

**Proceedings of 2022
International Additive
Manufacturing Conference**

(IAM2022)

**October 19-20, 2022
Lisbon, Portugal**

Conference Sponsor
Manufacturing
Engineering Division

THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS

Two Park Avenue * New York, N.Y. 10016

© 2022, The American Society of Mechanical Engineers, 2 Park Avenue, New York, NY 10016, USA
(www.asme.org)

All rights reserved. Printed in the United States of America. Except as permitted under the United States Copyright Act of 1976, no part of this publication may be reproduced or distributed in any form or by any means, or stored in a database or retrieval system, without the prior written permission of the publisher.

INFORMATION CONTAINED IN THIS WORK HAS BEEN OBTAINED BY THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS FROM SOURCES BELIEVED TO BE RELIABLE. HOWEVER, NEITHER ASME NOR ITS AUTHORS OR EDITORS GUARANTEE THE ACCURACY OR COMPLETENESS OF ANY INFORMATION PUBLISHED IN THIS WORK. NEITHER ASME NOR ITS AUTHORS AND EDITORS SHALL BE RESPONSIBLE FOR ANY ERRORS, OMISSIONS, OR DAMAGES ARISING OUT OF THE USE OF THIS INFORMATION. THE WORK IS PUBLISHED WITH THE UNDERSTANDING THAT ASME AND ITS AUTHORS AND EDITORS ARE SUPPLYING INFORMATION BUT ARE NOT ATTEMPTING TO RENDER ENGINEERING OR OTHER PROFESSIONAL SERVICES. IF SUCH ENGINEERING OR PROFESSIONAL SERVICES ARE REQUIRED, THE ASSISTANCE OF AN APPROPRIATE PROFESSIONAL SHOULD BE SOUGHT.

ASME shall not be responsible for statements or opinions advanced in papers or . . . printed in its publications (B7.1.3). Statement from the Bylaws.

For authorization to photocopy material for internal or personal use under those circumstances not falling within the fair use provisions of the Copyright Act, contact the Copyright Clearance Center (CCC), 222 Rosewood Drive, Danvers, MA 01923, tel: 978-750-8400, www.copyright.com.

Requests for special permission or bulk reproduction should be addressed to the ASME Publishing Department, or submitted online at: <https://www.asme.org/publications-submissions/journals/information-for-authors/journalguidelines/rights-and-permissions>

ISBN: 978-0-7918-8660-1

WELCOME TO IAM 2022

It gives us great pleasure to welcome everyone who has come from near and far, to this first international symposium on Additive Manufacturing (IAM 2022), jointly organized by ASME (American Society of Mechanical Engineers) and EWF (European Welding Federation) in this beautiful city of Lisbon. It is exciting to note that everyone will be meeting in person something which we have missed during the last couple of years.

The evolution of additive manufacturing technologies has changed the face of direct, digital technologies for the rapid production of models, prototypes, patterns and functional parts including repair and maintenance. Metal 3D Printing is poised to be the next industrial revolution in metals, plastics and ceramics, in enabling advancements in Defense, Aerospace, Power, Healthcare, Marine, Nuclear, Space, Oil & Gas, and various other sectors, defying the imagination of the designer.

We have had an overwhelming response to the call for abstracts. This is a positive start towards the effort to advance the additive manufacturing ecosystem, with experts from industry, academia, research labs, original equipment manufacturers, end users and budding researchers and students.

The symposium is scheduled over two days, October 19-20th with optional Industry Tours on the 21st. The conference covers four tracks, comprising, Polymers, Metals, Ceramics and Emerging Technologies. The contributory papers range from cutting edge research and developments in process optimization, new materials development, structure-property correlations, practical challenges in industrialization, design for additive manufacturing with participants from 16 different countries, to bring out a truly global insight into additive manufacturing.

Renowned global experts will be delivering a keynote lecture, addressing different aspects of how AM will enable sustainability. In addition, an exciting panel has been scheduled to address the wholistic role of standards, qualification and certification as enablers of accelerated qualifications in additive manufacturing.

We will have the opportunity to witness some state-of-the-art development in AM machines, consumables, characterization equipment, with an impressive list of generous sponsors covering a wide range of allied areas related to AM.

This conference has been made possible by a very passionate committee of over two dozen senior colleagues from academia and industry, who have volunteered their valuable time to ensure the roaring success of this first AM symposium.

We are sure that all of you will have a very enriching meeting in Lisbon.

**IAM 2022 INTERNATIONAL
ADDITIVE MANUFACTURING CONFERENCE
ORGANIZING COMMITTEE**

Conference Chair: Dheepa Srinivasan, *Pratt & Whitney*

Technical Program Chair: Yan Wang, *Georgia Tech*

Technical Program Chair: Michelangelo Mortello, *Italian Institute of Welding*

Review Chair: Guglielmo Vastola, *A*STAR*

Review Chair: Fernando Mañas, *CESOL*

Review Chair Advisor: Tim Simpson, *Penn State*

CONFERENCE ORGANIZERS

Polymers

Track Chair: Albert E. Patterson, Texas A&M University

Track Chair: Paula Queipo, Idonial

Ceramics

Track Chair: Grégoire Witz, Siemens

Track Chair: Paula Vilarinho, Universidade de Averio

Metals

Track Chair: Guha Manogharan, Penn State University

Track Chair: Jean-Daniel Penot, CESI

Track Chair: Doug Kautz, Los Alamos National Laboratory

Emerging Technologies

Track Chair: Xian Du, University of Massachusetts Amherst

Track Chair: David Wimpenny, MTC - The Manufacturing Technology Centre

REVIEWERS

Mohammad Azad
Shyam Sundar Balasubramanian
Saurabh Basu
Rodolfo Batalha
Jared Butler
Charul Chadha
Subhradeep Chatterjee
Vasile Cojocaru
Kishore Debnath
Fabiano Drozda
Xian Du
Nandha Kumar Eswaramoorthy
Derosh George
Seymur Hasanov
Doug Kautz
Nadia Kouraytem
Guha Manogharan
Nasiha Muna
Gaius Nzebuka
Easir Arafat Papon
Siddharth Patil
Albert Patterson
Prasad Raghupatruni
Santosh Reddy Sama
Shobhit Singh
Dheepa Srinivasan
Halil Tetik
Chukwuzubelu Ufodike
Bhaskar Vajjipeyajula
Guglielmo Vastola
Yan Wang
Sahil Wankhede

2022 INTERNATIONAL ADDITIVE MANUFACTURING CONFERENCE (IAM2022) CONTENTS

Polymers

- Influence of Matrix Material on Impact Properties of Chopped Carbon Fiber-Thermoplastic Composites Made Using FDM/FFF **IAM2022-88941**
Albert E. Patterson, Seymur Hasanov, and Bhaskar Vajjipeyajula
- Effects of Printing Parameters on Geometrical and Mechanical Properties of 3D-Printed High-Performance Thermoplastics, Toward the Digitalization of Power Transformers **IAM2022-91989**
Thiago Assis Dutra, Catarina Costa, João R. Matos, Bruna F. Oliveira, Luís Miguel Oliveira, and Cristiano Pereira Coutinho
- Fused Granulated Fabrication (FGF) Processing Study for Novel sCF/LMPAEK Recycled Material to Manufacture Aeronautic Structural Parts **IAM2022-93890**
Celia Martín-Pérez, Daniel Rodríguez-Del Rosario, Elena Rodríguez-Senín, and Noelia González-Castro
- Impact of Build Direction, Infill Pattern and Raster Angle on Mechanical Properties and Damage Tolerance of 3D Printed PLA **IAM2022-93940**
Deepesh Yadav, Prerna Gupta, and Balila Nagamani Jaya
- Food Contact Materials: An Analysis of Water Absorption in Nylon 12 3D Printed Parts Using SLS After VaporFuse Surface Treatment **IAM2022-93944**
Elizabeth Cristine Adam Trindade, Camille Ruest, Jean-Sébastien Deschênes, and Jean Brousseau
- Additive Manufacturing of Star Structured Auxetic Lattices With Overhanging Links **IAM2022-93965**
Benedict A. Rogers, Max D. A. Valentine, Elise C. Pegg, Alexander J. G. Lunt, and Vimal Dhokia
- Comparison of Technical and Economic Properties of Additively Manufactured Components Using Masked Stereolithography and Fused Layer Modeling **IAM2022-94087**
Stefan Junk and Felix Bär

Metals

- Thermal Stability of Additively Manufactured Mar M 509 **IAM2022-91410**
Shreehard Sahu, Bikash Kumar, Siba Sundar Sahoo, Balila Nagamani Jaya, and Dheepa Srinivasan
- Development of a New Manufacturing Route by Direct Laser Metal Deposition With NiCrSiFeB Alloys to Replace Cobalt in Aeronautical Components **IAM2022-91705**
Juan Carlos Pereira, Fidel Zubiri, David Aguilar, Maria Del Carmen Taboada, Gaylord Guillonneau, and Jerome Rocchi

- Effect of Heat Treatment on Structure and Properties of Laser Powder Bed Fusion Inconel 939 **IAM2022-93945**
E. Nandha Kumar, K. S. Athira, Subhradeep Chatterjee, and Dheepa Srinivasan
- A Feasibility Study of Additively Manufactured Composite Tooling **IAM2022-93952**
Max Valentine, Arjun Radhakrishnan, Vincent Maes, Elise Pegg, Maria Valero, James Kratz, and Vimal Dhokia
- Dimensional Deviation Prediction Model Based on Scale and Material Concentration Effects for LPBF Process **IAM2022-93969**
Sabrine Ben Amor, Floriane Zongo, Borhen Louhichi, Antoine Tahan, and Vladimir Brailovski
- From Photopolymerization of Metal Suspension to Practical and Economical Additive Manufacturing of Haynes 214 Alloy for High Temperature Application **IAM2022-93984**
Hoa Xuan Nguyen, Hawke Suen, Bibek Poudel, Zhiyuan Qu, Mohsan Uddin Ahmad, Patrick Kwon, Andre Benard, and Haseung Chung
- Effect of Build Geometry and Porosity in Additively Manufactured CuCrZr **IAM2022-93986**
Anup Kulkarni, Vivek C. Peddiraju, Subhradeep Chatterjee, and Dheepa Srinivasan
- In-Process Mechanical Working of Additive Manufactured Rene 41 **IAM2022-94060**
William Sean James, Supriyo Ganguly, and Goncalo Pardal
- The Role of an Individual Lack-of-Fusion Defect in the Fatigue Performance of Additive Manufactured Ti-6Al-4V Part **IAM2022-94120**
Zongchen Li, Andre Gut, Iurii Burda, Silvain Michel, Dejan Romancuk, and Christian Affolter
- Polarized Illumination for Optical Monitoring System in Laser Powder Bed Fusion **IAM2022-94437**
Song Zhang, Sebastian Enk, Moritz Kolter, and Johannes Henrich Schleifenbaum
- Development of Adaptive Toolpaths for Repair and Cladding of Complex 3D Components by Laser Metal Deposition **IAM2022-94946**
Igor Ortiz, Piera Álvarez, Maria Angeles Montealegre, Francisco Cordovilla, and José Luis Ocaña
- A Multi-Modal Data-Driven Decision Fusion Method for Process Monitoring in Metal Powder Bed Fusion Additive Manufacturing **IAM2022-96740**
Zhuo Yang, Jaehyuk Kim, Yan Lu, Ho Yeung, Brandon Lane, Albert Jones, and Yande Ndiaye

Emerging Technologies

- Encapsulating and Inkjet-Printing Electronics on Flexible Substrates for Harsh Environment **IAM2022-92250**
Sahil Wankhede, Xian Du, Ali Alshehri, Keith Brashler, and Doru Turcan

- System Architecture and Design Parameters for Extrusion-Based Autonomous Construction Systems **IAM2022-93884**
Albert E. Patterson, Bhaskar Vajjipeyajula, and William R. Norris
- Temperature Field Monitoring in Fused Filament Fabrication Process Based on Physics-Constrained Dictionary Learning **IAM2022-93987**
Yanglong Lu and Yan Wang
- Exploring Augmented Reality for Teaching Design for Additive Manufacturing **IAM2022-94406**
Gustavo Melo, Rohit Ravi, Lucas Jauer, and Johannes Henrich Schleifenbaum
- Advantages of Additive Manufacturing Technology in Damping Improvement of Turbine Blading **IAM2022-96752**
Grzegorz Moneta, Michal Fedasz, Michal Szmidt, Slawomir Cieslak, and Wieslaw Krzymien