueller)	\$10,000
Microtrac (Pan)	\$5,053
Arcast Vacuum Caster (Mueller)	\$5,400
Services (use fees?)	\$18,523
Supplies	\$3,447
Travel	\$130
Matching Grant	\$1,154
Non-mandatory Transfers Out	
ACMAL Service Agreement	\$8,000
ACMAL Protochips & ESEM Upgrade	\$10,000
Total	\$118,270
FY25 Carry Forward	\$42,409

b. Institute IRAD was used to enhance member capacity to compete for external sponsored awards through funding a portion of Research Engineer Allison Hein’s salary, who provides members with pre- and post-award support

IRAD was dedicated to the purchase of equipment for member research in the amount of \$24,053. A Gleeble machine (\$10,000) and Arcast vacuum caster (\$9,053) was purchased to support the research of Dr. Joshua Mueller. A Microtrac instrument (\$5,000) was purchased to support the work of Dr. Lei Pan.

A graduate student stipend of \$4,189 was provided for doctoral student Shaoqin Chen for Summer 2023 to assist IMP member Yun Hang Hu’s research. IMP member Bowen Li was awarded cost-share for project supplies and use fees in the amount of \$1,154.

IMP provided monetary support to the Applied Chemical and Morphological Analysis Laboratory (ACMAL); \$8,000 was committed to a service agreement and \$10,000 was dedicated to protochip and ESEM upgrades.

Also, IMP facilitates the work of externally funded faculty and student research by providing cost share of use fees charged to utilize materials processing facilities, and any use fees necessary to characterize and certify the materials produced subsequently (e.g., ACMAL, mechanical testing). On externally funded IMP projects, this initiative pays 25% of the hours of use for ACMAL and IMP labs with use fees at the approved use rate from the IMP IRAD index.

At least seven technical staff members (Dewald, McFall, Hein, Wakeham, Jacszak, Stein, Wood) direct charged all or a portion of their salary to IMP-administered projects. At least 26 graduate students receive funding from IMP projects in support of their thesis and/or dissertation.

c. See Appendix B

d.

FY24 IMP ASPIRE 5-Year Forecast							
	2025	2026	2027	2028	2029	2030	2031
Proposals in ASPIRE	\$22,736	\$28,335	\$21,755	\$13,254	\$5,309	\$1,892	\$0
Anticipated	\$30,901	\$30,290	\$24,869	\$0	\$0	\$0	\$0
Current	\$182,344	\$65,657	\$4,685	\$613	\$222	\$0	\$0

Future Plans and Goals

IMP plans to support member participation and research through the establishment of research focus areas and a seed grant program. The Institute intends to continue to fund a portion of staff salary for Hein and work towards supporting a portion of staff salary for Syth. IMP will also continue to do the following:

- Support the installation, development, and (occasionally, maintenance) of major materials processing facilities that are available to university faculty and staff for research.
- Support of processing and characterization use fee cost sharing in support of faculty research.
- Work with department chairs and college deans to assist with new faculty start-up packages that involve material processing.
- Support proposal submissions and selected post-award activities.

Appendix A

Membership

College	Department	First Name	Last Name
College of Business		Jenny	Apriesnig
College of Engineering	BME	Bruce	Lee
College of Engineering	BME	Daniel	Seguin
College of Engineering	BME	Smitha	Rao Hatti
College of Engineering	BME	Chunxiu	Yu
College of Engineering	CEGE	David	Labyak
College of Engineering	CEGE	Zhanping	You
College of Engineering	ChEng	David	Shonnard
College of Engineering	ChEng	Edward	Laitila
College of Engineering	ChEng	Elizabeth	Miller
College of Engineering	ChEng	Emanuel	Xavier-Oliveira
College of Engineering	ChEng	Erico	Freitas
College of Engineering	ChEng	Ezra-Bar	Ziv
College of Engineering	ChEng	Gerard	Caneba
College of Engineering	ChEng	Kaiwu	Huang
College of Engineering	ECE	Christopher	Middlebrook
College of Engineering	ECE	Greg	Odegard
College of Engineering	GMES	Jaroslav	Drelich
College of Engineering	GMES	Snehamoy	Chatterjee
College of Engineering	MEEM	Jeremy	Goldman
College of Engineering	MEEM	Jonathan	Robins
College of Engineering	MEEM	Josh	Mueller
College of Engineering	MEEM	Kazuya	Tajiri
College of Engineering	MEEM	Larry	Sutter
College of Engineering	MEEM	Laura	Connolly
College of Engineering	MEEM	Lei	Pan
College of Engineering	MMET	Matt	Portfleet
College of Engineering	MMET	Miguel	Levy
College of Engineering	MSE	Alexandra	Glover
College of Engineering	MSE	Anjana	Asthana

College of Engineering	MSE	Bowen	Li
College of Engineering	MSE	Isabella	Jaszczak
College of Engineering	MSE	Nicholas	Hendrickson
College of Engineering	MSE	Pasi	Lautala
College of Engineering	MSE	Patricia	Heiden
College of Engineering	MSE	Paul	Bergstrom
College of Engineering	MSE	Paul	Fraley
College of Engineering	MSE	Paul	Sanders
College of Engineering	MSE	Peter	Jaszczak
College of Engineering	MSE	Ranjit	Pati
College of Engineering	MSE	Rebecca	Ong
College of Engineering	MSE	Robert	Handler
College of Engineering	MSE	Russell	Stein
College of Engineering	MSE	Sriram	Vijayan
College of Engineering	MSE	Stephen	Hackney
College of Engineering	MSE	Stephen	Techtmann
College of Engineering	MSE	Steve	Kampe
College of Engineering	MSE	Thomas	Wood
College of Engineering	MSE	Timothy	Eisele
College of Engineering	MSE	Timothy	Leftwich
College of Engineering	MSE	Trisha	Sain
College of Engineering	MSE	Vinh	Nguyen
College of Engineering	MSE	Walter	Milligan
College of Science & Arts	BioSci	Zequn	Wang
College of Science & Arts	Chem	Kathryn	Perrine
College of Science & Arts	Chem	Yu	Wang
College of Science & Arts	Physics	Dongyan	Zhang
College of Science & Arts	Physics	Jae	Yong Suh
College of Science & Arts	Physics	Yoke	Khin Yap
College of Science & Arts	Physics	Yongmei	Jin
College of Science & Arts	SS	Adam	Wellstead
College of Science & Arts	SS	Mark	Rhodes
College of Science & Arts	SS	Timothy	Scarlett
College of Science & Arts	SS	Yun	Hang Hu
	GLRC	Daniel	Trepal

Appendix B

Proposals Submitted

PI	Sponsor	Full Project Title	Total Project Cost	Status
Alexandra Glover	Triad National Security LLC	Optimization of Metal Manufacturing	\$ 2,500,000	Funded
Alexandra Glover	American Lightweight Materials Manufacturing Innovation Institute(ALMMII)	Processing and Analyses	\$ 9,000	Funded
Alexandra Glover	International Organization on Shape Memory and Superelastic Technologies (SMST)	Investigation of Abnormal Grain Growth Under Complex Thermo-Mechanical Conditions in Fe-based Superelastic Alloys	\$ 74,524	Closed
Alexandra Glover	US Dept of Defense/Navy/Office of Naval Research(ONR)	DURIP: Plasma FIB-SEM to facilitate interdisciplinary research and education to realize the next generation of multifunctional materials and structures.	\$ 2,848,160	Pending
Bowen Li	Michigan Dept of Environment Great Lakes and Energy(EGLE)	Recycling native copper from copper tailings of Michigan's Keweenaw Peninsula and the sustainable uses of the tailings' leftover	\$ 673,931	Pending
Bruce Lee	US Dept of Defense/Navy/Office of Naval Research(ONR)	Biomimetic, Electro-Responsive Adhesive		Closed
Bruce Lee	US Dept of Defense/Navy/Office of Naval Research(ONR)	Biomimetic and Electro-Responsive Adhesive with Improved Performance	\$ 570,150	Pending
Christopher Middlebrook	Calumet Electronics Inc	DREAMS - Domestic Resurgence & Evolution of Advanced Manufacturing for Substrates	\$ 3,499,318	Pending
Edward Laitila	Aalberts Surface Technologies	XRD Analyses	\$ 5,000	Funded
Edward Laitila	Mercury Marine	XRD Analyses	\$ 1,000	Funded
Edward Laitila	US Dept of Energy/Advanced Research Projects Agency - Energy(ARPA-E)	Novel Iron Making Method – Chemical Comminution		Closed
Elizabeth Miller	ICON Technology	Analyses and Testing	\$ 5,000	Funded
Elizabeth Miller	Michigan Rocks and Minerals	Various Sponsor: Analyze Samples	\$ 1,000	Pending
Elizabeth Miller	Sutter Engineering LLC	SEM characterization	\$ 5,000	Pending
Elizabeth Miller	Medical College of Wisconsin	General Materials Characterization	\$ 10,000	Funded
Elizabeth Miller	Calumet Electronics Inc	SEM and other analyses	\$ 21,000	Pending
Elizabeth Miller	Marquette University	Lipid corrosion	\$ 5,000	Pending
Elizabeth Miller	Upper Michigan Energy Resources Corp (WEC Energy Group)	Materials Characterization and Analyses	\$ 15,762	Funded

Erico Fraga Freitas	Aperam South America	STEM and XEDS analysis of Electrical Steel	\$ 30,000	Funded
Erico Fraga Freitas	Ford Motor Co	TEM sample preparation and analyses	\$ 4,130	Pending
Erico Fraga Freitas	Instituto Tecnológico Vale Mineração / Vale Technological Institute (ITV)	STEM / EBSD analyses and sample prep	\$ 33,325	Pending
Gerard Caneba	US Dept of Energy/Office of Energy Efficiency and Renewable Energy(EERE)	Novel High-Energy-Density Chain- Polymerization Reactions		Closed
Jaroslav Drelich	US Dept of Health and Human Services/National Institutes of Health(NIH)	Bioresorbable Vascular Scaffolds of Uniform Biodegradation	\$ 2,940,185	Pending
Jeremy Goldman	Texas A&M University System	Biomimetic Acellular Vascular Graft Engineering	\$ 589,750	Pending
Jeremy Goldman	US Dept of Health and Human Services/National Institutes of Health(NIH)	Antiplatelet/anti-inflammatory biodegradable stent metal development	\$ 2,669,445	Pending
Jeremy Goldman	Texas A&M University System	Acellular and Completely Biological Tissue Engineered Vascular Graft	\$ 589,750	Closed
Jeremy Goldman	Texas A&M University System	Acellular and Completely Biological Tissue Engineered Vascular Graft	\$ 589,750	Pending
Jeremy Goldman	Marquette University	Deciphering the relationship between bioresorbable magnesium alloy corrosion and the inflammatory microenvironment of the neotima	\$ 31,784	Funded
Jonathan Robins	Alfred P Sloan Foundation	Mining the Past for the Future: Critical Minerals and Waste Landscapes	\$ 753,610	Closed
Joshua Mueller	Becht Engineering Co Inc	Effect of Ageing on Microstructure Evolution and Impact Toughness in 304H and 347AP	\$ 25,335	Pending
Joshua Mueller	Forging Industry Educational and Research Foundation	Investigating the Coaction of Cyclic and Thermal Softening to Evaluate Heat Checking Resistance in Die Steels	\$ 170,000	Closed
Joshua Mueller	Becht Engineering Co Inc	Testing and Analyses - additional work	\$ 166,698	Funded
Joshua Mueller	Forging Industry Educational and Research Foundation	Development of a Joint Modeling- and Experimental-Based Methodology to Evaluate Heat Checking Resistance in Open-Die Forge Tooling	\$ 104,394	Funded
Joshua Mueller	Becht Engineering Co Inc	Testing and Analyses	\$ 143,537	Funded
Joshua Mueller	Triad National Security LLC	Development of High Strength High Toughness Materials for Impulsively Loaded Pressure Vessels	\$ 820,000	Funded
Kaiwu Huang	US Dept of Energy/Office of Fossil Energy	Improving Nickel Production and Recovery by Increasing Flotation Efficiency	\$ 702,393	Pending
Lei Pan	US Dept of Health and Human Services/Centers for Disease Control and Prevention(CDC)	Size-dependent Metric Analysis of Respirable Coal Mine Dust (RCMD)	\$ 160,000	Pending
Lei Pan	US Dept of Energy/Office of Fossil Energy	Integrated Accelerated Mineral Carbonation and Critical Mineral Recovery from Domestic Mine Tailings	\$ 3,262,521	Pending

Lei Pan	Nissan/Nissan Technical Center North America/Headquarters	Direct recycling process development to reach high purity and high recovery efficiency of materials from degraded Leaf batteries, scrap manufacturing and advanced Ariya batteries	\$ 163,144	Funded
Matthew Sisson	University of Michigan-Michigan Space Grant Consortium	Micromagnetism of Self-Assembled FeSi ₂ Nanoislands	\$ 5,000	Pending
Paul Bergstrom	University of Michigan	Adaptable Wideband Hardware for Communication	\$ 800,000	Pending
Paul Bergstrom	National Science Foundation(NSF)	NSF Convergence Accelerator Track L: Advancing Digital Biosensing at Ultralow Concentrations using Advanced Nanofabrication Technologies	\$ 625,000	Closed
Paul Bergstrom	National Science Foundation(NSF)	MRI: Track 2 Acquisition of a Plasma FIB-SEM enabling multi-scale in-situ analysis on advanced materials and patterning for interdisciplinary research and education	\$ 3,393,316	Closed
Paul Bergstrom	ThermoAnalytics Inc	Congressional Add-Electrification 23	\$ 200,000	Funded
Paul Fraley	Neuvokas Corp	Miscellaneous Testing	\$ 10,000	Funded
Paul Fraley	Amsted Rail Co Inc	Materials Characterization and Analyses	\$ 7,900	Funded
Paul Fraley	KS Kolbenschmidt US Inc/Rheinmetall Automotive	Tensile Testing	\$ 4,160	Pending
Paul Fraley	KS Kolbenschmidt US Inc/Rheinmetall Automotive	Rotary Bend Fatigue and Tensile Testing	\$ 20,000	Funded
Paul Fraley	Dynamic Design Group Inc	Steel Testing	\$ 5,000	Funded
Paul Sanders	Texas Biochemicals Inc	Cost-effective Manufacturing of Nanocomposite Steel Wire for Arresting Gear Purchase Cable	\$ 79,995	Pending
Paul Sanders	Aerojet Rocketdyne/Redmond	Machine learning for low orbit vehicles	\$ 35,468	Closed
Paul Sanders	US Dept of Energy/Industrial Efficiency and Decarbonization Office	Electric Induction-heated Kiln to Decarbonize Wollastonite-Rich Clinker Production		Closed
Paul Sanders	Brazeway	Alloy design for extruded aluminum tube return bends	\$ 60,000	Funded
Paul Sanders	Shape Corp	Student Design: Extrusion texture optimization for improved vehicle crash energy absorption	\$ 27,086	Funded
Paul Sanders	Loukus Technologies Inc	Optimized Feedstock Alloy Production for Light Alloy Additive Manufacturing	\$ 10,000	Funded
Paul Sanders	Stanford University	Sample Production of Laser-Shocked High Entropy Alloys	\$ 10,000	Funded
Paul Sanders	Loram Maintenance of Way Inc	Grind Wheel Research Phase 1 Rev 3: Research, Prototype and Test	\$ 30,057	Pending
Paul Sanders	University of Kansas/Center of Research	Use of Steel Slag in Concrete and Cement	\$ 879,890	Pending
Paul Sanders	Magsorbeo Biomedical Corp	Magnesium alloy extrusion trial	\$ 3,600	Funded

Paul Sanders	Howmet Aerospace	Senior Design: Effect of hafnium on superalloy castability and mechanical properties	\$ 27,086	Funded
Paul Sanders	Waupaca Foundry Inc	Student Design: Effect of boron on gray iron microstructure and properties	\$ 27,086	Funded
Paul Sanders	CBMM North America Inc	Quantifying the Evolution of Strengthening Mechanisms Along Coil Length for Hot-Rolled Nb-Ti HSLA Steel Sheet	\$ 43,000	Funded
Paul Sanders	Aerojet Rocketdyne/Redmond	Machine learning for low orbit vehicles	\$ 200,000	Funded
Paul Sanders	Hobart Brothers Co	Senior Design: Investigate manufacturability of the low manganese solid wire	\$ 27,086	Funded
Paul Sanders	Western Michigan University	Extrude Rods from Nanopowder	\$ 10,000	Funded
Paul Sanders	Loram Maintenance of Way Inc	Research, Prototype and Test	\$ 12,000	Funded
Paul Sanders	Secat Inc	Analysis of Alloy Materials File Generation	\$ 7,500	Funded
Paul Sanders	Bonnell Aluminum	Root cause and mitigation of non-structural streaks in 6000 series extruded-aluminum profiles	\$ 10,000	Funded
Paul Sanders	Hydro- Extrusion USA LLC	Tensile Test	\$ 8,500	Funded
Russell Stein	Carley Foundry Inc	206 Weld Rod	\$ 4,400	Funded
Russell Stein	Resolve Surgical Technologies	Various Sponsor: Print Parts	\$ 1,900	Funded
Snehamoy Chatterjee	National Science Foundation(NSF)	EAGER: CET: Assessing the Simultaneous Potential of Carbon Mineralization, Hydrogen Production, and Critical Mineral Recovery in Mafic and Ultramafic Mine Wastes	Pending	Pending
Sriram Vijayan	US Dept of Energy/Advanced Research Projects Agency - Energy(ARPA-E)	High throughput design and development of additively manufactured oxide dispersion strengthened tungsten-based multi principal elemental alloys reinforced with diamond		Closed
Sriram Vijayan	National Science Foundation(NSF)	LEAPS-MPS: Understanding the effects of extreme thermal gradients and thermal cycling on complex metallic alloys	\$ 249,997	Closed
Stephen Kampe	Consolidated Nuclear Security LLC	Processing / Structure / Properties Support for the Research Development, Test and Evaluation (RDT&E) for Nuclear Materials Technology	\$ 150,000	Funded
Stephen Kampe	Virginia Polytechnic Institute and State University(VT)	Low- Temperature, Mechanical Alloying and Production of Nanocomposite Arresting Gear Purchase Cable	\$ 14,000	Pending
Thomas Wood	FEA Materials LLC	Testing and Analysis of Al-Sc alloys	\$ 10,000	Funded
Thomas Wood	Loukus Technologies Inc	Processing, Testing, and Analyses	\$ 50,000	Funded
Thomas Wood	NanoAl LLC	Metal Casting	\$ 1,500	Funded
Timothy Eisele	US Dept of Energy/Advanced Research Projects Agency - Energy(ARPA-E)	Reductive Bioleaching and Electrowinning of Iron from Tailings and Goethitic Ores	\$ -	Closed

Timothy Eisele	US Dept of Energy/Office of Energy Efficiency and Renewable Energy(EERE)	Production of Improved DRI Feed from Diverse Iron Ore Sources by Reductive Bioleaching	\$ -	Pending
Timothy Eisele	Georgia Institute of Technology	DIRECT HYDROGEN REDUCTION OF IRON ORE CONCENTRATE AND NET-SHAPED FABRICATION OF LINEAR CELLULAR ALLOY STEELS	\$ 495,000	Pending
Timothy Eisele	ArcelorMittal Global	Bioleaching of Iron Tailings for Production of Voteron(TM) Process Feedstock	\$ 200,000	Pending
Timothy Eisele	US Dept of Energy/Office of Fossil Energy	Biological leaching process for producing high-grade manganese dioxide from low-grade sources	\$ 669,783	Pending
Vinh Nguyen	Georgia Institute of Technology	Improving the Curing Efficiency for Composite Aerostructures Through Multi-Task Optimization of a Physics-informed Multiple Neural Network Framework	\$ 400,208	Funded
Yoke Yap	National Science Foundation(NSF)	MRI: Track 1: Acquisition of a Confocal Raman Microscope for Multidisciplinary Research, Education, and Outreach Programs in the Remote Upper Peninsula of Michigan	\$ 684,520	Pending
Yu Wang	National Science Foundation(NSF)	Computational Study of Magnetoelectric Composites in Multiple Frequency Regimes	\$ 615,848	Closed
Yun Hu	National Science Foundation(NSF)	Manufacturing of Non-stoichiometric Lithium Imide Materials	\$ 498,797	Pending
Yun Hu	American Chemical Society/The Petroleum Research Fund	High Entropy Catalysts for High Temperature Processes of Methane Conversion	\$ 183,342	Closed
Yun Hu	National Science Foundation(NSF)	In-situ detection of structure changes and reactivities of atomic carbon chains	\$ 491,670	Closed
Yun Hu	National Aeronautics and Space Administration(NASA)	Partially Hydrogenated 3D Graphene Based Charge Dissipative Coating for Lunar Dust Adhesion Mitigation	\$ 749,940	Pending
Yun Hu	National Science Foundation(NSF)	Highly Conductive and Defects-Enriched Alkali-Metal-Embedded Carbon Nanomaterials as Electrodes for Energy Devices	\$ 488,554	Pending
Zhanping You	Qtek LLC	Upcycling and sustainable use of copper tailings stamp sand on Lake Superior shoreline	\$ 41,670	Closed
		Total Proposals (93):	\$ 37,073,455	
		Total Awarded (41):	\$7,834,483	