New Center Project - Effects of Aerosol Jet Printing Parameters on the Lifetime Performance of Additively-Manufactured Flexible Circuits, Janet Gbur

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Meme of the Month!

https://en.wikipedia.org/wiki/Bootstrap_aggregating

LATEST NEWS

Spring 2023 Meeting

We cordially invite you to attend our Spring MDS-Rely Center Meeting on April 17-18 in-person on the University of Pittsburgh Campus. Attend faculty project pitches, a poster session, and network with PItt and Case faculty and graduate students and other industrial and government lab members. Find more information about the Spring 2023 meeting here.

Register Here!

New Center Project

Effects of Aerosol Jet Printing Parameters on the Lifetime Performance of Additively-Manufactured Flexible Circuits

***Janet Gbur**, Research Assistant Professor, Case Western Reserve University, Investigator, Advanced Platform Technology (APT) Center, VA Northeast Ohio Health Care Center*

Abstract: Aerosol jet printing (AJP) is an emerging additive manufacturing technology that can be used to fabricate flexible electrical circuits. The benefits of this approach allow for a wider variety of substrate materials, material shapes, less hazardous processing materials, lower cost, and less production time compared to traditional microfabrication approaches. The proposed work examines the effect of various printing parameters on the aerosol jet produced conductive traces. Applications for AJP flexible electronics can vary significantly; however, fundamental material and device-level understanding can be gained by considering a simple circuit. Circuits will be fabricated to study the effects of printing parameters on the mechanical and electrical behavior of the device. Data collected will be used to develop processing maps correlating with printing parameters to guide future development of the sensors, including final fabrication, mechanical testing, and functional testing.

MEMBER SPOTLIGHT

Naval Nuclear Laboratory

Naval Nuclear Laboratory (NNL) develops advanced naval nuclear propulsion technology, for the safety and reliability of our Navy's submarine and aircraft carrier Fleets. The Naval Nuclear Propulsion Program has cradle-to-grave responsibility for all naval nuclear propulsion matters and includes our civilian and military personnel who design, build, operate, maintain, and manage the nuclear-powered ships and other facilities of the U.S. nuclear-powered naval Fleet.

Through the MDS-rely membership, NNL seeks to improve materials reliability and speed to market through materials informatics approaches, accelerate the adoption of data science in materials development, network and collaborate with center members, and share the incredible career opportunities we offer with the next generation of scientists and engineers.

USS Connecticut

UPCOMING EVENTS

Monthly Technical Seminar

“Reimagining medical devices: Exploring the value and reliability of aerosol printing technology to replace microfabrication and/or wire-based structures in high-density connections”

***Janet Gbur**, Research Assistant Professor, Case Western Reserve University, Investigator, Advanced Platform Technology (APT) Center, VA Northeast Ohio Health Care Center*

Date: Thursday, January 19th 4-5 PM EST
Location: *virtual (zoom)
Zoom Meeting Link Here

Abstract: Flexible circuits have revolutionized how we collect data, in particular for point-of-care (PoC) diagnostic devices. Tremendous market growth is expected due to the need for cost-effective approaches to sensor development. Generally, the goal is to deliver smaller, thinner, and more flexible devices in a faster and more economical manner than past conventional microfabrication methods. The same argument could be made for implantable neural interfacing applications for stimulation, muscle recording, and pain control. The development of higher-channel count neural interfaces provides increased resolution and marked improvement in sensory feedback; however, in traditional microfabrication and wire-based devices, particularly in system connections, this means an increase in channel count can lead to an increase in overall device volume. This volumetric increase can result in tissue incompatibility and increased device stiffness as the number of channels scales upward, thus adversely affecting reliability.

Aerosol jet printing (AJP), a form of additive manufacturing (AM), has emerged to address the higher costs, complexity of fabrication, hazardous chemicals, and limited materials options associated with microfabrication. AJP methods allow for integrated electronics to be printed on a variety of substrates with micron-scale traces across topologically varying substrates. Moreover, this direct-write method allows for deposited trace widths as small as 10 micrometers wide providing the opportunity to produce extremely small, highly dense electronics without the complexities and cost associated with traditional microfabrication. Despite novel designs for AM flexible circuits, there remains a critical need to improve the overall performance and chronic reliability of these devices to provide the most accurate electrical and mechanical profiles over time. Unfortunately, limited literature exists covering long-term reliability and no robust standardized approach(es) have been developed to systematically evaluate the effects of printing and curing parameters on such deposited traces. Ongoing work and the launch of a new MDS RELY project aims to close this gap by developing methods to examine the effects of printing and curing parameters on the mechanical and electrical reliability of AJP traces. The current technical landscape of AJP will be discussed and the challenges of this emerging technology explored from the understanding how to characterize ink stability over time to developing test methods to determine mechanical and functional reliability.

Biweekly Project Meetings Available To All Members

If you are interested in attending any biweekly project meeting, please visit our Members portal, which can be accessed via the link at the top right of our Center website. You can also go to a specific project and raise a request to get access to the Zoom links to attend any of these meetings. You can also access prior recordings and presentations of any biweekly meetings.

1. netSEM Modeling for Service Life Prediction of Polymers
Prof. Laura Bruckman
January 24, February 7... Tuesdays 1 - 1:30 PM

2. Achieving Reliable Laser Powder Bed Fusion based Additive Manufacturing via Machine Learning of in-situ Optical Profilometry Monitoring Data
Prof. Xiayun Zhao
January 27, February 10... Fridays 4:15 - 4:45 PM

3. Image Machine Learning of Printed Metal Films for EMI Shielding
Profs. Leu, French, Iyengar

January 18, February 1, 15...Wednesdays 1:30 - 2 PM

4. Comparative analysis of Machine Learning techniques in predicting structure property relationships for composite dielectric materials
Profs. Sehirlioglu, Martin
January 30, February 13 ...Mondays 10:30 - 11 AM

Check out our calendar with upcoming events here!

JOB OPENINGS AND OPPORTUNITIES

Research Experiences for Undergraduates

If you are an undergraduate interested in a research experience because you are interested in graduate school, going beyond classwork, and working with a faculty and graduate student mentors, please email David Ruvolo (david.ruvolo@pitt.edu) about which of our projects you might be interested in.

NNL Fellowship Opportunities

The Admiral Hyman Rickover Graduate Fellowship Program

Description: This program in Nuclear Engineering prepares graduate students for roles in the Naval Nuclear Propulsion Program as it supports the broader objective of advancing fission energy development through the research efforts of Fellows.

Department of Energy Computational Science Graduate Fellowship Program

Description: Computational Science Graduate Fellows are given opportunities to develop improved algorithms for parallel computer architectures, advanced visualization, advanced data management, etc, etc. You could be involved in new developments within several broad categories, including but not limited to reactor physics, materials science (including semiconductor applications), two-phase flow, and radiation shielding.

Learn more about both opportunities here. Feel free to contact the Fellowship Coordinator Dr. Jake Ballard (jake.ballard@unnpp.gov) with any questions.

Naval Nuclear Laboratory: Materials Engineer

Job Description: “The Naval Nuclear Laboratory is seeking an enthusiastic materials engineer to join our team to develop the next generation of materials for nuclear propulsion systems, support projects currently being designed & built, and provide technical support for the US Navy's operating nuclear power plants. Join a team of experienced engineers with a long history of solving challenging problems. Work may include: Design, coordination, & documentation of material test programs; Integration with suppliers and vendors responsible for fabrication and manufacturing of parts; and / or consults on emergent issues. Areas of interest are manufacturing, mechanical properties, processing, forging, metal working, and specifications of plant components & systems. Test efforts often study heat treatment effects, embrittlement, fracture mechanics, welding fatigue, and aqueous corrosion. The ability to communicate, coordinate, and integrate with many stakeholders is necessary. If you want to put your talents to work in a mission-driven environment, apply now!” Apply here.

Assistant Professor of Industrial Engineering, Tenure Stream

The Department of Industrial Engineering at the University of Pittsburgh invites applications for an open tenure-track faculty position at the assistant professor rank with an expected start date of Fall 2023.

“We are seeking candidates in all areas of industrial engineering with priority given to data science, simulation, AI/ML, and operations research applied to address challenges in health systems, manufacturing, materials, robotics, and quality/reliability. Applicants must hold a PhD in Industrial Engineering or a closely related field. Applicants should also have a strong methodological background and an ability to conduct impactful, cutting-edge, interdisciplinary research. Our primary search criterion is the potential to build and sustain a successful research program. Candidates should have evidence of, or potential for, teaching excellence.” For more information on how to apply, click here.

Member Summer Internship Opportunities

If you are a Center member interested in offering summer internship opportunities to our graduate or undergraduate students, please contact David Ruvolo (david.ruvolo@pitt.edu) and we will be sure to feature the opportunity in our next newsletter and distribute information to students.

Submit News

Fill out a news form here!

Submit Job Openings

*For MDS-Rely members only

Fill out a job opening form here!

Interested in partnering with Case Western or Pitt Professors?

Please contact Dr. Roger French or Dr. Paul Leu for more information!

CONNECT WITH US!

Our mailing address is:
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