CV | Mohammad HOUSHMAND KHANEGHAHI, PH.D.

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PROFESSIONAL SUMMARY

Associate Research Scientist at the **National Institute of Standards and Technology (NIST)** with **10+ years** of research experience in **Materials Science**, **Structural Engineering**, and **Infrastructure Systems**. Research spans scales from material chemistry, microstructure, and characterization to durability, mechanics, and structural performance, with particular emphasis on nature-inspired, self-healing, and low-carbon materials and composites for resilient infrastructure. Leads high-impact research from novel concept to proof-of-concept, validation, and technology translation through rigorous experimentation and systematic de-risking. Experienced in teaching and mentoring students and early-career researchers to develop scientific independence and problem-solving skills.

RESEARCH INTERESTS

Advanced Materials Characterization • Infrastructure Materials Development • Cementitious Materials • Bio-Inspired Materials Design • Self-Healing Materials • Low-Carbon Materials • Durability & Corrosion • Measurement Science • Multiphysics & Multiscale Modeling • Uncertainty Quantification • Physics-Aware AI/ML • Data-Driven Materials Design • Closed-Loop Experimentation & Intelligent Manufacturing • Structural Performance Analysis • Sensor-Informed Structural Assessment

EDUCATION

Postdoc	Civil Engineering	Johns Hopkins University	Baltimore, MD, USA	2024-2026
PhD	Civil Engineering	Drexel University	Philadelphia, PA, USA	2021-2024
MSc	Civil Engineering	Sharif University of Technology	Tehran, Iran	2014-2017
BSc	Civil Engineering	Shahid Beheshti University	Tehran, Iran	2010-2014

EMPLOYMENT HISTORY

Associate Research Scientist	NIST/JHU	Gaithersburg, MD	10/2026 – Present
Associate Researcher	NIST/JHU	Gaithersburg, MD	10/2024 – 09/2026
Co-Founder & CEO	novaMATs LLC	Rockville, MD	12/2025 – Present
Research Associate	Turner-Fairbank Research Center	McLean, VA	01/2024 – 07/2024
Research Assistant	Drexel University	Philadelphia, PA	01/2021 – 09/2024
Laboratory Liaison	Drexel University	Philadelphia, PA	01/2022 – 12/2023
Research Assistant	Texas State University	San Marcos, TX	09/2019 – 12/2020
Graduate Research Assistant	Tarbiat Modares University	Tehran, Iran	03/2017 – 09/2019
Graduate Research Assistant	Sharif University of Technology	Tehran, Iran	09/2015 – 02/2017
Project Engineer	Armeno Co.	Tehran, Iran	02/2011 – 02/2013

AWARDS & RECOGNITION

Award	Distinguished Associate Award	Engineering Lab, NIST	2026
Finalist	EYP Postdoctoral Pitch	Johns Hopkins Univ.	2025
Fellowship	Concrete 3D Printing Travel Fellowship	NSF AccelNet & DuRe-Transp Center	2024
Award	Research Excellence Award	Drexel Univ.	2024
Fellowship	Corleone Fellowship	College of Engineering, Drexel Univ.	2024
Grant	Non-Academic Research Internship	NSF	2023
Award	Outstanding Research Award	European Marie Curie SMARTINCS	2023

Award	Teck-Kah Lim Travel Award	College of Engineering, Drexel Univ.	2023
Award	Science Image Award	Nanotechnology World Association, Purdue	2023
Scholarship	Iranian Cultural Society of America	Shabahang Org.	2022
Fellowship	Travel Fellowship	Johns Hopkins University	2020
Award	Best Teaching Assistant Award	Shahid Beheshti University	2013

RESEARCH RECORD

Journal Articles: 23 • Conference: 18 • Citations: +780 • h-index: 15 • i10-index: 19 • ORCiD: 0000-0001-5230-0214 • Google Scholar

- **Peer-Reviewed Journal Publications**

J1. Houshmand, M., Rahmaninezhad, A., Sales, C.M., Schauer, C.L., Najafi, A.R., Farnam, Y.A., (2026). Self-healing mechanism and crack-filling performance of multifunctional bacteria-laden fiber (bioFiber) in cementitious matrix. *Materials and Structures*. Vol. 59, Article 215. DOI

J2. Rahmaninezhad, S.A., **Houshmand, M.**, Namakiaraghi, P., Sadighi, A., Ahmari, K., Kamireddi, D., Farnam, Y.A., Schauer, C.L., Najafi, A.R., Sales, C.M., (2026). Enhancing microbial induced calcium carbonate precipitation (MICCP) in self-healing concrete by addressing cell encapsulation: Investigating the impact of exogenous carbonate ions. *Process Biochemistry*. Vol. 160, pp. 194–205. DOI

J3. Sadighi, A., Kerrane, S., Lee, H.W., Meng, L., **Houshmand, M.**, Rahmaninezhad, S.A., Kamireddi, D., Farnam, Y.A., Sales, C.M., Schauer, C.L., Najafi, A.R., (2025). Phase-field modeling of fracture and healing in BioFiber-Reinforced Concrete. *International Journal of Mechanical Sciences*. Vol. 301, Article 110447. DOI

J4. Osan, R., Deb, R., **Houshmand, M.**, Namakiaraghi, P., Iqbal, M.I., Farnam, Y.A., (2025). Nature inspired vascular self-thermal responsive cementitious composites with phase change materials. *Journal of Building Engineering*. Vol. 108, Article 112878. DOI

J5. Houshmand, M., Mutua, A., He, J., Mishra, G., Farnam, Y.A., (2024). Long-term performance of soybean-based concrete surface protectant under laboratory accelerated aging conditions. *Transportation Research Record*. Vol. 2678(8), pp. 470–481. DOI

J6. Rahmaninezhad, S.A., **Houshmand, M.**, Sadighi, A., Ahmari, K., Kamireddi, D., Street, R.M., Farnam, Y.A., Schauer, C.L., Najafi, A.R., Sales, C.M., (2024). Overcoming the inhibitory effects of urea to improve the kinetics of microbial-induced calcium carbonate precipitation (MICCP) by Lysinibacillus sphaericus strain MB284. *Journal of Bioscience and Bioengineering*. Vol. 138(1), pp. 63–72. DOI

J7. Rahmaninezhad, S.A., **Houshmand, M.**, Sadighi, A., Kamireddi, D., Street, R.M., Farnam, Y.A., Schauer, C.L., Najafi, A.R., Sales, C.M., (2024). Generation of enhanced endospores for microbially induced calcium carbonate precipitation (MICCP) via thermal shock for concrete self-healing. *Construction and Building Materials*. Vol. 419, Article 135528. DOI

J8. Houshmand, M., Rahmaninezhad, S.A., Kamireddi, D., Sadighi, A., Sales, C.M., Schauer, C.L., Najafi, A.R., Farnam, Y.A., (2024). Carbonate biomineralization potential of endospore-laden polymeric fibers (BioFibers) for bio-self-healing applications. *Developments in the Built Environment*. Vol. 17, Article 100351. DOI

J9. Houshmand, M., He, J., Farnam, Y.A., (2024). Investigation on physical and chemical protecting mechanism of SME-PS as a concrete surface protectant. *Journal of Materials in Civil Engineering*. Vol. 36(1), 04023529. DOI

J10. Houshmand, M., Kamireddi, D., Rahmaninezhad, A., Sadighi, A., Schauer, C.L., Sales, C.M., Najafi, A.R., Cotton, A., Street, M., Farnam, Y.A., (2023). Development of a nature-inspired polymeric fiber (BioFiber) for advanced delivery of self-healing agents into concrete. *Construction and Building Materials*. Vol. 408, 133765. DOI

J11. Sadighi, A., Maghami, E., **Houshmand, M.**, Kamireddi, D., Rahmaninezhad, S.A., Farnam, Y.A., Sales, C.M., Schauer, C.L., Najafi, A.R., (2023). Fracture analysis of multifunctional fiber-reinforced concrete using phase-field method. *International Journal of Solids and Structures*. Vol. 283, Article 112493. DOI

J12. Balapour, M., **Houshmand, M.**, Garboczi, E.J., Hsuan, Y.G., Hun, D.E., Farnam, Y.A., (2022). Off-spec fly ash-based lightweight aggregate properties and their influence on the fresh, mechanical, and hydration properties of lightweight concrete: A comparative study. *Construction and Building Materials*. Vol. 342, Article 128013. DOI

J13. Houshmand, M., Ghamsari, A.K., Ozbakkaloglu, T., (2021). Stress-relaxation behavior of fiber-reinforced polymer sheets at elevated temperatures. *Construction and Building Materials*. Vol. 307, Article 124900. DOI

J14. Sahloddin, Y., Dalvand, A., Ahmadi, M., Hatami, H., **Houshmand, M.**, (2021). Performance evaluation of built-up composite beams fabricated using thin-walled hollow sections and self-compacting concrete. *Construction and Building Materials*. Vol. 305, Article 124645. DOI

J15. Houshmand, M., Najafabadi, E.P., Bazli, M., Oskouei, A.V., Zhao, X.L., (2020). The effect of elevated temperatures on the compressive section capacity of pultruded GFRP profiles. *Construction and Building Materials*. Vol. 249, Article 118725. DOI

J16. Oskouei, A.V., Nazari, R., **Houshmand, M.**, (2020). Laboratory and in situ investigation of the compressive strength of CFRD concrete. *Construction and Building Materials*. Vol. 242, Article 118166. DOI

J17. Houshmand, M., Alembagheri, M., Soltani, N., (2019). Reliability and variance-based sensitivity analysis of arch dams during construction and reservoir impoundment. *Frontiers of Structural and Civil Engineering*. Vol. 13(3), pp. 526–541. DOI

J18. Soltani, N., Alembagheri, M., **Houshmand, M.**, (2019). Risk-based probabilistic thermal-stress analysis of concrete arch dams. *Frontiers of Structural and Civil Engineering*. Vol. 13(5), pp. 1007–1019. DOI

J19. Ganji, H.T., Alembagheri, M., **Houshmand, M.**, (2019). Evaluation of seismic reliability of gravity dam-reservoir-inhomogeneous foundation coupled system. *Frontiers of Structural and Civil Engineering*. Vol. 13(3), pp. 701–715. DOI

J20. Najafabadi, E.P., Oskouei, A.V., **Houshmand, M.**, Shoaei, P., Ozbakkaloglu, T., (2019). The tensile performance of FRP bars embedded in concrete under elevated temperatures. *Construction and Building Materials*. Vol. 211, pp. 1138–1152. DOI

J21. Najafabadi, E.P., **Houshmand, M.**, Amiri, H.A., Estekanchi, H.E., Ozbakkaloglu, T., (2019). Experimental investigation and probabilistic models for residual mechanical properties of GFRP pultruded profiles exposed to elevated temperatures. *Composite Structures*. Vol. 211, pp. 610–629. DOI

J22. Houshmand, M., Najafabadi, E.P., Shoaei, P., Oskouei, A.V., (2018). Effect of intumescent paint coating on mechanical properties of FRP bars at elevated temperature. *Polymer Testing*. Vol. 71, pp. 72–86. DOI

J23. Jarrah, M., Najafabadi, E., **Houshmand, M.**, Oskouei, A., (2018). The effect of elevated temperatures on the tensile performance of GFRP and CFRP sheets. *Construction and Building Materials*. Vol. 190, pp. 38–52. DOI

- **Conference Presentations and Proceedings**

C1. Efe, I., **Houshmand, M.**, Taller, E., Snyder, K.A., Jones, S.Z., (2026). Passivation and chloride-induced corrosion of reinforcing steel in simulated pore solutions of alternative cementitious materials. *250th ECS Meeting*, Calgary, AB, Canada, October 25-29, 2026.

C2. Houshmand, M., Snyder, K.A., Efe, I., Jones, S.Z., (2026). Concrete pore solution elemental analysis using wavelength-dispersive X-ray fluorescence (WD-XRF). *16th Advances in Cement-Based Materials*, Coral Gables, FL, US, June 10-12, 2026.

C3. Houshmand, M., Snyder, K.A., Efe, I., Jones, S.Z., (2026). Elemental analysis of concrete pore solutions in emerging binder systems using X-ray fluorescence (XRF). *33rd Annual NIST Sigma Xi Early-Career Poster Presentation (ECPP)*, Gaithersburg, MD, US, May 12, 2026.

C4. Houshmand, M., Efe, I., Jones, S.Z., Snyder, K.A., (2025). Corrosion of steel in alternative cement concretes. *Workshop on Low-Carbon Concrete: Industry Trends and Their Impact on ASTM Cement and Concrete Standards*, Atlanta, GA, US, December 7, 2025.

C5. Houshmand, M., Farnam, Y.A., Sales, C.M., Schauer, C.L., Najafi, A., (2025). Multifunctional polymeric fiber (bioFiber): A three-in-one fiber integrating crack bridging, self-healing, and damage-induced activation for concrete. *32nd Annual NIST Sigma Xi Early-Career Poster Presentation (ECPP)*, Gaithersburg, MD, US, April 30, 2025.

C6. Houshmand, M., Kamireddi, D., Rahmaninezhad, S.A., Sadighi, A., Schauer, C.L., Sales, C.M., Najafi, A., Farnam, Y.A., (2024). Performance assessment of cementitious matrix reinforcement with multifunctional bacterial-laden fibers (BioFibers). *9th International Conference on Self-Healing Materials*, Madrid, Spain, June 24-26, 2024.

C7. Houshmand, M., Rahmaninezhad, S.A., Schauer, C.L., Sales, C.M., Najafi, A., Farnam, Y.A., (2024). Self-healing mechanism and crack-filling performance of multi-functional bacterial-laden fiber (bioFiber) in cementitious

matrix. *RILEM Spring Convention and Conference*, Milan, Italy, April 7-12, 2024. DOI

C8. Houshmand, M., Kamireddi, D., Rahmaninezhad, S.A., Sadighi, A., Schauer, C.L., Sales, C.M., Najafi, A., Farnam, Y.A., (2023). Development of bacteria-laden polymeric fiber (BioFiber) for self-healing application in quasi-brittle materials. *Fall 2023 Fiber Society Conference*, Philadelphia, PA, US, October 25-27, 2023.

C9. Houshmand, M., Rahmaninezhad, S.A., Kamireddi, D., Schauer, C.L., Sales, C.M., Najafi, A., Sadighi, A., Farnam, Y.A., (2023). Evaluation of crack-healing performance of bio-inspired multi-functional polymeric fibers (BioFibers) for concrete self-healing applications. *77th RILEM Annual Week and 1st Interdisciplinary Symposium on Smart & Sustainable Infrastructures*, Vancouver, BC, Canada, September 4-8, 2023.

C10. Houshmand, M., Rahmaninezhad, S.A., Kamireddi, D., Schauer, C.L., Sales, C.M., Najafi, A., Sadighi, A., Farnam, Y.A., (2023). Mineral-forming capacity/kinetics of a nature-inspired endospore-laden polymeric fiber (BioFiber) for concrete self-healing applications. *13th Advances in Cement-Based Materials*, New York City, NY, US, June 14-16, 2023.

C11. Houshmand, M., Kamireddi, D., Rahmaninezhad, S.A., Schauer, C.L., Sales, C.M., Najafi, A., Cotton, A., Sadighi, A., Farnam, Y.A., (2023). Development of a damage-responsive self-healing system using bio-inspired polymeric fiber (BioFiber) for incorporation into infrastructure materials. *ASCE Engineering Mechanics Institute Conference*, Atlanta, GA, US, June 6-9, 2023.

C12. Houshmand, M., Kamireddi, D., Rahmaninezhad, S.A., Schauer, C.L., Sales, C.M., Najafi, A., Cotton, A., Sadighi, A., Farnam, Y.A., (2023). Development of bio-inspired multi-functional polymeric-based fibers (BioFiber) for advanced delivery of bacterial-based self-healing agent in concrete. *SMARTINCS'23 Conference on Self-Healing and Advanced Repair Technologies in Cementitious Systems*, Ghent, Belgium, May 22-23, 2023.

C13. Rahmaninezhad, S.A., **Houshmand, M.**, Farnam, Y.A., Schauer, C.L., Najafi, A., Street, R.M., Sadighi, A., Kamireddi, D., Sales, C.M., (2023). Understanding the importance of endosporulation methods for generating endospores that can resist harsh conditions and produce calcite in bio self-healing of concrete. *SMARTINCS'23 Conference on Self-Healing, Multifunctional and Advanced Repair Technologies in Cementitious Systems*, Ghent, Belgium, May 22-23, 2023.

C14. Houshmand, M., Mutua, A., He, J., Farnam, Y.A., (2023). Long-term performance of soybean-based concrete surface protectant under accelerated aging conditions. *Drexel Emerging Graduate Scholars Conference*, Philadelphia, PA, US, April 20, 2023.

C15. Houshmand, M., Mutua, A., He, J., Farnam, Y.A., (2022). Long-term performance of Soy Methyl Ester-Polystyrene as concrete surface protectant exposed to accelerated laboratory aging conditions. *ACI Fall Convention*, Dallas, TX, US, October 23-27, 2022.

C16. Houshmand, M., He, J., Farnam, Y.A., (2021). Investigation on protecting mechanism of Soy Methyl Ester-Polystyrene as a concrete surface protectant. *ACI Fall Convention*, Atlanta, GA, US, October 17-21, 2021.

C17. Ganji, H.T., Boushehri, R., Alembagheri, M., **Houshmand, M.**, Estahbanati, S.H., (2020). Effect of earthquake intensity on probabilistic analysis of dam-reservoir-foundation systems. *Geo-Congress 2020: Modeling, Geomaterials, and Site Characterization*, Minneapolis, MN, US, February 25-28, 2020.

C18. Ganji, H.T., Boushehri, R., Alembagheri, M., **Houshmand, M.**, Estahbanati, S.H., (2020). Comparison of First-Order Second-Moment and Latin Hypercube Sampling methods on probabilistic seismic hazard analysis of dam-reservoir-foundation systems. *Geo-Congress 2020: Geotechnical Earthquake Engineering and Special Topics*, Minneapolis, MN, US, February 25-28, 2020.

- **Manuscripts and Reports in Progress**

M1. Houshmand, M., Snyder, K.A., Efe, I., Jones, S.Z., (2026). Concrete Pore Solution Elemental Analysis using Wavelength-Dispersive X-ray Fluorescence (WD-XRF). *Materials and Structures*. Under Review.

M2. Houshmand, M., Efe, I., Jones, S.Z., Snyder, K.A., Hariri-Ardebili, M.A., Sattar, S., (2026). Corrosion Testing and Condition Assessment Methods for Reinforced Concrete Structures. *NIST Technical Note*. Under Internal Review.

M3. Houshmand, M., Jones, S.Z., (2026). A Critical Review of Corrosion Mechanisms and Assessment Techniques in Infrastructure Materials with Implications for Forward-Looking Standards. *Construction and Building Materials*. To Be Submitted.

M4. McAllister, T., Jones, S.Z., Sattar, S., Snyder, K.A., **Houshmand, M.**, et al., (2026). Future Natural Hazards and

Their Application in Codes and Standards: State-of-the-Art Review. *NIST Report*. Under Internal Review.
M5. McAllister, T., Jones, S.Z., Sattar, S., Snyder, K.A., **Houshmand, M.**, et al., (2026). Next Generation Building Standards NIST Research Roadmap Report. *NIST Report*. Under Internal Review.
M6. Houshmand, M., Cooper, M., Youtcheff, J., Najafi, A., Schauer, C.L., Sales, C.M., Visvalingam, S., Kirabo, P., Farnam, Y.A., (2026). Mechanical Properties and Interfacial Bonding of Biotic Self-Healing Fiber (bioFiber) within Cementitious Composites. *Cement and Concrete Composites*. To Be Submitted.
M7. Houshmand, M., (2026). Self-Healing Concrete: The Good, the Bad and the Ugly: From Research Promise to Market Readiness. *Materials and Structures*. To Be Submitted.
M8. Houshmand, M., (2026). From AI Hype to Materials Intelligence: Measurement, Physics, and Data Foundations for Predictive Materials Science. *npj Computational Materials*. In Preparation.

PATENTS

Houshmand, M., Farnam, Y.A., (2025). Damage-Responsive Self-Healing Concrete. *International Patent Application*, PCT/US2025/023374; Publication No. WO2025217013A1, published October 16, 2025.

TEACHING & MENTORING

- **Teaching**

Teaching Assistant	Construction Materials (2 qtrs.)	Drexel University	2021 – 2022
Teaching Assistant	Earthquake Engineering (1 sem.)	Sharif University	2015
Teaching Assistant	Statics (1 sem.)	Shahid Beheshti University	2014
Teaching Assistant	Fluid Mechanics (4 sem.)	Shahid Beheshti University	2012 – 2014
Teaching Assistant	Soil Mechanics Laboratory (1 sem.)	Shahid Beheshti University	2013
Teaching Assistant	Computer Programming (2 sem.)	Shahid Beheshti University	2011 – 2012
Private Tutor	Statics, Mechanics of Materials		2013-2019

- **Research Mentoring**

Gabriel Johnson	Undergraduate	NIST-SURF	2025
Yacoub Alqenai	PhD Student	NSF-CMMI, Drexel Univ.	2024
Angela Mutua	PhD Student	NSF-CMMI, Drexel Univ.	2024
Karamoko Sow	Undergraduate	NSF-REU, Drexel Univ.	2024
Priscilla Kirabo	Undergraduate	NSF-REU, Drexel Univ.	2024
Aidan Cotton	Undergraduate	NSF-REU, Drexel Univ.	2023
Rhythm Osan	Undergraduate	STAR, Drexel Univ.	2023
Jacob Lee Carter	Undergraduate	SMREU, Rowan Univ.	2022
Sarah Sowah	Undergraduate	NSF-REU, Drexel Univ.	2021
Christian Albert	Undergraduate	Co-Op, Drexel Univ.	2021

- **STEM Outreach**

K-12 STEM Internship	Latin Charter School (2-m program)	Drexel Univ.	2023
K-12 Workshop	Eureka Summer Camp	Drexel Univ.	2022

JOURNAL PEER REVIEW SERVICES

Advanced Materials Technologies • Journal of Materials in Civil Engineering • Reliability Engineering & System Safety • AIMS Bioengineering • Applied Sciences • Construction and Building Materials • Developments in the Built Environment • Infrastructures • Journal of Bridge Engineering • Materials • Proceedings of the Institution of Mechanical Engineers, Part L: Journal of Materials: Design and Applications • Proceedings of the Institution of Mechanical Engineers, Part M: Journal of Engineering for the Maritime Environment

LEADERSHIP

Vice President	Persian Student Association, Drexel University	2022
Event Coordinator	Persian Student Association, Drexel University	2021
Secretary	Materials Science Club, Texas State University	2020
Vice President	Sharif Journal Club, Sharif University of Technology	2015
President	Civil Engineering Student Society, Shahid Beheshti University	2012

PROFESSIONAL MEMBERSHIPS

Association for Materials Protection and Performance (AMPP)	2026 – Present
ASTM International	2026 – Present
The Electrochemical Society (ECS)	2026 – Present
American Coatings Association (ACA)	2025 – Present
International Union of Laboratories and Experts in Construction Materials (RILEM)	2024 – Present
American Ceramic Society (ACerS)	2023 – Present
American Concrete Institute (ACI)	2021 – Present
American Society of Civil Engineers (ASCE)	2019 – Present
Iranian National Committee on Large Dams (IRCOLD)	2015 – 2017

SELECTED RESEARCH PROJECTS

Next-Generation Building Standards

- *Measurement Science for Low-Carbon Cementitious Systems* • NIST 2024 – Present
  Advances measurement science for low-carbon cementitious systems through controlled chemical, phase, and thermal characterization, rigorous uncertainty quantification, and thermodynamic modeling. Transforms traceable, uncertainty-quantified measurements into quantitative materials properties, enabling physics-informed predictive modeling, data-driven materials design, and performance assessment.
- *Multiphysics Modeling and Corrosion Experimentation* • NIST 2024 – Present
  Develops an integrated computational-experimental framework coupling thermodynamic, ionic transport, electrochemical, and mechanical models through automated multi-solver co-simulation. Combines controlled corrosion experiments with reaction-stress coupling to resolve degradation mechanisms in alternative cementitious systems, with emphasis on steel passivation, corrosion initiation and propagation, and the evolution of material damage.

Nature-Inspired Self-Responsive Materials

- *Multifunctional Fiber-Enabled Self-Healing Concrete* • Drexel/NSF 2021 – 2024
  Developed bioFiber, a multifunctional bacteria-laden polymeric fiber that integrates structural reinforcement, crack-growth control, and autonomous damage-responsive healing within a single engineered system. Established a process-structure-property-function framework linking fiber fabrication and architecture to fiber–matrix interactions, mechanical performance, microbial activity, and healing efficiency.
- *Structural Performance of Bio-Self-Healing Concrete* • FHWA/Drexel/NSF 2024
  Evaluated the mechanical and fracture performance of bioFiber-reinforced cementitious composites by quantifying crack control, post-cracking behavior, strength recovery, and the influence of autonomous healing on structural response.
- *Vascular Self-Thermal Responsive Cementitious Composites* • Drexel 2023 – 2024
  Developed nature-inspired vascular self-thermal responsive cementitious composites (VASCI) that mimic biological thermoregulation by integrating architected vascular networks with phase-change materials. Established architecture–mechanics–thermal response relationships to enable passive, self-regulating thermal management in energy-efficient building systems.
- *Bio-Inspired Restoration of Aged Concrete Edifices (BRACE)* • Drexel/DARPA 2024
  Developed bio-enabled repair strategies for aged concrete using hydrogel-based bacterial and fungal systems. Controlled biologically induced mineral formation and calcium-carbonate polymorphism to tailor crack filling and restoration mechanisms for deteriorated cementitious materials.

Sustainable Materials Development

- *Thermodynamics-Guided Upcycling of Industrial Byproducts* • Drexel/NSF 2021 – 2022
  Advanced the conversion of off-spec coal-based ash into value-added lightweight aggregates via thermodynamics-guided processing and materials characterization, supporting scalable manufacturing and circular resource utilization in sustainable construction.
- *Organic Surface Protection for Concrete Durability* • Drexel/Indiana Soybean Alliance 2021 – 2022
  Advanced understanding of the physical and chemical mechanisms by which soybean-based organic sealants mitigate deicing-salt-induced concrete deterioration, including pore blocking and suppression of calcium oxychloride formation.

Thermo-Mechanical Degradation of FRP Composites

- *Fire Performance of FRP Structural Systems* 2017 – 2019
  Integrated microstructural characterization, mechanical testing, thermal analysis, and thermo-mechanical modeling to establish relationships between material degradation and structural fire performance of infrastructure FRP composites. Evaluated the effectiveness of intumescent protective coatings in mitigating thermal degradation, incorporating uncertainty quantification into the assessment of residual mechanical capacity and structural performance.

Reliability Analysis of Concrete Infrastructure

- *Seismic Reliability of Concrete Dams* 2015 – 2019
  Developed probabilistic finite-element frameworks to quantify seismic response and reliability of concrete dam systems, incorporating dam–reservoir–foundation interaction, foundation heterogeneity, and uncertainty in structural and loading parameters.
- *Probabilistic Thermal-Stress Analysis of Concrete Dams* • *Sharif University of Technology* 2017 – 2019
  Developed risk-based thermal–structural frameworks to quantify temperature-induced stresses during construction and reservoir impoundment, integrating uncertainty and sensitivity analysis to identify the parameters governing structural performance and reliability.

TECHNOLOGY TRANSLATION & ENTREPRENEURSHIP

Co-Founder & CEO • novaMATs LLC 12/2025 – Present
Rockville, MD, USA nova-mats.com

- Leads commercialization, manufacturing scale-up, funding strategy, and industry engagement for novaFiber, a multifunctional polymeric fiber integrating crack control and autonomous damage-responsive self-healing for concrete infrastructure.
- Advanced market validation through 150+ customer interviews, identifying and validating 3D concrete printing as the initial beachhead market and bridge repair as a follow-on opportunity.
- Built an early commercial pipeline with 3 paid pilots under discussion, 1 joint development agreement (JDA) in active discussion, and 1 channel partnership advancing toward an LOI.
- Submitted a $1.2M NSF Translation to Practice (NSF TTP-T) proposal, *Scalable Manufacturing of Multilayer Functional Polymeric Fibers (MFP-Fibers) for Autonomous Concrete Self-Healing*.
- Developing the NSF SBIR Phase I project, *AI-Enabled Scalable Manufacturing of novaFiber for Autonomous Self-Healing Concrete*, targeting scalable manufacturing, in-line sensing and AI-enabled process control, 3D-printing validation, and pilot-ready production.
- Develops an academic-to-market translation model connecting research innovation, student entrepreneurship, industry partnerships, intellectual property, and venture creation.

Entrepreneurial Lead • Lean Startup Accelerator (LSA), 06/2026 – 08/2026
NSF I-Corps Northeast Hub, Princeton University, NJ, USA

- Advanced venture readiness through structured development in beachhead-market selection, customer validation, founder leadership, company foundations, startup economics, investor engagement, and opportunity pitching.

· Developed and refined the NSF SBIR Phase I pitch and commercialization strategy for novaFiber by integrating technical scale-up needs, customer evidence, market positioning, and funding strategy, while advancing customer validation and securing pilot opportunities.

Entrepreneurial Lead • National Innovation Corps (I-Corps) Program 06/2025 – 12/2025
National Science Foundation, USA (Virtual)

· Led customer discovery across the construction value chain to identify customer pain points, early adopters, and viable beachhead markets for multifunctional fiber technologies.
· Evaluated product-market fit, competitive positioning, adoption barriers, and value propositions through iterative hypothesis testing and Lean LaunchPad methodology.
· Translated customer-discovery evidence into commercialization strategy and venture-development priorities for self-healing infrastructure materials.

Technology Commercialization Lead • Regional Innovation Corps (I-Corps) Program 06/2024 – 09/2024
NSF I-Corps Northeast Hub, Drexel University, Philadelphia, PA, USA

· Conducted market and stakeholder analysis to evaluate adoption pathways for emerging infrastructure-material technologies.
· Refined value propositions, communicated technical concepts to industry stakeholders, explored partnership and funding opportunities, and aligned technical development milestones with commercialization objectives.

TECHNICAL EXPERTISE

Materials Characterization: Microscopy, Imaging & Petrography (OM, SEM/EDS, DHM, X-CT), X-ray Analytical Methods (XRD, XRF), Thermal Analysis (DSC, IC), Gravimetric Analysis (TGA, DVS), Surface & Interfacial Characterization (iGC), Chemical Characterization (FT-IR, Titration)
Materials Development: Ceramics, Polymers, Construction Materials, Novel Cementitious Materials Formulation, Self-healing Materials, 3D Printable Cementitious Materials, Functionalized Fibers, Nature-Inspired Self-Responsive Composites, Measurement-Informed Materials Design
Structural Testing: Sensor-based Instrumentation, DIC, Mechanical & Fracture Testing, Test Setup & Data Acquisition, Forensic Evaluation, NDT Testing
Modeling and Simulation: Finite Element (ABAQUS), Multiphysics (COMSOL), Multiphase Thermodynamic & Geochemical Equilibrium Modeling (GEMS, PHREEQC)
Data Science & Coding: Python, MATLAB, Physics-informed Modeling, AI/ML Model Development, Reliability & Probabilistic Analysis, Uncertainty Quantification
Engineering & Project Software: AutoCAD, Autodesk Civil 3D, Microsoft Project, Primavera P6, LaTeX

LICENSURE & CERTIFICATIONS

Professional Engineer (PE), Virginia	Expected 2026
LEED Green Associate	Expected 2026

SELECTED MEDIA COVERAGE

ACerS Bulletin	Biomimicry: Innovations Inspired by Nature • Link	Dec 2025
Institution of Mech. Engineers	Why Sustainability Engineers Are Turning to Microbes • Link	Apr 2024
The Conversation	Bacteria-Coated Fibers Leading to Self-Healing Concrete • Link	Mar 2024
NSF - The Discovery Files	BioFiber Self-Healing Concrete	Mar 2024
Drexel News	Veins of Bacteria Forming a Self-Healing Concrete • Link	Dec 2023
Drexel College of Engineering	Doctoral Student Creates Innovative Self-Healing Material • Link	Nov 2023