

# SEMIH AKIN

Assistant Professor of Mechanical Engineering  
Department of Mechanical, Aerospace, and Nuclear Engineering  
Rensselaer Polytechnic Institute, Troy, New York, 12180  
E-mail: [akins@rpi.edu](mailto:akins@rpi.edu) Website: <https://semilab-rpi.com>

## EDUCATION

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<b>Ph.D. in Mechanical Engineering</b> , Purdue University, West Lafayette, USA	2017 - 2022
<b>M.S. in Mechanical Engineering</b> , Bursa Technical University, Turkey	2013 - 2016
<b>B.S. in Industrial Engineering</b> , Uludag University, Turkey, ( <i>Double Major</i> )	2010 - 2013
<b>B.S. in Mechanical Engineering</b> , Uludag University, Turkey	2008 - 2013
<i>Honor student, Ranked 1<sup>st</sup> in the class diploma</i>	

## RESEARCH & PROFESSIONAL EXPERIENCE

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<b>Assistant Professor</b> , Rensselaer Polytechnic Institute, USA	Jan 2024 - Now
<b>Post-Doctoral Associate</b> , Purdue University, USA	2022 - 2023
<b>Lecturer</b> , Purdue University, USA	2021 - 2022
<b>Teaching Assistant</b> , Purdue University, USA	2019 - 2021
<b>Research Assistant</b> , Purdue University, USA	2017 - 2021
<b>Research Assistant</b> , Bursa Technical University, Turkey	2013 - 2016

## RESEARCH INTERESTS

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

**Additive Manufacturing:** Cold spray additive manufacturing & sustainable repairing, Aerosol printing, Multifunctional 3-D printing, Ceramic 3D printing

**Printed Electronics:** Flexible electronics, Electronic textiles, Microheaters

**Energy Devices:** Triboelectric nanogenerators, Dye-sensitized solar cells, Supercapacitors

## HONORS, AWARDS & RECOGNITIONS

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### 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 ambulatory health monitoring), 2022
- **Master thesis scholarship** by the Technological Research Council of Turkey, 2015
- **Honor student, ranked 1<sup>st</sup>** 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
- Early-career travel award by the NSF 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

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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 application-pending), (2021) [\[Link\]](#)

## EXTRAMURAL RESEARCH GRANTS

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

## JOURNAL PUBLICATIONS

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23. **S. Akin**, T. Chang, Y. W. Kim, S. Xu, J. Lim, C. Nath, J.T. Tsai, J. Lee, H. Lee, W. Wu, C.H. Lee, MBG. Jun, "One-step manufacturing of functionalized electrodes on 3-D printed polymers for triboelectric nanogenerators", *Journal of Manufacturing Process*, (Under review).
22. Jeong H. Kim, **S. Akin**, MBG. Jun, Y. H. Jeong, "Fabrication of electrospun nanofibers with spray direct-write conductive patterns", *Journal of the Korean Soc. for Precision Eng.*, (Under review).
21. J.T. Tsai, **S. Akin**, D.F. Bahr, MBG. Jun, "A predictive modeling for cold spray metallization on polymers", *Surface & Coatings Technology*, (Under revision).
20. D.G. Ruzgar, **S. Akin**, S. Lee, J. Walsh, Y.H. Jeong, H. Lee, MBG. Jun, "Highly flexible, conductive, and antibacterial surfaces toward multifunctional flexible electronics", *International Journal of Precision Engineering and Manufacturing Green Technology*, (Under revision).
19. 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*, [10.1016/j.jmapro.2024.02.005](https://doi.org/10.1016/j.jmapro.2024.02.005).
18. T. Chang\*, **S. Akin\***, 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. **S. Akin**, C. Nath, MBG. Jun, "Selective surface metallization of 3D-printed polymers by cold spray-assisted electroless deposition", *ACS Applied Electronic Materials*, (2023), ([10.1021/acsaelm.3c00893](https://doi.org/10.1021/acsaelm.3c00893)).

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\*denotes equal contribution (co-first author).

16. J. Lee, **S. Akin**, 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/s40964-023-00500-0>).
15. **S. Akin**, 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. **S. Akin**, 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, **S. Akin**, 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.4332298>).
12. **S. Akin**, 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.2022.12.035>).
11. **S. Akin**, S. Lee, S. Jo, DG. Ruzgar, JT. Tsai, MBG. Jun, "Cold spray-based rapid and scalable production of printed flexible electronics", **Additive Manufacturing**, (2022), ([doi.org/10.1016/j.addma.2022](https://doi.org/10.1016/j.addma.2022)).
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/acsami.2c09367>).
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, **S. Akin**, 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. **S. Akin**, 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](https://doi.org/10.1007/s11666-021-01179-x)), (*Editor's choice article*)
3. **S. Akin**, 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. **S. Akin**, 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. **S. Akin**, 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](https://doi.org/10.18178/JOCET.2017.5.2.352)).

## CONFERENCE PROCEEDINGS & PRESENTATIONS

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14. MBG. Jun, Y.W. Kim, **S. Akin**, J. Sutherland, "Cold spray-produced functional surfaces for triboelectric nanogenerators", (Under review).
13. J. Lee, **S. Akin**, Y. Kim, E. Kim, MBG. Jun, "Powder flow diagnosis in cold spray additive manufacturing via stethoscope sound-guided interpretable deep learning", *North American Manufacturing Research Conference, NAMRC-52*, (Under review).
12. JT. Tsai, **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)*, (2023).
11. **S. Akin**, MBG. Jun, "Additively manufactured counter electrodes for dye-sensitized solar cells", *World Congress on Micro and Nano Manufacturing (WCMNM-2023)*, (2023).
10. MBG. Jun, **S. Akin**, "Unleashing the potential of cold spray additive manufacturing in triboelectric energy harvesting", *US-Korea Conference on Science, Technology and Entrepreneurship (UKC-2023)*.
9. **S. Akin**, 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*, (2023).
8. T. Chang, **S. Akin**, L. Couetil, MBG. Jun, C.H. Lee "Dual regime spray of functional nanomaterials for electronic textiles", *Material Research Society (MRS)*, (2022).
7. **S. Akin**, 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), ([doi.org/10.1115/MSEC2022-85703](https://doi.org/10.1115/MSEC2022-85703)).
6. T. Gabor, **S. Akin**, JT. Tsai, S. Jo, F. Najjar, MBG. Jun, "Numerical studies on cold spray particle deposition using a rectangular nozzle", *ASME MSEC*, (2022), ([doi.org/10.1115/MSEC2022-85673](https://doi.org/10.1115/MSEC2022-85673)).
5. **S. Akin**, 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 2021)*.
4. S. Jo, **S. Akin**, MS. Park, MBG. Jun, "An integrated method for selective metallization on glass surface: Laser direct writing coupled with supersonic spray coating", *World Congress on Micro and Nano Manufacturing (WCMNM)*, (2021), (*Best Paper Award*).
3. T. Gabor, 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)*, (2020), (<https://doi.org/10.1115/MSEC2020-8444>).
2. JT. Tsai, **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*, (2020), (<https://doi.org/10.1115/MSEC2020-8461>).
1. **S. Akin**, T. Gabor, S. Jo, H. Joe, JT. Tsai, Y. Park, CH. Lee, MS. Park, MBG. Jun, "Dual regime spray deposition based laser direct writing of metal patterns on polymer substrates", *The 3rd World Congress on Micro and Nano-Manufacturing*, Raleigh NC, (2019), (*WCMNM-2019*).

## TEACHING & MENTORING EXPERIENCE

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### Instructor:

Rensselaer Polytechnic Institute

- ENGR 2050: Introduction to Engineering Design

Jan 2024-Now

Purdue University, West Lafayette

- ME 354: Machine Design

Aug 2022-Dec 2022

## 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

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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

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Programming languages: Python, MATLAB

Engineering software:

- **Computer-aided design (CAD):** Solidworks, CATIA, NX, AutoCAD, SpaceClaim
- **Computer-aided engineering (CAE):** ANSYS (Workbench, Fluent), HyperMesh, Abaqus
- **Other:** MS Office,  $\text{\LaTeX}$ , OriginPro, MS Visio

## INVITED TALKS & SEMINARS

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1. Spray-based Additive Manufacturing of Functional Smart Surfaces

*-University of Illinois Chicago (UIC) - Mechanical and Industrial Engineering, October 2023.*

## PROFESSIONAL SOCIETY MEMBERSHIP

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

## PROFESSIONAL SERVICES

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Journal Paper Peer-Reviewer:

- ASME Journal of Manufacturing Science and Engineering
- ASME Journal of Micro-and Nano Manufacturing
- Journal of Manufacturing Process
- Additive Manufacturing

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:

Head volunteer, ASME MSEC/SME NAMRC-2022

## GRADUATE STUDENT MENTORING

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- **Primary Advisor - Ph.D. Students:** Sazidur R. Shahriar (Jan 2024 - Present)
- **Mentor - Ph.D. Students:** Jinhan Ren, Joni C. Dhar, Shamim H. Abir (Jan 2024 - Present)

## UNDERGRADUATE STUDENT MENTORING

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- **Advisor - Undergraduate Research Students:** Brandon Villanueva, Zach Goncalves, Zhi Guan, (Jan 2024 - Present)
- **Mentor - Undergraduate Research Students:** Charli Smith, ZJared Zornitger (Jan 2024 - Present)

## SELECTED MEDIA COVERAGE

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- "Remote horse slicker monitors chronic health conditions" *Veterinary33*, July 2022.
- "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.
- "Specially designed slicker captures horse's vital signs on a laptop via Bluetooth" *Phys.org*, February 2022.
- "Horse slicker may help tell of animal's chronic diseases" *Newsbug*, February 2022.