## Proceedings of ASME 2021 International Mechanical Engineering Congress and Exposition

(IMECE2021)

Volume 3

November 1-5, 2021 Virtual, Online

Conference Sponsor
American Society of
Mechanical Engineers

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

© 2021, 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: 978-0-7918-8557-4

## **CONTENTS**

| Proceedings of ASME 2021 International Mechanical Engineering Congress and Exposition Volume 3 |
|--|
| Advanced Materials: Design, Processing, Characterization, and Applications                     |
| Applications of Al/ML for Materials Processing   |
| IMECE2021-71283  |
| Architected Composites and Structures: Design for Multifunctionality                           |
| IMECE2021-73307  |
| Bioinspired Materials, Structures, and Applications  |
| IMECE2021-71880  |
| Sekkappan Chockaiingam, Jong Eun Ryu, Mu Didardi Islam, and Myers Harbinson                    |
| Design of Engineered Materials and Components for Additive Manufacturing                       |
| IMECE2021-69695  |
| IMECE2021-70328  |
| IMECE2021-70564  |
| IMECE2021-70583  |
| IMECE2021-71519  |
| IMECE2021-72865  |
| IMECE2021-73086  |

| MECE2021-70064  | Design of Metamaterials, Metasurfaces, and Metadevices   |
|---|--|
| Sipan Liu, Md Didarul Islam, Zahyun Ku, Augustine M. Urbas, John Derov, Darryl A. Boyd, Woohong Kim, Jasbinder S. Sanghera, and Jong E. Ryu  IMECE2021-70843. V003T03A012 Highly Efficient Mid-Wavelength Infrared (MWIR) Polarizer by ORMOCHALC Composite With Improved Thermomechanical Stability and Spectral Selectivity Md Didarul Islam, Sipan Liu, John Derov, Augustine M. Urbas, Zahyun Ku, Arny Sihn, Evan M. Smith, Darryl A. Boyd, Woohong Kim, Jasbinder S. Sanghera, Vinh Q. Nguyen, Jason D. Myers, Colin C. Baker, and Jong Eun Ryu  Fracture and Damage: Nano- to Macro-Scale  IMECE2021-69336. V003T03A013 Probabilistic Study of Corrosion Pit-Induced Fatigue Benjamin Starr, Serge L. Shiskin, Chittaranjan Sahay, and Suhash Ghosh  IMECE2021-70083. V003T03A014 Ductile-to-Brittle Fracture Size Effect of Titanium Sheets in Micro/Meso-Scale Plastic Deformation Lei Sun, Zhutian Xu, Linfa Peng, and Ximmin Lai  IMECE2021-70138. V003T03A015 A Study of Stress Intensity Factors in Lozenge Pattern of Joints K. Hithnerda and Raghu V. Prakash  Manufacturing, Integration, and Characterization of Multifunctional Structure and Devices  IMECE2021-69766. V003T03A016 Influence of Welding Sequence on Residual Stress Evolution in SUS304/Q235 Bimetallic Clad  Plate Butt-Weided Joints Min Zhu, Yansong Zhang, Qiao Zheng, Wei Wu, Weifang Qian, and Baosen Wang  Material Processing of Flexible/Emerging Electronics, Sensors, and Devices  IMECE2021-70062. V003T03A016  Microwave Synthesis of Plant-Based Supercapacitor Electrodes for Flexible Electronics  Siddi Mehta, Swam Jha, Weston Slewart, and Hong Llang  Materials Processing and Characterization  IMECE2021-70062. V003T03A018  V003T03A019  XRay Computed Tomography (XCT) Scanning Parameters Effects on the Hounsfield Unit (HU)  Messurements for AA2O11  Ahmad M. R. Baydoun and Ramsey F. Hamade  IMECE2021-68010. V003T03A020  Multi Response Optimization of Friction Stir Processing  Akash Manickam, Reman Kuppussamy, Sudha Jayaprakasham, and Senthil Kumar Velukkudi | Novel Nanocomposite Refractive Index Tuning Mechanism Based on Controlling Embedded  |
| Highly Efficient Mid-Wavelength Infrared (MWIR) Polarizer by ORMOCHALC Composite With Improved Thermomechanical Stability and Spectral Selectivity  Md Didarul Islam, Sipan Liu, John Derov, Augustine M. Urbas, Zahyun Ku, Amy Sihn, Evan  M. Smith, Darryl A. Boyd, Woohong Kim, Jasbinder S. Sanghera, Vinh Q. Nguyen, Jason D.  Myers, Colin C. Baker, and Jong Eun Ryu  Fracture and Damage: Nano- to Macro-Scale  IMECE2021-89336. V003T03A013  Probabilistic Study of Corrosion Pit-Induced Fatigue Benjamin Starr, Serge L. Shishkin, Chittaranjan Sahay, and Suhash Ghosh  IMECE2021-70083. V003T03A014  Ductile-to-Brittle Fracture Size Effect of Titanium Sheets in Micro/Meso-Scale Plastic Deformation Lei Sun, Zhutian Xu, Linfa Peng, and Ximmin Lai  IMECE2021-70138. V003T03A015  A Study of Stress Intensity Factors in Lozenge Pattern of Joints K. Hithendra and Raghu V. Prakash  Manufacturing, Integration, and Characterization of Multifunctional Structure and Devices  IMECE2021-69766. V003T03A016  Influence of Welding Sequence on Residual Stress Evolution in SUS304/C235 Bimetallic Clad  Plate Butt-Welded Joints Min Zhu, Yansong Zhang, Qiao Zheng, Wei Wu, Weifang Qian, and Baosen Wang  Material Processing of Flexible/Emerging Electronics, Sensors, and Devices  IMECE2021-70062. V003T03A017  Microwave Synthesis of Plant-Based Supercapacitor Electrodes for Flexible Electronics  Siddhi Mehta, Swam Jha, Weston Stewart, and Hong Liang  Materials for Biology and Medicine  IMECE2021-67415. V003T03A019  X-Ray Computed Tomography (XCT) Scanning Parameters Effects on the Hounsfield Unit (HU)  Measurements for AA2011  Almad M. R. Baydoun and Ramsey F. Hamade  IMECE2021-68010. V003T03A020  Multi Response Optimization of Friction Stir Processing  Akash Manickam, Raman Kuppusamy, Sudha Jayaprakasham, and Senthil Kumar Velukkudi   | Sipan Liu, Md Didarul Islam, Zahyun Ku, Augustine M. Urbas, John Derov, Darryl A. Boyd,  |
| IMECE2021-69336 Probabilistic Study of Corrosion Pit-Induced Fatigue Benjamin Starr, Serge L. Shishkin, Chittaranjan Sahay, and Suhash Ghosh  IMECE2021-7083  Ductile-to-Brittle Fracture Size Effect of Titanium Sheets in Micro/Meso-Scale Plastic Deformation Lei Sun, Zhutian Xu, Linfa Peng, and Xinmin Lai  IMECE2021-70138  A Study of Stress Intensity Factors in Lozenge Pattern of Joints K. Hithendra and Raghu V. Prakash  Manufacturing, Integration, and Characterization of Multifunctional Structure and Devices  IMECE2021-69766  IMECE2021-69766  Influence of Welding Sequence on Residual Stress Evolution in SUS304/Q235 Bimetallic Clad  Plate Butt-Welded Joints Min Zhu, Yansong Zhang, Qiao Zheng, Wei Wu, Weifang Qian, and Baosen Wang  Material Processing of Flexible/Emerging Electronics, Sensors, and Devices  IMECE2021-7062  IMECE2021-7062  IMECE2021-7062  Microwave Synthesis of Plant-Based Supercapacitor Electrodes for Flexible Electronics Siddhi Mehta, Swam Jha, Weston Stewart, and Hong Llang  Materials for Biology and Medicine  IMECE2021-72998  V003T03A018  Pull-Out Force of Bean Plants Grown in Agar With Fluidic Microchannels Abdul Aziz Azlan, Kai Boon Lim, and Abu Samah Zuruzi  Materials Processing and Characterization  IMECE2021-67415  V003T03A019  X-Ray Computed Tomography (XCT) Scanning Parameters Effects on the Hounsfield Unit (HU)  Measurements for AA2011 Ahmad M. R. Baydoun and Ramsey F. Hamade  IMECE2021-68010  V003T03A020  Multi Response Optimization of Friction Stir Process Parameters on AA2024 / SiC Composite Fabricated Using Friction Stir Processing Akash Manickam, Raman Kuppusamy, Sudha Jayaprakasham, and Senthil Kumar Velukkudi   | Highly Efficient Mid-Wavelength Infrared (MWIR) Polarizer by ORMOCHALC Composite With Improved Thermomechanical Stability and Spectral Selectivity  Md Didarul Islam, Sipan Liu, John Derov, Augustine M. Urbas, Zahyun Ku, Amy Sihn, Evan  M. Smith, Darryl A. Boyd, Woohong Kim, Jasbinder S. Sanghera, Vinh Q. Nguyen, Jason D. |
| Probabilistic Study of Corrosion Pit-Induced Fatigue Benjamin Starr, Serge L. Shishkin, Chittaranjan Sahay, and Suhash Ghosh IMECE2021-70083  | Fracture and Damage: Nano- to Macro-Scale  |
| Ductile-to-Brittle Fracture Size Effect of Titanium Sheets in Micro/Meso-Scale Plastic Deformation Lei Sun, Zhutian Xu, Linfa Peng, and Xinmin Lai  IMECE2021-70138. V003T03A015  A Study of Stress Intensity Factors in Lozenge Pattern of Joints K. Hithendra and Raghu V. Prakash  Manufacturing, Integration, and Characterization of Multifunctional Structure and Devices  IMECE2021-69766. V003T03A016  Influence of Welding Sequence on Residual Stress Evolution in SUS304/Q235 Bimetallic Clad Plate Butt-Welded Joints Min Zhu, Yansong Zhang, Qiao Zheng, Wei Wu, Weifang Qian, and Baosen Wang  Material Processing of Flexible/Emerging Electronics, Sensors, and Devices  IMECE2021-70062. V003T03A017  Microwave Synthesis of Plant-Based Supercapacitor Electrodes for Flexible Electronics Siddhi Mehta, Swarn Jha, Weston Stewart, and Hong Liang  Materials for Biology and Medicine  IMECE2021-72998. V003T03A018  Pull-Out Force of Bean Plants Grown in Agar With Fluidic Microchannels Abdul Aziz Azlan, Kai Boon Lim, and Abu Samah Zuruzi  Materials Processing and Characterization  IMECE2021-67415. V003T03A019  X-Ray Computed Tomography (XCT) Scanning Parameters Effects on the Hounsfield Unit (HU)  Measurements for AA2011  Ahmad M. R. Baydoun and Ramsey F. Hamade  IMECE2021-68010. V003T03A020  Multi Response Optimization of Friction Stir Processing Akash Manickam, Raman Kuppusamy, Sudha Jayaprakasham, and Senthil Kumar Velukkudi   | Probabilistic Study of Corrosion Pit-Induced Fatigue   |
| A Study of Stress Intensity Factors in Lozenge Pattern of Joints K. Hithendra and Raghu V. Prakash  Manufacturing, Integration, and Characterization of Multifunctional Structure and Devices  IMECE2021-69766  | Ductile-to-Brittle Fracture Size Effect of Titanium Sheets in Micro/Meso-Scale Plastic Deformation   |
| IMECE2021-69766   | A Study of Stress Intensity Factors in Lozenge Pattern of Joints   |
| Influence of Welding Sequence on Residual Stress Evolution in SUS304/Q235 Bimetallic Clad Plate Butt-Welded Joints  Min Zhu, Yansong Zhang, Qiao Zheng, Wei Wu, Weifang Qian, and Baosen Wang  Material Processing of Flexible/Emerging Electronics, Sensors, and Devices  IMECE2021-70062  | Manufacturing, Integration, and Characterization of Multifunctional Structure and Devices  |
| Material Processing of Flexible/Emerging Electronics, Sensors, and Devices  IMECE2021-70062   | Influence of Welding Sequence on Residual Stress Evolution in SUS304/Q235 Bimetallic Clad Plate Butt-Welded Joints   |
| Microwave Synthesis of Plant-Based Supercapacitor Electrodes for Flexible Electronics Siddhi Mehta, Swarn Jha, Weston Stewart, and Hong Liang  Materials for Biology and Medicine  IMECE2021-72998  |  |
| IMECE2021-72998.  Pull-Out Force of Bean Plants Grown in Agar With Fluidic Microchannels     Abdul Aziz Azlan, Kai Boon Lim, and Abu Samah Zuruzi  Materials Processing and Characterization  IMECE2021-67415.  X-Ray Computed Tomography (XCT) Scanning Parameters Effects on the Hounsfield Unit (HU)  Measurements for AA2011     Ahmad M. R. Baydoun and Ramsey F. Hamade  IMECE2021-68010.  Multi Response Optimization of Friction Stir Process Parameters on AA2024 / SiC Composite Fabricated Using Friction Stir Processing     Akash Manickam, Raman Kuppusamy, Sudha Jayaprakasham, and Senthil Kumar Velukkudi  | Microwave Synthesis of Plant-Based Supercapacitor Electrodes for Flexible Electronics  |
| Pull-Out Force of Bean Plants Grown in Agar With Fluidic Microchannels Abdul Aziz Azlan, Kai Boon Lim, and Abu Samah Zuruzi  Materials Processing and Characterization  IMECE2021-67415   | Materials for Biology and Medicine   |
| IMECE2021-67415  X-Ray Computed Tomography (XCT) Scanning Parameters Effects on the Hounsfield Unit (HU)  Measurements for AA2011  Ahmad M. R. Baydoun and Ramsey F. Hamade  IMECE2021-68010  Multi Response Optimization of Friction Stir Process Parameters on AA2024 / SiC Composite  Fabricated Using Friction Stir Processing  Akash Manickam, Raman Kuppusamy, Sudha Jayaprakasham, and Senthil Kumar Velukkudi   | Pull-Out Force of Bean Plants Grown in Agar With Fluidic Microchannels   |
| X-Ray Computed Tomography (XCT) Scanning Parameters Effects on the Hounsfield Unit (HU)  Measurements for AA2011  Ahmad M. R. Baydoun and Ramsey F. Hamade  IMECE2021-68010   | Materials Processing and Characterization  |
| IMECE2021-68010   | X-Ray Computed Tomography (XCT) Scanning Parameters Effects on the Hounsfield Unit (HU) Measurements for AA2011  |
| Multi Response Optimization of Friction Stir Process Parameters on AA2024 / SiC Composite Fabricated Using Friction Stir Processing Akash Manickam, Raman Kuppusamy, Sudha Jayaprakasham, and Senthil Kumar Velukkudi   |  |
|   | Multi Response Optimization of Friction Stir Process Parameters on AA2024 / SiC Composite Fabricated Using Friction Stir Processing  Akash Manickam, Raman Kuppusamy, Sudha Jayaprakasham, and Senthil Kumar Velukkudi   |

| IMECE2021-68181  |
|--|
| IMECE2021-68595  |
| IMECE2021-69865  |
| IMECE2021-69956  |
| IMECE2021-70176  |
| IMECE2021-70245  |
| Alyaqadhan Allamki, Majid Al-Maharbi, Ramanathan Arunachalam, and Sayyad Zahid Qamar  IMECE2021-70393  |
| IMECE2021-70589  Experimental Approach and Conventional Analytical Techniques to the Carbon Nanotube Network Interphase in 3-Phase Polymer Matrix Nano-Composites  Masoud Yekani Fard and Joel Swanstrom |
| IMECE2021-70717  |
| IMECE2021-71258  |
| IMECE2021-71461  |
| IMECE2021-72026  |
| IMECE2021-72226  |
| IMECE2021-72319  |

| IMECE2021-72478   |
|---|
| Solder Paste Additives for Thermal Expansion Control  P. Capela, M. S. Souza, S. Costa, M. Fernandes, H. Figueiredo, R. Alves, I. Delgado,  J. Teixeira, and D. Soares  |
| IMECE2021-72572   |
| On the Fatigue Properties of 3D Steel Structures Welded Onto Ceramics Seyed M. Allameh, Douglas Alexander, Roger Miller, Avery Lenihan, and Hadi Allameh  |
| IMECE2021-73192   |
| IMECE2021-73258   |
| IMECE2021-73849  Investigation of the Effect and Contribution of Process Parameters By Taguchi and ANOVA  Analysis on the Morphological and Electrical Properties of RF Magnetron Sputtered SiO <sub>2</sub> Over Si  Substrate  Societ Machine University Research Bisuper Machinetics Zulkernein, Abroad Toubarri, Normal |
| Sajid Mahfuz Uchayash, Prosanto Biswas, Meah Imtiaz Zulkarnain, Ahmed Touhami, Nazmul<br>Islam, and Hasina Huq  |
| Mechanics of Adhesion and Friction  |
| IMECE2021-67839   |
| IMECE2021-71154   |
| Modeling and Experimentation of Geomaterials  |
| IMECE2021-71914   |
| Modeling and Experimentation of Polymer Mechanics   |
| IMECE2021-70816   |
| IMECE2021-71178   |
| Arne Leenders, Hamed Vahdati Zadeh, and Matthias Wangenheim   |
| IMECE2021-71382   |
| Modeling, Simulation, and Design of Multifunctional Materials   |
| IMECE2021-67793   |

| IMECE2021-72137   |
|---|
| Nanomaterials for Energy  |
| IMECE2021-71494   |
| Processing of Ceramics and Composites for Additive and Advanced Manufacturing                                   |
| IMECE2021-70601   |
| IMECE2021-72527   |
| Yi-feng Xiong, Wen-hu Wang, Yao-yao Shi, Rui-song Jiang, Bo Huang, Cong Liu, Xiao-fen Liu<br>and Xiao-xiang Zhu |
| Recent Developments in Tribology  |
| IMECE2021-66843   |
| IMECE2021-69155   |
| IMECE2021-69792   |
| IMECE2021-70430   |
| IMECE2021-70459   |
| IMECE2021-73701   |
| Symposium on Plasticity, Damage, and Fracture in Metallic Materials   |
| IMECE2021-69574   |