Semih Akin

Assistant Professor of Mechanical Engineering
Department of Mechanical, Aerospace, and Nuclear Engineering
Rensselaer Polytechnic Institute, Troy, New York, 12180

 ♠ Rensselaer Polytech. Inst.
 ☑ akins@rpi.edu
 ♠ https://semilab-rpi.com
 in Semih Akin

EDUCATION **Ph.D. Purdue University**, Mechanical Engineering (West Lafayette, USA) 2017 - 2022 • Thesis: Scalable spray deposition of micro-and nanoparticles and fabrication of functional coatings 🗹 Supervisor: Prof. Martin Byung-Guk Jun **M.S.** Bursa Technical University, Mechanical Engineering, (Turkey) 2013 - 2016**B.S. Uludag University**, Industrial Engineering, (Turkey) 2010 - 2013 Double Major in Industrial Engineering **B.S. Uludag University**, Mechanical Engineering, (Turkey) 2008 - 2013• Honor student, Ranked 1^{st} in the class diploma RESEARCH & PROFESSIONAL EXPERIENCE Assistant Professor, Rensselaer Polytechnic Institute, USA Jan 2024 - Now Post-Doctoral Associate, Purdue University, USA 2022 - 2023 **Lecturer**, Purdue University, USA 2021 - 2022 **Teaching Assistant**, Purdue University, USA 2019 - 2021 Research Assistant, Purdue University, USA 2017 - 2021 **Research Assistant**, Bursa Technical University, Turkey 2013 - 2016

RESEARCH INTEREST _____

Additive Manufacturing: Cold spray additive manufacturing, Directed energy deposition, Aerosol jet printing, Multi-material 3-D printing, Smart structures

Surface Engineering: Surface-matter interaction, Meta-material surface deposition, Smart thin-films, Electroless deposition, Functional surface metallization of polymers and glass

Printed Electronics: Flexible electronics, Electronic textiles, Microheaters

Energy Devices: Triboelectric nanogenerators, Dye-sensitized solar cells, Lithium-ion batteries

Space Manufacturing: Space resource utilization, Additive manufacturing for space, Manufacturing for space exploration

HONORS, AWARDS & RECOGNITION

Research Awards:

- Outstanding Graduate Student Research Award, Purdue University, CoE, 2023
- **Best Researcher Awards**, International Research Awards on Computer-Aided Design in Mechanical Engineering, 2023
- Italian Packaging Technology Award by the Italian Trade Agency, 2023
- Graduate School Summer Research Grant, Purdue University, CoE, 2022
- Featured article in the Purdue News, (e-textiles for health monitoring), 2022
- Master thesis scholarship by the Technological Research Council of Turkey, 2015
- Honor student, ranked 1st in Mechanical Engineering, Bursa Uludag University, 2013
- Outstanding student scholarship by the Turkish Automobile Factory (TOFAS), 2009-2013

Teaching Awards:

- Ward A. Lambert Graduate Teaching Fellowship, Purdue University, 2022
- Graduate Teaching Award, Purdue University Teaching Academy, 2022

Paper Awards:

- Frontispiece cover article, Advanced Materials, 2022
- Editor's choice article, Journal of Thermal Spray Technology, 2021
- Best paper award, World Congress on Micro and Nano Manufacturing (WCMNM), 2021

Travel Awards:

- National Science Foundation (NSF) travel award for the WCMNM 2023
- NSF Early-Career travel award for NAMRC 51/MSEC 2023
- NSF student travel award for the WCMNM 2019
- Technical trip award to Germany by the Durmazlar Machine Company, 2013

INTELLECTUAL PROPERTY

- **1.** C.H. Lee, T. Chang, **S. Akin**, MBG. Jun, "*In-situ* spray polymerization of conductive polymers" (U.S. Patent application-pending), (2023)
- **2.** MBG. Jun, **S. Akin**, "Cold spray printed flexible electronics and method for manufacturing the same" (U.S. Patent application-pending), (2022) [Link] ☑
- **3.** C.H. Lee, T. Chang, **S. Akin**, MBG. Jun, L. Couetil, "Electronic textiles and methods for fabrication thereof", (*U.S. Patent*), (Active by 2043) [Link] ☑

EXTRAMURAL RESEARCH GRANTS

Defense Advanced Research Projects Agency (DARPA): SENSE: "Convergent Manufacturing of Smart Metal Structures with Embedded Sensing Capabilities", 01/22/24 - 01/22/26
 PI: J. Samuel; Co-PIs: <u>S. Akin</u>, F. Kopsaftopoulos, S. Mishra, J. Wen, Project budget = \$1,000,000, (S. Akin's Share = 30%).

JOURNAL PUBLICATIONS

†: Equal contribution

*: Corresponding author

- **28.** S. Chen, F. Zhou, BN. Reggetz, EG. Lee, MA. Virji, AA. Afshari, MBG. Jun, **S. Akin***, "Polymer metallization via cold spray: an investigation into the effects of particle hardness and morphology, **Manufacturing Letters**, (Under review).
- **27.** F. Zhou, S. Chen, <u>S. Akin</u>, T. Gabor, MBG. Jun*, "Real-time monitoring of thin film thickness and surface roughness using a single mode optical fiber, **Mechanical Systems and Signal Processing**, (Under review).
- **26.** T. Gabor, Y. Wang, **S. Akin**, F. Zhou, J. Chen, MBG. Jun*, "Design, Modeling, and Characterization of a Pulsed Cold Spray, **Surface & Coatings Technology**, (Under review).
- **25.** J. Lee, <u>S. Akin</u>*, Y. Kim, E. Kim, J. Nam, K. Song, MBG. Jun*, "A stethoscope-guided interpretable deep learning framework for powder flow diagnosis in cold spray additive manufacturing", **Manufacturing Letters**, **(2024)**, (In-press).
- **24.** <u>S. Akin</u>^{†*}, T. Chang[†], S.H. Abir[†], Y. W. Kim, S. Xu, J. Lim, Y. Sim, J. Lee, J.T. Tsai, C. Nath, H. Lee, W. Wu, J. Samuel, C.H. Lee*, MBG. Jun*, "One-step fabrication of functionalized electrodes on 3D-printed polymers for triboelectric nanogenerators", **Nano Energy, (2024)**, (https://doi.org/10.1016/j.nanoen.2024.110082) ☑.
- **23.** DG. Ruzgar, <u>S. Akin</u>, S.Lee, J. Walsh, YH. Jeong, H.Lee, MBG. Jun*, "Highly flexible, conductive, and antibacterial surfaces toward multifunctional flexible electronics", <u>International Journal of Precision Engineering and Manufacturing Green Technology</u>, (2024), (doi.org/10.1007/s40684-024-00608-w) ∠.
- **22.** <u>S. Akin</u>*, S.Kim, C.K. Song, S.Y. Nam, MBG. Jun*, "Fully additively manufactured counter electrodes for dye-sensitized solar cells", Micromachines, (2024), (doi.org/10.3390/mi15040464) ☑.
- **21.** JT. Tsai*, <u>S. Akin</u>, DF. Bahr, MBG. Jun, "A predictive modeling approach for cold spray metallization on polymers", **Surface & Coatings Technology, (2024), (doi.org/10.1016/j.surfcoat.2024) ☑.**
- **20.** T. Gabor, **S. Akin**, MBG. Jun*, "Numerical studies on cold spray gas dynamics and powder flow in circular and rectangular nozzles", **Journal of Manufacturing Process**, **(2024)**, **(https://doi.org/10.1016/j.jmapro.2024.02.005)** ☑.
- **19.** Jeong H. Kim, <u>S. Akin</u>, MBG. Jun, Y. H, Jeong*, "Fabrication of electrospun nanofibers with spray direct-write conductive patterns", **Journal of the Korean Society for Precision Engineering**, **(2024)**, **(doi.org/10.7736/jkspe)** ☑.

- **18.** T. Chang[†], <u>S. Akin</u>[†], S. Cho[†], S. Lee, J. Lee, S. Lee, T. Park, S. Hong, T. Yu, Y. Ji, S. Gong, D.R. Kim, Y.L. Kim, MBG. Jun*, C.H. Lee*, "*In-situ* spray polymerization of conductive polymers for personalized e-textiles", **ACS Nano**, (2023), (https://doi.org/10.1021/acsnano.3c07283) ☑.
- **17.** <u>S. Akin</u>*, C. Nath, MBG. Jun, "Selective surface metallization of 3D-printed polymers by cold sprayassisted electroless deposition", ACS Applied Electronic Materials, (2023), (10.1021/acsaelm.3c00893) ☑.
- **16.** J. Lee, <u>S. Akin</u>, J. Walsh, H. Lee, MBG. Jun, Y. Shin*, "A Nitinol structure with functionally gradient pure titanium layers and hydroxyapatite over-coating for orthopedic implant applications", **Progress in Additive Manufacturing**, (2023), (https://doi.org/10.1007/s40964) ☑.
- **15.** <u>S. Akin</u>*, Y.W. Kim, S. Xu, C. Nath, W. Wu, MBG. Jun, "Cold spray direct writing of flexible electrodes for enhanced performance triboelectric nanogenerators", *Journal of Manufacturing Process*, (2023), (https://doi.org/10.1016/j.jmapro.2023.05.015) ☑.
- **14.** <u>S. Akin</u>, P. Wu, C. Nath, J. Chen, MBG. Jun*, "A study on converging-diverging nozzle design for supersonic spraying of liquid droplets towards nanocoating applications", **Journal of Manufacturing Science and Engineering**, (2023), (https://doi.org/10.1115/1.4062351) ☑.
- **13.** DG. Ruzgar, <u>S. Akin</u>, S.Lee, J. Walsh, YH. Jeong, H.Lee, MBG. Jun*, "Multifunctional Cold Spray Hybrid Coatings on Flexible Polymers for Improved Surface Properties", **SSRN Pre-print**, **(2023)**, **(https://dx.doi.org/10.2139/ssrn)** ☑.
- **12.** <u>S. Akin</u>, S. Jo, MBG. Jun*, "A cold spray-based novel manufacturing route for flexible electronics", *Journal of Manufacturing Process*, (2023), (https://doi.org/10.1016/j.jmapro.2022) ☑.
- **11.** <u>S. Akin</u>, S. Lee, S. Jo, DG. Ruzgar, JT. Tsai, MBG. Jun*, "Cold spray-based rapid and scalable production of printed flexible electronics", **Additive Manufacturing**, (2022), (https://doi.org/10.1016/j.addma.2022.103244) .
- **10.** Y.W. Kim*, **S.** Akin, H. Yun, S. Xu, W. Wu, MBG. Jun, "Enhanced performance of triboelectric nanogenerator and sensor via cold spray particle deposition", **ACS Applied Materials & Interfaces**, **(2022)**, **(https://pubs.acs.org/doi/10.1021)** ☑.
- **9.** T. Gabor, H. Yun, **S. Akin**, K.H. Kim, J.K. Park, MBG. Jun*, "Continuous coaxial nozzle designs for improved powder focusing in direct laser metal deposition", **Journal of Manufacturing Process**, **(2022)**, **(https://doi.org/10.1016/j.jmapro.2022.08.03900)** □.
- **8.** JT. Tsai, **S.** Akin, F. Zhou, MS Park, D.F. Bahr, MBG. Jun*, "Electrically conductive metallized polymers by cold spray and co-electroless deposition", **ASME Open Journal of Engineering**, **(2022)**, **(https://doi.org/10.1115/1.4053781)** ☑.
- 7. T. Chang[†], S. Akin[†], M.K. Kim, L. Murray, S. Cho, L. Couetil, MBG. Jun*, C.H. Lee* "A Programmable dual regime spray for large-scale and custom-designed electronic textiles", **Advanced Materials**, (2022), (https://doi.org/10.1002/adma.202108021) , (Frontispiece Cover Article, [Link]).
- **6.** S. Jo, <u>S. Akin</u>, MS. Park, MBG. Jun*, "Selective metallization on glass surface by laser direct writing combined with supersonic particle deposition", **Manufacturing Letters**, (2022), (https://doi.org/10.1016/j.mfglet.2021.07.009) ☑.
- **5.** <u>S. Akin</u>, P. Wu, JT. Tsai, C. Nath, J. Chen, MBG. Jun*, "A study on droplets dispersion and deposition characteristics under supersonic spray flow for nanomaterial coating applications", **Surface & Coatings Technology**, (2021), (https://doi.org/10.1016/j.surfcoat.2021.127788) ☑.

- **4.** JT. Tsai, **S.** Akin, F. Zhou, DF. Bahr*, MBG. Jun, "Establishing a cold spray particle deposition window on polymer substrate", **Journal of Thermal Spray Technology**, **(2021)**, **(doi.org/10.1007/s11666-021-01179-x)** ☑, (*Editor's choice article*)
- 3. <u>S. Akin</u>, JT. Tsai, MS. Park, YH. Jeong, MBG. Jun*, "Fabrication of electrically conductive patterns on ABS polymer using low-pressure cold spray and electroless plating", **ASME Journal of Micro and Nano-Manufacturing**, (2020), (https://doi.org/10.1115/1.4049578) ☑.
- 2. <u>S. Akin</u>, T. Gabor, S. Jo, H. Joe, JT. Tsai, Y. Park, C.H. Lee, MS. Park, MBG. Jun*, "Dual regime spray deposition based laser direct writing of metal patterns on polymer substrates", **ASME Journal of Micro and Nano-Manufacturing**, (2020), (https://doi.org/10.1115/1.4046282) ☑.
- 1. <u>S. Akin</u>*, Y. Kara, "An assessment of wind power potential along the coast of Bursa, Turkey: A wind power plant feasibility study for Gemlik Region", **Journal of Clean Energy Technologies**, (2017), (doi:10.18178/JOCET.2017.5.2.352) ☑.

CONFERENCE PROCEEDINGS & PRESENTATIONS

 Ψ : Presenter

*: Corresponding author

- **17.** J. Lee, <u>S. Akin</u>, J. Walsh, H. Lee, MBG. Jun, Y. Shin $^{\Psi*}$, "A Nitinol structure with functionally gradient pure titanium layers and hydroxyapatite over-coating for orthopedic implant applications", **TMS Annual Meeting & Exhibition**, (Accepted).
- **16.** Y.W. Kim, <u>S. Akin</u> $^{\Psi^*}$, MBG. Jun, J. Sutherland, "Cold spray-produced functional surfaces for triboelectric nanogenerators", *ASME International Mechanical Engineering Congress & Exposition, IMECE* \Box , (Accepted).
- **15.** S. Jo, **S. Akin**, MS. Park, MBG. Jun^{Ψ^*} , "A study on supersonic spray-assisted laser-induced ultrafine selective metallization of glass surface", *World Congress on Micro and Nano Manufacturing (WCMNM)*-2024 \Box .
- **14.** S. Jo, <u>S. Akin</u>, H. Yun, M. Park, MBG. Jun^{Ψ^*} , "Laser-assisted ultrafine selective metallization of glass surface using supersonic spray deposition", *International Conference on Precision Engineering and Sustainable Manufacturing* \square , *Chiang Mai, Thailand*, (Under review).
- **13.** J. Lee $^{\Psi}$, **S. Akin***, Y. Kim, E. Kim, J. Nam, K. Song, MBG. Jun*, "A stethoscope-guided interpretable deep learning framework for powder flow diagnosis in cold spray additive manufacturing", *North American Manufacturing Research Conference*, *NAMRC-52* \nearrow , *Knoxville*, *Tennessee*, *US*, (In Press).
- **12.** JT. Tsai $^{\Psi^*}$, **S. Akin**, DF. Bahr, MBG. Jun, "A predictive modeling for cold spray deposition and the resulting microstructure toward additive manufacturing using polymeric templates", *International Thin Films Conference (TACT-2023)* **\Box**, *Taipei, Taiwan*, **(2023)**.
- **11.** <u>S. Akin</u> Ψ^* , MBG. Jun, "Additively manufactured counter electrodes for dye-sensitized solar cells", World Congress on Micro and Nano Manufacturing (WCMNM) \Box , Evanston, IL, USA (2023).
- **10.** MBG. Jun $^{\Psi^*}$, **S. Akin**, "Unleashing the potential of cold spray additive manufacturing in triboelectric energy harvesting", *US-Korea Conference on Science, Technology and Entrepreneurship* \Box .
- **9.** <u>S. Akin</u> $^{\Psi^*}$, Y.W. Kim, S. Xu, C. Nath, W. Wu, MBG. Jun, "Cold spray direct writing of flexible electrodes for enhanced performance triboelectric nanogenerators", *North American Manufacturing Research Conference*, *NAMRC* , New Brunswick, New Jersey, USA, (2023).

- **8.** <u>S. Akin</u> $^{\Psi^*}$, P. Wu, C. Nath, J. Chen, MBG. Jun*, "A study on the effect of nozzle geometrical parameters on supersonic cold spraying of droplets", *ASME International Manufacturing Science and Engineering Conference*, (2022), West Lafayette, Indiana, USA, (doi.org/10.1115/MSEC2022-85703) \Box .
- **7.** T. Gabor $^{\Psi}$, **S. Akin**, JT. Tsai, S. Jo, F. Najjar, MBG. Jun*, "Numerical studies on cold spray particle deposition using a rectangular nozzle", *ASME MSEC*, **(2022)**, *West Lafayette, Indiana, USA*, **(doi.org/10.1115/MSEC2022-85673)** \square .
- **6.** <u>S. Akin</u> $^{\Psi^*}$, J.H. Kim, MBG. Jun*, "Electrically conductive textiles based on decoupled atomized spray coating and electroless plating", *International Symposium on Precision Engineering and Sustainable Manufacturing* (*PRESM*) \Box , South Korea, (2021).
- **4.** T. Gabor $^{\Psi}$, H. Joe, **S. Akin**, KH. Kim, JK. Park, MBG. Jun*, "Numerical investigations of various coaxial nozzle designs for direct laser deposition", *ASME International Manufacturing Science and Engineering Conference (MSEC)*, Cincinnati, Ohio, USA, **(2020)**, (https://doi.org/10.1115/MSEC2020-8444) \square .
- **3.** JT. Tsai $^{\Psi}$, **S. Akin**, F. Zhou, DF. Bahr, MBG. Jun*, "Simulation and characterization of cold spray deposition of metal powders on polymer substrate electrically conductive application", *ASME International Manufacturing Science and Engineering Conference*, *Cincinnati, Ohio, USA*, **(2020)**, **(https://doi.org/10.1115/MSEC2020-8461)** \square .
- **2.** <u>S. Akin</u> $^{\Psi}$, JT. Tsai, MS. Park, YH. Jeong, MBG. Jun*, "Fabrication of electrically conductive patterns on ABS polymer using low-pressure cold spray and electroless plating", *ASME International Manufacturing Science and Engineering Conference*, *Cincinnati, Ohio, USA*, (2020), (https://doi.org/10.1115/MSEC2020-8437) \square .

POSTER PRESENTATIONS

- **1.** B. Reggetz, A. Virji, S. Friend, MBG. Jun, <u>S. Akin</u>, D. Hard, EG. Lee, "Assessment of cold spray powder emissions in a controlled laboratory Setting", *Cold Spray Action Team (CSAT)* ∠, (2024).
- **2.** B. Reggetz, EG. Lee, A. Virji, S. Friend, MBG. Jun, <u>S. Akin</u>, "Cold spray powder emissions in a laboratory setting", *AIHA Connect* ☑, **(2024)**.
- **3.** T. Chang, <u>S. Akin</u>, L. Couetil, MBG. Jun, C.H. Lee "Dual regime spray of functional nanomaterials for electronic textiles", *Material Research Society (MRS)* ∠, (2022).
- **4. S. Akin**, JT. Tsai, H. Joe, H. Joe, MBG. Jun, "Smart thin film on polymer and textile substrates by controlled spray and electroless plating", *NextFlex*, **(2020)**.

TEACHING & MENTORING EXPERIENCE

Instructor:

Rensselaer Polytechnic Institute

• ENGR 2050: Introduction to Engineering Design

Spring 2024

• **ENGR 2050:** Introduction to Engineering Design

Fall 2024

Purdue University, West Lafayette

Aug 2022-Dec 2022

Instructor as the Ward A. Lambert Fellow

• **ME 354:** Machine Design Course Quality: 4.3/5 Teaching Effectiveness: 4.4/5

Teaching Assistant:

Purdue University, West Lafayette

2019-2022

- **ME 352**: Machine Design I (Fall 2019, Spring 2020, Spring 2022)
- **ME 354**: Machine Design II (Fall 2020, Spring 2021, Fall 2021)

Bursa Technical University, TURKEY

2013-2016

• Computer-aided design (CAD), Thermodynamics, Machine Laboratory, Senior Design Project

INDUSTRIAL EXPERIENCE

Intern at the **OYAK-RENAULT Automotive Company ☑**, TURKEY

2012-2013

- Assisted a project from concept to minimize quality errors in vehicle batteries.
- Collected and analyzed data on quality errors of the vehicle batteries.
- Designed the software for quality control of the batteries.

TECHNICAL SKILLS _____

Programming languages: Pyhton, MATLAB

Engineering software:

- Computer-aided design (CAD): Solidworks, CATIA, NX, AutoCAD, SpaceClaim
- Computer-aided engineering (CAE): ANSYS (Workbench, Fluent), HyperMesh, Abaqus, COMSOL
- Other: MS Office, ŁTĘX, OriginPro, MS Visio

INVITED TALKS & SEMINARS _____

- 1. Spray-based Additive Manufacturing of Functional Smart Surfaces
 - -University of Illinois Chicago (UIC) Mechanical and Industrial Engineering, October 2023.

PROFESSIONAL SOCIETY MEMBERSHIP

- American Society of Mechanical Engineering (ASME)
- Society of Manufacturing Engineers (SME)
- SigmaXI Scientific Research Honor Society (Full Member)

PROFESSIONAL SERVICES _____

Editorial Experience:

Guest Editor: Sustainability

Special Issue: "Advanced Manufacturing for Sustainable and Renewable Energy Technologies" 🗹

Journal Paper Peer-Reviewer:

- Journal of Manufacturing Process
- ASME Journal of Micro and Nano Science and Engineering
- Journal of Manufacturing and Materials Processing
- International Journal of Heat and Mass Transfer
- Applied Surface Science Advances
- Additive Manufacturing
- Applied Mechanics
- Micromachines
- Electronics
- Coatings

Conference Reviewer:

- North American Manufacturing Research Conference (NAMRC-52, 2024)
- North American Manufacturing Research Conference (NAMRC-51, 2023)
- World Congress on Micro-and Nano-Manufacturing (WCMNM-2023)

Services:

- Symposium Organizer, "Advances in Manufacturing of Thin Films and Coatings", ASME/MSEC 2025
- Head volunteer, ASME MSEC/SME NAMRC-2022

GRADUATE STUDENT MENTORING

Advisor - Ph.D. Students:

Sazedur Rahman (Aug 2024 - Present)

• Mentor - Ph.D. Students:

Jinhan Ren, Joni C. Dhar, Shamim H. Abir, Sazidur Shahriar Rahman (Jan 2024 - Present)

Mentor - Master of Eng. Students:

Charli Smith, Jared Zornitger (Jan 2024 - Present)

UNDERGRADUATE STUDENT MENTORING _____

Advisor - Undergraduate Research Students:

Brandon Villanueva, Zach Goncalves, Zhi Guan, (Spring 2024) Alex Wong, Travis Johnson, Hongfei Liu, Hongru Liu, (Fall 2024)

SELECTED MEDIA COVERAGE ____

- "Outstanding Research Award" Purdue University, College of Engineering, 2023. [Link]
- "Remote horse slicker monitors chronic health conditions" Veterinary 33, July 2022. [Link]
- "How do you test for equine asthma and heart disease using a remote horse slicker? Put the horse on a treadmill" *Purdue Research News*, April 2022. [Link]
- "Specially designed slicker captures horse's vital signs on a laptop via Bluetooth" *Phys.org*, February 2022. [Link] 🗹
- "Horse slicker may help tell of animal's chronic diseases" Newsbug, February 2022. [Link] 🗹