



CURRICULUM VITAE | MOHAMMAD HOUSHMAND, 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, rigorous problem-solving skills, and the foundation to become future engineers, scientists, and innovators.

RESEARCH INTERESTS

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

EDUCATION

Postdoc	Johns Hopkins University, Baltimore, MD, USA	Whiting School of Engineering	2024 – 2026
Ph.D.	Drexel University, Philadelphia, PA, USA	Civil Engineering	2021 – 2024
M.S.	Sharif University of Technology, Tehran, Iran	Civil Engineering	2014 – 2017
B.S.	Shahid Beheshti University, Tehran, Iran	Civil Engineering	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	01/2025 – 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	02/2010 – 02/2013

SELECTED RESEARCH PROJECTS

Next-Generation Building Standards • NIST	2024 – Present
• <i>Measurement Science for Low-Carbon Cementitious Systems</i>	
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*

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 • Turner-Fairbank FHWA • Drexel

2021 – 2024

- *Multifunctional Fiber-Enabled Self-Healing Concrete*

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*

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*

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)*

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.

CORE SKILLS

- **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:** Physics-informed Modeling, AI/ML Model Development, Reliability & Probabilistic Analysis, Uncertainty Quantification
- **Leadership:** Leading R&D Efforts, Structuring Workflows, Coordinating Cross-Functional Teams, Planning & Prioritizing Technical Tasks, Supporting Project Execution
- **Innovation and Commercialization:** Technology Translation, Lean Launchpad
- **Coding:** Python, MATLAB

RESEARCH RECORD

Journal Articles: +25 | Conference: +10 | Book Chapters: 2 | Citations: +780 | h-index: 15 | i10-index: 19 | ORCID: 0000-0001-5230-0214 | Google Scholar

+ Selection of Peer-Reviewed Journal Publications

- **J1. Houshmand, M.,** Rahmaninezhad, A., Sales, C., Schauer, C., Farnam, Najafi, A., Farnam, Y.A., (2025). Self-healing mechanism and crack-filling performance of multifunctional bacteria-laden fiber (bioFiber) in cementitious matrix. *Journal of Materials and Structures*. Vol. 108, pp 112878. DOI

- **J2.** 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, pp 112878. DOI
- **J3.** **Houshmand, M.**, Rahmaninezhad, S.A., Kamireddi, D., Sadighi, A., Sales, C.M., Schauer, C.L., Najafi, A., 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, p.100351. DOI
- **J4.** **Houshmand, M.**, He, J., Farnam, Y., (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), p.04023529. DOI
- **J5.** **Houshmand, M.**, M.H., Mutua, A., He, J., Mishra, G., Farnam, Y., (2024). Long-Term Performance of Soybean-Based Concrete Surface Protectant under Laboratory Accelerated Aging Conditions. *Transportation Research Record*. 2678(8), pp.470-481. DOI
- **J6.** **Houshmand, M.**, Kamireddi, D., Rahmaninezhad, S.A., Sadighi, A., Schauer, C.L., Sales, C.M., Najafi, A.R., Cotton, A., Street, R., 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, p.133765. DOI
- **J7.** **Houshmand, M.**, Kamireddi, D., Rahmaninezhad, S.A., Schauer, C.L., Sales, C.M., Najafi, A., Cotton, A., Sadighi, A., Farnam, Y.A., (2024). Self-healing mechanism and crack-filling performance of multi-functional bacterial laden fiber (Biofiber) in cementitious matrix. *Proceedings of the RILEM Spring Convention*. Vol. 56, pp 102–110. DOI
- **J8.** Rahmaninezhad, S.A., **Houshmand, M.**, Namakiaraghi, P., Sadighi, A., Ahmari, K., Kamireddi, D., Farnam, Y.A., Schauer, C.L., Najafi, A., Sales, C.M., (2025). 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, P 194–205. DOI
- **J9.** Sadighi, A., Maghami, E., **Houshmand, M.**, Kamireddi, D., Rahmaninezhad, S.A., Farnam, Y.A., Sales, C.M., Schauer, C.L., Najafi, A., (2023). Fracture analysis of multifunctional fiber-reinforced concrete using phase-field method. *Journal of Solids and Structures*. Vol. 283, p. 112493. DOI
- **J10.** Rahmaninezhad, S.A., **Houshmand, M.**, Sadighi, A., Kamireddi, D., Street, R.M., Farnam, Y.A., Schauer, C.L., Najafi, A., Sales, C.M., (2024). Fracture analysis of multifunctional fiber-reinforced concrete using phase-field method. *Journal of Solids and Structures*. Vol. 419, p. 135528. DOI
- **J11.** Balapour, M., **Houshmand, M.**, Garboczi, E.J., Hsuan, Y.G., Hun, D.E., Farnam, Y., (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, p.128013. DOI
- **J12.** **Houshmand, M.**, Ghamsari, A.K. and Ozbakkaloglu, T., (2021). Stress-relaxation behavior of fiber-reinforced polymer sheets at elevated temperatures. *Construction and Building Materials*. Vol. 307, p.124900. DOI
- **J13.** **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, p. 118725. DOI
- **J14.** **Houshmand, M.**, Alembagheri, M., Soltani, N., (2018). Reliability and variance-based sensitivity analysis of arch dams during construction and reservoir impoundment. *Frontiers of Structural and Civil Engineering*. Vol. 13, pp.526–541. DOI
- **J15.** 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, pp.1007–1019. DOI
- **J16.** Ganji, H.T., Alembagheri, M., **Houshmand, M.**, (2019). Evaluation of seismic reliability of gravity dam-reservoirinhomogeneous foundation coupled system. *Frontiers of Structural and Civil Engineering*. Vol. 13, pp.1007–1019. DOI
- **J17.** **Houshmand, M.**, Najafabadi, E.P., Shoaee, 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

+ Selection of Conference Presentations

- **C1.** **Houshmand, M.**, Snyder, K., Efe, I., Jones, S., (2024), Concrete Pore Solution Elemental Analysis using Wavelength-Dispersive X-ray Fluorescence (WD-XRF), *16th Advances in Cement-Based Materials, ACerS, Miami*,

FL, US, June 10-12, 2026.

- **C2. Houshmand, M.** et al. (2024), Performance assessment of cementitious matrix reinforcement with multi-functional bacterial-laden fibers (BioFibers), *9th International Conference on Self-healing Materials*, Madrid, Spain, June 24-26, 2024.

PATENT

Houshmand, M., Farnam A.Y., *Damage-Responsive Self-Healing Concrete*, Patent No. WO2025217013A1.

PEER REVIEW SERVICE

Advanced Materials Technologies (1) | Applied Sciences (2) | Construction and Building Materials (12) | Developments in the Built Environment (4) | Journal of Bridge Engineering (1) | Journal of Materials in Civil Engineering (10) | Journal of Materials (1) | AIMS Bioengineering (1) | Part L: Journal of Materials: Design and Applications (1) | Part M: Journal of Engineering for the Maritime Environment (1) | Reliability Engineering & System Safety (1) | Infrastructures (1)

LEADERSHIP & SERVICE

Mentor, *SURF Students, NIST* (2025) | Laboratory Liaison, *AIM Lab, Drexel* (2021–2024) | Mentor, *NSF-REU Students, Drexel* (2021–2024) | Vice President, *Persian Student Association, Drexel* (2022) | Secretary, *Materials Science Club, Texas State* (2020)

AWARDS

Distinguished Associate Award, *NIST* (2026) | EYP Postdoctoral Pitch Finalist, *Johns Hopkins* (2025) | Concrete 3D Printing Fellowship, *NSF AcceINet* (2024) | Research Excellence Award, *Drexel* (2024) | College of Engineering Corleone Fellowship, *Drexel* (2024) | Outstanding Research Award, *Smartincs, RILEM* (2023) |

PROFESSIONAL MEMBERSHIP

American Concrete Institute (ACI) | American Society of Civil Engineers (ASCE) | American Ceramic Society (ACerS) | American Coatings Association (ACA) | RILEM

CERTIFICATIONS

Professional Engineer (PE, Structural, State of Virginia) - Expected 2026 | LEED Green Associate - Expected 2026

BROADER IMPACTS

- ACerS Bulletin | Biomimicry: Innovations inspired by nature | Dec 2025
- The Conversation | Thin bacteria-coated self-healing fibers for concrete application | Mar 2024
- Drexel News | Doctoral student helps create innovative self-Healing concrete additive | Nov 2023