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 **Website:** https://semi-lab.github.io/

EDUCATION

Ph.D. in Mechanical Engineering, Purdue University, West Lafayette, USA *2017 - 2022*

M.S. in Mechanical Engineering, Bursa Technical University, Turkey *2013 - 2016*

B.S. in Industrial Engineering, Uludag University, Turkey, *(Double Major)* *2010 - 2013*

B.S. in Mechanical Engineering, Uludag University, 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 INTERESTS

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

Research Awards:

- **Outstanding Graduate Student Research Award** by Purdue University, CoE, 2023
- **Best Researcher Awards** by the 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** at 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^{st} 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** at Purdue University, 2022.
- **Graduate Teaching Award** by Purdue University Teaching Academy, CoE, 2022.

Paper Awards:

- **Frontispiece cover article** by *Advanced Materials*, 2022
- **Editor's choice article** by the *Journal of Thermal Spray Technology*, 2021.
- **Best paper award** at *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

1. C.H. Lee, T. Chang, **S. Akin**, MBG. Jun, "*In-situ* spray polymerization of conductive polymers" *(U.S. Patent application-pending)*, (2023)

2. **S. Akin**, MBG. Jun, "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 textile devices for health status monitoring *", (U.S. Patent application-pending)*, (2021) [Link]

JOURNAL PUBLICATIONS

22. JT. Tsai, **S. Akin**, DF. Bahr, MBG. Jun, "A predictive modeling for cold spray metallization on polymers and resulting microstructure", (Under review).

21. **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).

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**, (Under review).

19. DG. Ruzgar, **S. Akin**, S.Lee, J. Walsh, YH. 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 review).

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)**.

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)**.

[*]denotes equal contribution (co-first author).

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.2022.10324)**.

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 and 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. **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)**.

CONFERENCE PROCEEDINGS & PRESENTATIONS

13. Y.W. Kim*, **S. Akin***, MBG. Jun, "Functional surfaces for triboelectric nanogenerators produced by cold spray".

12. 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*, **(2024)**, *(Submitted)*.

11. 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)**.

10. **S. Akin**, MBG. Jun, "Additively manufactured counter electrodes for dye-sensitized solar cells", *World Congress on Micro and Nano Manufacturing (WCMNM-2023)*, **(2023)**.

9. 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)*.

8. **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)**.

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)**.

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)**.

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

Instructor as the Ward A. Lambert Fellow, *Purdue University* *Aug 2022-Dec 2022*

ME 354: Machine Design

- Course Quality: 4.3/5 Teaching Effectiveness: 4.4/5

Teaching Assistant, *Purdue University* *2019-2022*

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

Teaching Assistant, *Bursa Technical University* *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
- **Other:** MS Office, LaTeX, 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 SOCIETIES & SERVICES

Journal Reviewer:

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

Conference Reviewer:

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

Professional Membership:

- American Society of Mechanical Engineering (ASME)
- Society of Manufacturing Engineers (SME)

Services:

Head volunteer, ASME MSEC/SME NAMRC-2022