CENTER of EXCELLENCE
Research to Standards

ASTM INTERNATIONAL

4th ASTM Symposium on Structural Integrity of Additive Manufactured Materials & Parts

M T W T

October 7-10, 2019
Gaylord National Resort
and Convention Center
Oxon Hill, Md.

www.amcoe.org

CONTENTS

Learn latest progress and challenges on the structural integrity of AM parts through a greater understanding of application requirements, process controls, and process-structure-property-performance relationships.

SPONSORING ORGANIZATIONS

Additive Industries

SUPPORTING ORGANIZATIONS

America Makes

ESIS European Structural Integrity Society

Federal Aviation Administration

FDA

NIST National Institute of Standards and Technology U.S. Department of Commerce

DEFENSE TECHCONNECT INNOVATION SUMMIT & EXPO
OCTOBER 8-10, 2019 • NATIONAL HARBOR, MD

WELCOME

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Technical Presentations

To ensure the structural integrity of additively manufactured parts, feedstock-process-structure-property-performance relationships must be established. This particularly applies to safety-critical applications for these components and structures.

This event is intended to provide a forum to exchange information about the structural integrity of AM parts, focusing on the need for industry standards and design principals as well as challenges with qualification and certification.

This is ASTM International's fourth event related to the structural integrity of AM parts. The first event, a May 2016 workshop, was sponsored by the committee on fatigue and fracture (E08) in San Antonio, Texas. The second event, a November 2017 symposium, was sponsored by E08 and the committee on additive manufacturing technologies (F42) in Atlanta, Georgia. The third event, sponsored by the F42, E08, and E07 (nondestructive testing) committees, was held in Washington, D.C., in November 2018.

With the creation of ASTM International Additive Manufacturing Center of Excellence (AM CoE) in early 2018, and the growth of the AM industry, the effort is now being led by the AM CoE and involves additional technical committees, including:

- Metal Powders and Metal Powder Products (B09);
- Plastics (D20);
- Composite Materials (D30);
- Nondestructive Testing (E07);
- Fatigue and Fracture (E08)
- Medical and Surgical Materials and Devices (F04); and
- Additive Manufacturing Technologies (F42).

This series of events continues to grow and become the main gathering for standardization, qualification, and certification of AM materials and parts. This year, we are pleased to report that we have more than 100 talks, including about 45 invited presentations, 10 posters, 27 student competitions, 3 panels, and more than 300 attendees.

In addition, we are excited to announce that starting next year, this event will be organized as the ASTM International Conference of Additive Manufacturing (ASTM ICAM) and have an even wider scope related to standardization, qualification, and certification. This will be an event involving even more ASTM committees and external stakeholders, setting the stage to bring experts from all around the world to exchange the latest development in the field of additive manufacturing with emphasis on standardization.

We invite you to enjoy this 4th ASTM Symposium on the Structural Integrity of Additive Manufactured Materials and Parts, learn about the most recent advancements in the field, meet new friends and collaborators, and take the opportunity to visit some of the attractions in the Washington, D.C., area.

Nima Shamsaei and Mohsen Seifi
Symposium Co-Chairs

Nima Shamsaei
Auburn University

Mohsen Seifi
ASTM International

Rachel Andrulonis
NIAR

Stefano Beretta
Polytechnic of Milan

Filipo Berto
NTNU

Steve Daniewicz
University of Alabama

Matthew DiPrima
FDA

Matthew Donovan
Oerlikon

Ben Dutton
MTC

Michael Gorelik
FAA

Johannes Gumpinger
ESA

Chris Holshouser
NIAR

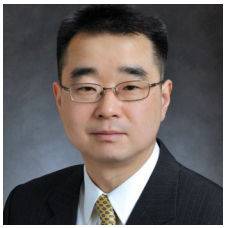
Nik Hrabe
NIST

Chee Kai
SUTD

Rod McMillian
Johnson & Johnson

Frank Medina
EWI

Thomas Niendorf
University of Kassel



Charles Park
Boeing

Richard Russell
NASA

Anil Sachdev
General Motors

Mohsen Seifi
ASTM International

Nima Shamsaei
Auburn University

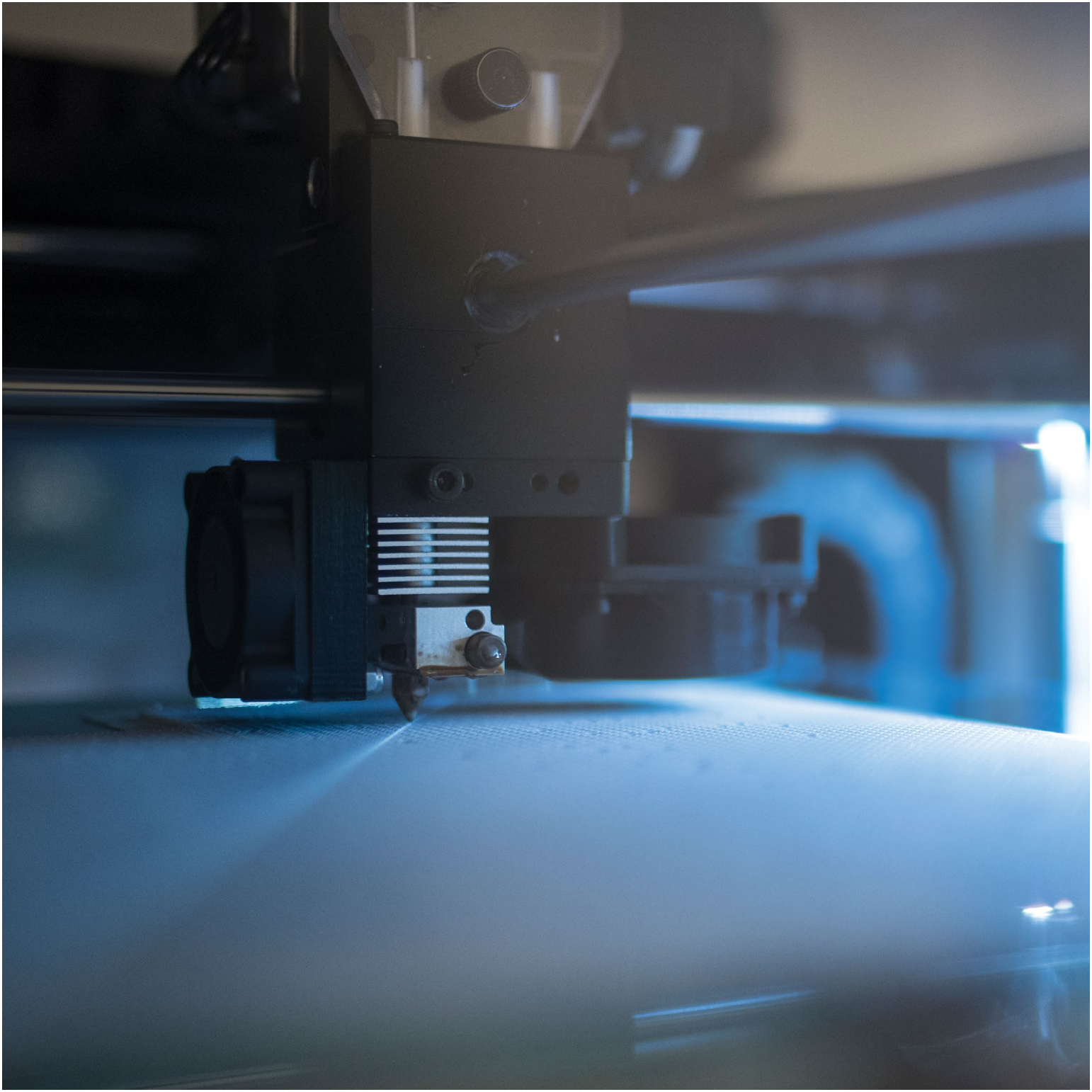
John Slotwinski
The Johns Hopkins University

Tony Thornton
Micromeritics Instrument

Doug Wells
NASA

10/07

MONDAY



Competition

Session Chair
Stefano Beretta, Polytechnic of Milan

STUDENT PRESENTATIONS
National Harbor 12-13

11:30 a.m.	Localized Properties of Multi-material Structures Fabricated using Laser- Directed Energy Deposition Additive Manufacturing *Beytullah Aydogan, Michigan State University* (Advisor: Himanshu Sahasrabudhe)
11:45 a.m.	New protocol to streamline new materials development in additive manufacturing *Bing Zhang, Texas A&M University* (Advisor: Alaa Elwany)
12:00 p.m.	Scaffolds with sheet-based architectures produced by SLM for orthopedic applications *Cambre Kelly, Duke University* (Advisor: Ken Gall)
12:15 p.m.	Effect of Microstructure and Internal Defects on the Mechanical Properties of Gyroid Lattice Structures for Biomedical Implants *Dalia Mahmoud, McCaster University* (Advisor: M.A. Elbestawi)
12:30 p.m.	Characterization of DED Based Gradient Materials *Daniel Melzer, University of West Bohemia* (Advisor: Jan Dzugan, Ph.D.)
12:45 p.m.	Corrosion Properties of Additively Manufactured Ti6Al4V in Bio-fluids *David Fischer, University of Illinois* (Advisor: Mathew Thoppil-Mathew)
1:00 p.m.	Process validation of additively manufactured lattice structures for orthopedic implants *Dimitri Papazoglou, University of Dayton* (Advisor: Amy Doll)
1:15 p.m.	Comparison of baseline ultrasonic NDE response between samples fabricated using Laser DED and cold rolling *Guillermo Huanes-Alvan, Michigan State University* (Advisor: Sunil Kishore Chakrapani)
1:30 p.m.	Corrosion resistance of as-built additively- manufactured and conventional wrought 316L materials *Haden A. Johnson, University of Mississippi Medical Center* (Advisor: Michael D. Roach)
1:45 p.m.	Additive manufacturing of fatigue resistant materials: Avoiding the early life crack initiation *Jonathan Pegues, Auburn University* (Advisor: Nima Shamsaei)
2:15 p.m.	FEM analysis of 3D printed pieces contour *Julen Durlan, Universitat Politècnica de Catalunya-UPC* (Advisor: J. Antonio Travieso-Rodriguez)
2:30 p.m.	Effect of process parameters on porosity of IN718 *Lonnie Smith, Carnegie Mellon University* (Advisor: Chris Pistorius)

2:00 - 2:15 COFFEE BREAK

2:45 p.m.	Application of compliance data collection to rapid fatigue performance characterization *Luke Sheridan, Wright State University* (Advisor:Joy Gockel)
3:00 p.m.	Scan strategy effects on as-built LPBF thin walls *Mandar Shinde, Arizona State University* (Advisor: Dhruv Bhate)
3:15 p.m.	Magnetically assisted AM for freeform optics *Mojtaba Falahati, Washington State University* (Advisor: Lei Li)
3:30 p.m.	Void characterization of multi LPBF components *Nora Boyle, Ohio State University*
3:45 p.m.	Multiaxial fatigue behavior and modeling of LB-PBF Ti-6Al-4V parts *Patricio E. Carrion, Auburn University* (Advisor: Nima Shamsaei)
4:15 p.m.	Comparison of thin wall behavior: LPBF & Sheet *Paul David Paradise, Arizona State University* (Advisor: Dhruv Bhate)
4:30 p.m.	Fatigue assessment of LB-PBF 17-4 PH SS *Pooriya Dastranjy Nezhadfar, Auburn University* (Advisor: Nima Shamsaei)
4:45 p.m.	Investigating specimen property to part performance relationships *Rakish Shrestha, Auburn University* (Advisor: Nima Shamsaei)
5:00 p.m.	Location and orientation specific mechanical response of AM Inconel 718 *Timmanee Loveless, University of Utah* (Advisor: Ashley Spear)
5:15 p.m.	Influence of Part positioning on mechanical properties of EBM IN718 *Tizian Arold, University of Kassel* (Advisor: Thomas Niendorf)
5:30 p.m.	A 3D printable coffee/PLA polymer composite with enhanced impact toughness *Yu-Chung Chang, Washington State University* (Advisor: Lei Li)
5:45 p.m.	Physical understanding of propagating waves through eSHM-system for crack localization *Zoe Jardon, Vrije Universiteit Brussel* (Advisor: Michael Hinderdael)

4:00 - 4:15 COFFEE BREAK

10/08

TUESDAY

Technical Presentations

Session Chairs
Nik Hrabe, NIST
Doug Wells, NASA

MICROSTRUCTURAL AND MECHANICAL CHARACTERIZATIONS
Cherry Blossom Ballroom

7:45 a.m.	Welcome Remarks *Nima Shamsaei & Mohsen Seifi, Symposium Co-Chairs*
8:00 a.m.	On the structural integrity of Fe-based alloys processed by additive manufacturing from 316L to shape memory alloys *Thomas Niendorf, University of Kassel*
8:30 a.m.	Mechanical testing of additively manufactured IN625 in thin-walled elements *Arunima Banerjee, Johns Hopkins University*
8:50 a.m.	Fracture mechanical characterization of additive manufactured plastics depending on the test parameters *Benjamin Bauer, Paderborn University - Institute of Applied Mechan*
9:10 a.m.	Investigation of Microstructure and Mechanical Properties of SLM Produced Inconel 718 and Hastelloy-X Alloys *Guney Mert Bilgin, Tusas Engine Industries Inc.*
9:30 a.m.	Standardizing Evaluation of Additive Manufactured Materials for High Volume Implementation in Automotive Applications *Dale Gerard, General Motors, LLC - Invited Talk*
10:15 a.m.	Lattice Design Parameter Effects on AM Structure Performance *Daniel Porter, U.S. Food and Drug Administration*
10:45 a.m.	Prediction of residual stress evolution for end-to-end process chain of laser powder bed fusion process and determination of fatigue S-N curves *Jamie Frame, The Manufacturing Technology Centre (MTC)*
11:05 a.m.	Standardized AM certification program to ensure high quality for safety critical applications *Christophe Blanc, TUV SUD*
11:25 a.m.	Fatigue Life Prediction of Additively Manufactured Ti-6Al-4V Under Machined and as-Built Surface Conditions *John Ruschau, UDRI*

10:00 - 10:15 COFFEE BREAK | 11:55 - 1:00 LUNCH

Session Chairs
Steven Hall, The MTC
Tony Thornton, Micrometrics Instrument

FEEDSTOCK ISSUES
Eastern Shore 2

7:55 a.m.	Welcome Remarks *Tony Thornton & Steven Hall, Session Chairs*
8:00 a.m.	Direct Recycling of Metal Scrap Through Solid Phase Additive Manufacturing *Paul Allison, Univ. of Alabama*
8:30 a.m.	Aluminum Association Alloy and Temper Designations for AM and PM Feedstock and Products *Jack Cowie, The Aluminum Association*
8:50 a.m.	Powder degradation: Recycle number and Specification limits *Ankit Saharan, EOS North America*
9:10 a.m.	Characterization of Water- and Gas- Atomized 17-4 PH Stainless Steel Powder Precursors of LPBF AM Processes *Veeraraghavan Sundar, UES Inc.*
9:30 a.m.	Powder recycling in Additive manufacturing - concepts and quality assurance *Johannes Casper, MTU Aero Engines AG*
10:15 a.m.	Challenges and opportunities in characterizing powder feedstock flowability *Steven Hall, The Manufacturing Technology Centre (MTC)*
10:45 a.m.	The effects of powder particle size distribution on the rheological properties of the powder and the mechanical properties of additively manufactured 17-4 stainless steel *Jordan Weaver, NIST*
11:05 a.m.	The Influence of Particle Size Distribution on Metallic Powders Spreadability and Flowability *Filip Francqui, GranuTools*
11:25 a.m.	Fatigue Assessment of Additive Manufacturing: computational tools for defect and 'as-built' surfaces *Stefano Beretta, Politecnico di Milano*

10:00 - 10:15 COFFEE BREAK

Technical Presentations

Session Chairs
Stefano Beretta, Polytechnic of Milan
Thomas Niendorf, University of Kassel

MICROSTRUCTURAL AND MECHANICAL CHARACTERIZATIONS *(continued)*
Cherry Blossom Ballroom

1:00 p.m.	Effect of Defects on AM Fatigue - Application of probabilistic approaches *Jon Mardaras, Airbus Operations SAS*
1:30 p.m.	3D Printing of Multi-Functional Structures *Eric MacDonald, Youngstown State University*
1:50 p.m.	Influence of Defects on the Fatigue Behavior of Additively Manufactured Ti-6Al-4V by Laser Based Powder Bed Fusion *Jayme Keist, ARL / Penn State*
2:10 p.m.	Dynamic compression response of additive manufactured bulk metallic glass honeycombs *Ratneshwar Jha, Rowan University*
2:30 p.m.	Oxide-related Pores in Laser Powder Bed Fusion Parts: Origin, and Effect on Fatigue *Chris Pistorius, Carnegie Mellon University*
3:15 p.m.	A critical discussion on the diffraction-based experimental determination of Residual Stress in AM Parts *Alexander Evans, Federal Institute for Materials Research and Testing (BAM)*
3:45 p.m.	Sabotaging Structural Integrity in AM via Cyber – Exposure and Characteristic Aspects *Mark Yampolskiy, Auburn University*
4:05 p.m.	Tools, Challenges, and the Potential for Automated Additive Manufacturing Data Management *Peter Coutts, Penn State University*
4:25 p.m.	Corrosion response of wrought and additively-manufactured 17-4 PH stainless steels in phosphate buffered saline *Rod McMillan, Johnson & Johnson*
4:55 p.m.	Panel Discussion Preparation
5:00 p.m.	Panel Discussion 1: Challenges and Opportunities of Adopting AM in new Applications *Anil Sachdev, GM* *Nag Patibandla, Applied Materials* *Shane Collins, Additive Industries* *Eric MacDonald, Youngstown State University* Moderator *John Wilczynski, America Makes*

3:00 - 3:15 COFFEE BREAK

Technical Presentations

Session Chairs
Michael Gorelik, FAA
Frank Medina, SUTD

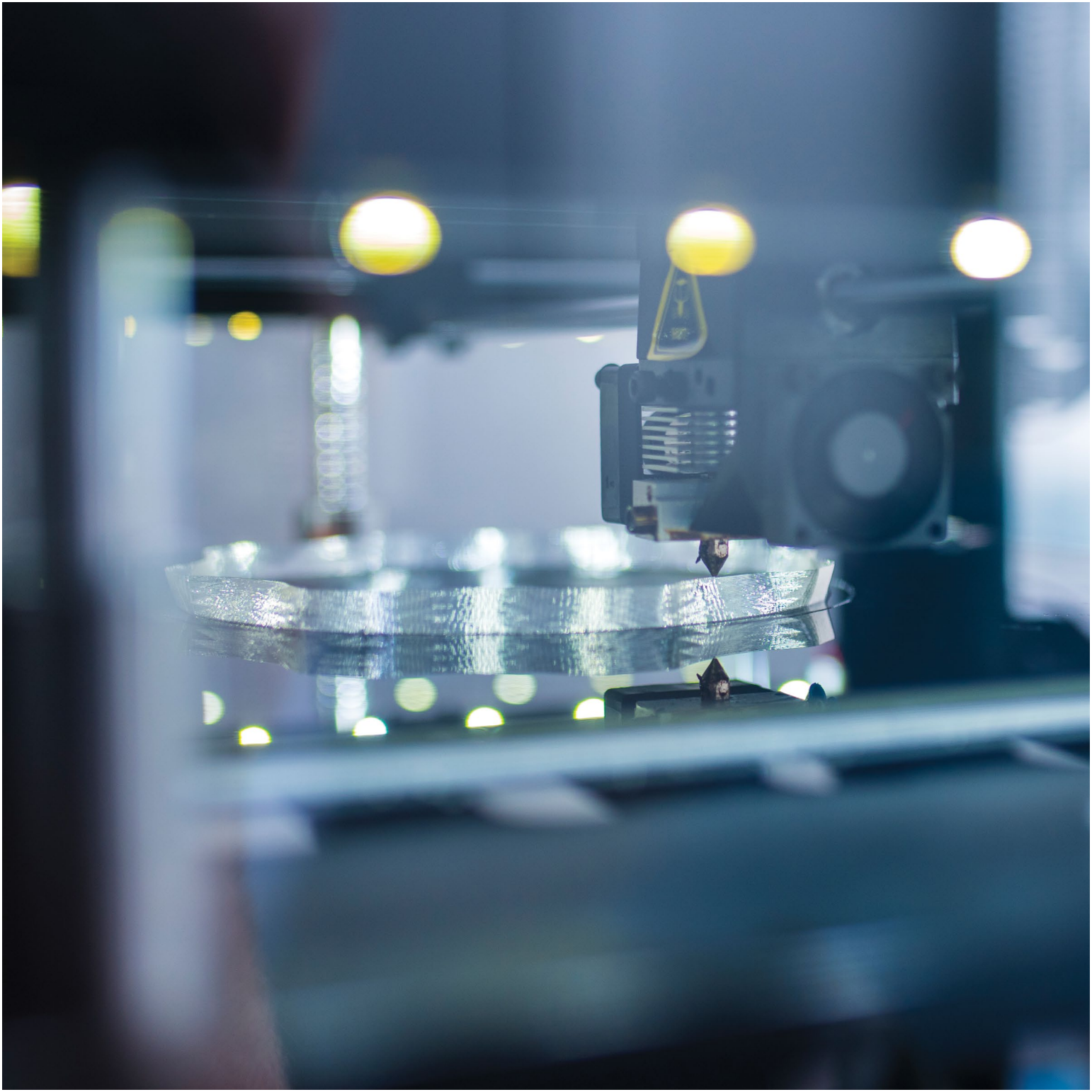
DESIGN, MODELING, AND SIMULATION
Eastern Shore 2

1:00 p.m.	Slight build layout changes in EBM-PBF Ti-6Al-4V leading to significant variations in crystallographic texture and mechanical properties *Nikolas Hrabe, NIST*
1:30 p.m.	Accurately Quantifying Process-Relevant Powder Properties for Additive Manufacturing Applications *John Yin, Freeman Technology Ltd*
1:50 p.m.	A Multiscale Material Modeling Approach to Predict the Mechanical Properties of Powder Bed Fusion (PBF) Metal with Consideration of Microstructure Uncertainties *Yang Li, Ford Motor Company*
2:10 p.m.	Ultrafast modelling of temperature and microstructure in the additive manufacturing process *Jamie Frame, The Manufacturing Technology Centre*
2:30 p.m.	Towards the rapid qualification of additive manufactured IN718, 718Plus, and Ti-6Al-4V through coupled fatigue modeling and in situ experiments *Michael Sangid, Purdue University*
3:15 p.m.	Mechanism-based fatigue assessment and statistical property modelling of additively manufactured aluminum alloys in the HCF and VHCF regime *Jochen Tenkamp, TU Dortmund University*
3:45 p.m.	Machine-learning-assisted method for maximizing interlayer fracture toughness of FFF specimens through processing parameter selection *Devin Young, University of Utah*
4:05 p.m.	Characterization and integration of the anisotropy of additively manufactured titanium in the topology optimization of light-weight structures *Matthew Vaughn, Johns Hopkins University*
4:25 p.m.	A New Method for Determining As-Built Interfacial Fracture Toughness between Solid and Lattice Support in L-PBF Inconel 718 *Albert To, University of Pittsburgh*
4:55 p.m.	Panel Discussion Preparation
5:00 p.m.	Panel Discussion in Cherry Blossom Ballroom

3:00 - 3:15 COFFEE BREAK | 11:55 - 1:00 LUNCH

10/09

WEDNESDAY



Technical Presentations

Session Chairs
Matthew DiPrima, FDA
Anil Sachdev, General Motors

MICROSTRUCTURAL AND MECHANICAL CHARACTERIZATIONS *(continued)*
Cherry Blossom Ballroom

7:55 a.m.	Welcome Remarks *Anil Sachdev & Matthew DiPrima, Session Chairs*
8:00 a.m.	Effect of build orientation on axial/torsional fatigue life of Ti-6Al-4V ELI made via DMLS and EBM *Vivek Paleupu, US Food and Drug Administration*
8:30 a.m.	Effects of Surface Roughness and Porosity on Fatigue Behaviors of AlSi10Mg Produced by Laser Power Bed Fusion Process *Wei-Jen Lai, Ford motor company*
8:50 a.m.	Rate-Dependent Failure of Additively Manufacture Polymers *Mark Oliver, Veryst Engineering*
9:10 a.m.	Integrated Process-Induced Sensitivities For Fatigue Simulation of Additive Manufacturing *Nicolas Lammens, Siemens Industry Software NV*
9:30 a.m.	Influence of Condensate Plume on Mechanical Properties In Multi-Laser Metal Powder Bed Fusion Machines *Shane Collins, Additive Industries North America*
10:15 a.m.	Effect of Surface Topography and Porosity on the Tensile Fatigue of 3D Printed Ti-6Al-4V Fabricated by Selective Laser Melting *David Safranski, MedShape, Inc.*
10:45 a.m.	Fatigue behavior of laser beam-powder bed fused Inconel 718 in the high cycle and very high cycle regimes *Jutima Simsiriwong, University of North Florida*
11:05 a.m.	Fatigue Behavior of Additive Manufactured Materials: An Investigation into Feedstock-Process-Structure-Property Relationships *Jonathan Pegues, Auburn University - NCAME*
11:25 a.m.	Correlation between Additive Manufactured as-built material properties, heat treatment variables and material property scatter understood *Pedro Santos, The Manufacturing Technology Centre (MTC)*

10:00 - 10:15 COFFEE BREAK | 11:55 - 1:00 LUNCH

Technical Presentations

Session Chairs
Matt Donovan, Oerlikon
Chris Holshouser, NIAR

PROCESSING
Eastern Shore 2

7:55 a.m.	Welcome Remarks *Matt Donovan & Chris Holshouser, Session Chairs*
8:00 a.m.	Process Nuances and Critical Microstructural Features of the Three Primary Metal Additive Manufacturing Methods A Metallurgical Perspective *Julius Bonini, Lucideon M+P*
8:30 a.m.	Assessment of LPBF Process Conditions with Ultrasonic Wave Dispersion Analysis *Ajay Krishnan, Incodema3D, LLC*
8:50 a.m.	Optimizing Additively-Manufactured Inconel 625 for Reliable Mechanical Properties and Corrosion Resistance *Michael Katz, NIST*
9:10 a.m.	Effect of process parameters on microstructure and mechanical properties of CoCr substrate and porous Ti dissimilar joint manufactured by 3D printing of DED method *Yonghaw Kim, Sejong University, Korea*
9:30 a.m.	Polymer AM Test Methods Round Robin Study *Rachael Andrulonis, Wichita State University – NIAR*
10:15 a.m.	Tensile and Fracture Behaviors of Additively Printed ABS: Effects of Print Architecture, Loading Rate and Moisture Studied using DIC *Hareesh Tippur, Auburn University*
10:35 a.m.	Additive Manufacturing Qualification and Certification Efforts at America Makes *Mark Benedict, AFRL*
10:55 a.m.	Laser scanning consistency in Laser Powder Bed Fusion (LPBF) *Sean-Anthony Smith, The Manufacturing Technology Centre*
11:15 a.m.	Nondestructive evaluation and characterization of additively manufactured materials for structural integrity assessment *Hossein Taheri, Georgia Souther University*
11:35 a.m.	Machine learning for localized processing parameter optimization in fused filament fabrication *Godfrey Sauti, NASA*

10:00 - 10:15 COFFEE BREAK | 11:55 - 1:00 LUNCH

Technical Presentations

Session Chair
Rachael Andrulonis, NIAR

STANDARDIZATIONS, QUALIFICATION, AND CERTIFICATION
Cherry Blossom Ballroom

1:00 p.m.	Additive Manufacturing - What can we learn from composites? *Cindy Ashforth, FAA*
1:30 p.m.	Design of Coupons and Test Methodology for Orthotropic Characterization of AM Processed ULTEM 9085 Comparing Methods and Results to Current Industry Best Practices *Tommy Hyatt, Lockheed Martin*
2:00 p.m.	Transformational Additive Manufacturing (AM) Data Management Standards *Bill Frazier, NAVAIR Retiree*
2:30 p.m.	Understanding the Quality Implications of Multi-Laser Stitching in the LPBF Process. *Jacob Rindler, The Ohio State University*
3:15 p.m.	On the Development of Fatigue and Damage Tolerance Framework for Additively Manufactured Parts *Michael Gorelik, FAA*
3:45 p.m.	Residual Stress Formation in Laser Powder Bed Fusion (L-PBF) of Invar 36 *Mostafa Yakout, McMaster University*
4:05 p.m.	Pre-clinical Testing of a Novel, Additive Manufactured, 3-Dimensional Porous Titanium Structure *Erik Woodard, Smith & Nephew Orthopaedics*
4:25 p.m.	Evaluation of an Alternate Method for Determining Yield Strength Offset Values for Selective Laser Sintered Polymeric Materials *Chul Park, Boeing Commercial Airplanes*
4:55 p.m.	Panel Discussion Preparation
5:00 p.m.	Panel Discussion 2: Current & Future States of AM in Medical Technology Industry *Daniel Porter, FDA* *Laura Gilmour, EOS* *David Heard, Stryker* *Dirk Scholvin, Wright Medical* *Dave Emmett, GE Additive* Moderator *Rod McMillan, Johnson & Johnson*

3:00 - 3:15 COFFEE BREAK
6:00 RECEPTION IN LOWER ATRIUM

Technical Presentations

Session Chairs
Matt Donovan, Oerlikon
Chris Holshouser, NIAR

PROCESSING/POST PROCESSING
Eastern Shore 2

1:00 p.m.	Optimization of Hot Isostatic Press (HIP) and Heat-Treated Cycles for 3D-Printed Aerospace Titanium *Frank Medina, the University of Texas at El Paso*
1:30 p.m.	Use of hot isostatic pressing treatments to manipulate defect content, microstructure, and mechanical properties in additively manufactured Ti-6Al-4V parts *Jake Benzing, NIST*
1:50 p.m.	An initial assessment of hybrid manufacturing as an alternative method to conventional manufacture of an In625 thin walled manifold *Sean-Anthony Smith, The Manufacturing Technology Centre (MTC)*
2:10 p.m.	Utilizing Cryogenic Temperatures to Reduce Deformation in 3D Printed Hydrogel Lattices *Yahya Cheema, University of Maryland*
2:30 p.m.	Enhancing fatigue properties of additively manufactured Ti-6Al-4V thin samples by post treatments *Jean-Yves Buffiere, INSA Lyon*
3:15 p.m.	Progress in post- and in-process measurement and characterization of metal powder bed surfaces *Richard Leach, University of Nottingham*
3:45 p.m.	A Guide Towards Understanding Surface Roughness and Surface Texture of Additively Manufactured Parts *Adam Brooks, EWI*
4:05 p.m.	Surface texture characterization and optimization via surface finishing of AM metal components *Agustin Diaz, REM Surface Engineering*
4:35 p.m.	Complementary Measurements of Residual Stresses Before and After Base Plate Removal in an Intricate Additively-Manufactured Stainless-Steel Valve Housing *Bjorn Clausen, Los Alamos National Laboratory*
4:55 p.m.	Panel Discussion Preparation
5:00 p.m.	Panel Discussion in Cherry Blossom Ballroom

3:00 - 3:15 COFFEE BREAK
6:00 RECEPTION IN LOWER ATRIUM

10/10

THURSDAY

Session Chair
Doug Wells, NASA

MICROSTRUCTURAL AND MECHANICAL CHARACTERIZATIONS, *(continued)*
Cherry Blossom Ballroom

7:55 a.m.	Welcome Remarks *Doug Wells, Session Chair*
8:00 a.m.	The State of Aluminum Additive Manufacturing in Aerospace *Paul Wilson, Boeing Research and Technology*
8:30 a.m.	Towards Mechanistic-Based Fatigue Life Prediction of Additively Manufactured Ti-6Al-4V Components *Derek Warner, Cornell University*
8:50 a.m.	Structure and mechanical properties of an additively manufactured hybrid S316L and Inconel 625 structure *Jingjing Li, Pennsylvania State University*
9:10 a.m.	Effect of Printing Orientation on the Structure Integrity and Performance of Inhalation Delivery Systems *Leo N.Y. Cao, US FDA*
9:30 a.m.	Analysis of Data Streams for Qualification and Certification of Inconel 738 Airfoils Processed Through Electron Beam Melting *Michael Kirka, Oak Ridge National Laboratory*
10:15 a.m.	Effect of residual stresses on crack propagation in Laser Beam Melted (LBM) additively manufactured 316L *Mauro Madia, Federal Institute for Materials Research and Testing (BAM)*
10:45 a.m.	Type 316L Stainless Steel Fabricated using Electron Beam Direct Energy Deposition (EB-DED) Additive Manufacturing Methods: Microstructure and Effects on Tensile Properties *Chelsea Snyder, Naval Nuclear Laboratory (NNL)*
11:05 a.m.	Fatigue Behavior of Additive Manufactured Materials: An Investigation into Specimen Property to Part Performance Relationships for Laser Beam Powder Bed Fusion *Rakish Shrestha, Auburn University*
11:25 a.m.	Characterization of Intrinsic Fatigue Thresholds for Additive Manufactured Materials *Sunder Ramasubbu, BISS (P) Ltd*
11:45 a.m.	Full-Scale High Load, Thermal, and Fatigue Testing of Additive Manufactured Powder Bed Fusion Part for Oil Field Applications *Matthew Sanders, Stress Engineering Services*

10:00 - 10:15 COFFEE BREAK
12:05 - 1:00 LUNCH

Session Chairs
Ben Dutton, The MTC
Nik Hrabe, NIST

IN-SITU MONITORING AND NDT
Eastern Shore 2

7:55 a.m.	Welcome Remarks *Ben Dutton & Nik Hrabe, Session Chairs*
8:00 a.m.	Non-destructive assessment of 3D Residual Strain fields in metal additive manufactured components *Sandra Cabeza Sanchez, ILL*
8:30 a.m.	Fretting Fatigue Characterization in Press-Fit Joints of AM Parts by X-ray Tomography and Digital Image Correlation *Inigo Bacaicoa, University of Kassel*
8:50 a.m.	Towards the Identification and Classification of Anomalous Thermal Signatures using In Situ Process Monitoring *Darren Beckett, Sigma Labs Inc*
9:10 a.m.	Ranking of X-CT settings for dimensional metrology of additive manufactured lattice structures using image analysis of minimum 2D projections *Younes Chahid, EPSRC Future Metrology Hub, School of Computing an*
9:30 a.m.	X-ray computed tomography inspection in metal additive manufacturing: the role of witness specimens *Anton du Plessis, Stellenbosch University*
10:15 a.m.	Fatigue life computation of SLM AlSi10Mg from Computed Tomography image *Yves Nadot, ISAE-ENSMA*
10:45 a.m.	Synergistic Effects of Stress Gradient and Surface Roughness on the Fatigue Behavior of LB-PBF 316L Stainless Steel *Jutima Simsiriwong, University of North Florida*
11:05 a.m.	Demonstration of Closed Loop Control Demonstration for Laser Powder Bed forming (L-PBF) *David Maass, Flightware*
11:25 a.m.	In-Situ Process Monitoring of Selective Laser Melted TI-6AL-4V Porous Biomaterials *Darragh Egan, i-form*
11:45 a.m.	Effects of laser-energy density and build orientation on the defect structure, microstructure and tensile properties of laser powder bed fused Inconel 718 *Dillon Watring, University of Utah*

10:00 - 10:15 COFFEE BREAK
12:05 - 1:15 LUNCH

Technical Presentations

Session Chair
Charles Park, Boeing

STANDARDIZATIONS, QUALIFICATION, AND CERTIFICATION *(continued)*
Cherry Blossom Ballroom

1:00 p.m.	Qualification research on laser powder bed fusion of AlSi10Mg structures *Brett Conner, Youngstown State University*
1:30 p.m.	Development of 4340 Steel Processing Parameters on the EOS M290 *Elias Jelis, U.S. Army ARDEC*
2:00 p.m.	Identifying methods to improve the structural integrity of multi-component, additive manufactured objects through the use of the ASTM/ISO 52915 AMF format *Robert Zollo, Avante Technology, LLC*
2:20 p.m.	Navigating Processing, Structure and Properties During Additive Manufacturing Development *Daniel Matejczyk, Aerojet Rocketdyne*
3:00 p.m.	A Framework and Tools for Additive Manufacturing Qualification and Certification *Matthew Sloane, U.S. Army Combat Capabilities Development Command*
3:30 p.m.	Perspective on Additive Manufacturing Standards Requirements to Accelerate Maintenance and Sustainment Applications *Marilyn Gaska, Lockheed Martin*
4:00 p.m.	Fracture Control and Structural Certification Guidance for Additive Manufactured Spacecraft Structures *Mark McElroy, NASA Johnson Space Center*
4:30 p.m.	Perspective on Nondestructive Evaluation of Additive Manufactured Components *Eric Lindgren, US Air Force Research Laboratory*
5:00 p.m.	Panel Discussion Preparation
5:05 p.m.	Panel Discussion 3: Recent Progress in Qualification & Certification of AM in Aerospace & Defense Industries *Mark Benedict, AFRL* *Marylin Gaska, Lockheed Martin* *Charles Park, Boeing* *Mark Shaw, GE Additive* *Jennifer Wolk, Office of Naval Research* Moderator *Cindy Ashforth, FAA*

2:50 - 3:00 COFFEE BREAK

Session Chairs
Ben Dutton, The MTC
Frank Medina, EWI

IN-SITU MONITORING AND NDT *(continued)*
Eastern Shore 2

1:00 p.m.	Characterization of Defects in Metal Additive Manufacturing using In-situ Diagnostics *Manyalibo (Ibo) Matthews, Lawrence Livermore National Lab*
1:30 p.m.	Challenges in Manufacturing and Inspecting Internal Features for Aluminum SLM Additive Manufactured Components *Ahmed Tawfik, University of Huddersfield*
1:50 p.m.	Probability of detection of seeded AM defects using X-ray Computed Tomography *Felix Kim, NIST*
2:10 p.m.	In-Line Inspection of Additive Manufactured Parts Using Laser Ultrasonics *Max Wiedmann, Intelligent Optical Systems*
2:30 p.m.	Exposing hidden mechanics and the effects of defects in additively manufactured metal structures via novel combination of mechanical and non-destructive testing techniques *Christopher Peitsch, Johns Hopkins University Applied Physics Lab*
3:05 p.m.	Powder bed fusion in-situ monitoring for the rapid detection of defects *Andrey Molotnikov, RMIT University*
3:35 p.m.	A study of applying 3D printing to improve testing reliability in Testing, Inspection and Certification (TIC) Industry *Chi Ho Li, The Open University of Hong Kong*
3:55 p.m.	Elemental Analysis of Powdered Metals and Additively Manufactured Parts *Michael DeLeon, SPECTRO Analytical Instruments*
4:15 p.m.	Spatially variant structures: unlocking the full potential of additive manufacturing *Jonathan Harris, nTopology*
4:35 p.m.	Scan-by-Scan Thermal Modeling for Defect and Prediction at the Part Scale *Derek Warner, Cornell University*
4:55 p.m.	Panel Discussion Preparation
5:00 p.m.	Panel Discussion in Cherry Blossom Ballroom

2:50 - 3:05 COFFEE BREAK

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