

*Proceedings of the ASME*

**INTERNATIONAL MECHANICAL ENGINEERING  
CONGRESS AND EXPOSITION  
- 2019 -**

---

**VOLUME 12**

**ADVANCED MATERIALS: DESIGN, PROCESSING,  
CHARACTERIZATION, AND APPLICATIONS**

**presented at**

**ASME 2019 INTERNATIONAL MECHANICAL ENGINEERING CONGRESS AND EXPOSITION**

**NOVEMBER 11-14, 2019**

**SALT LAKE CITY, UTAH, USA**

**sponsored by**

**ASME**

**THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS  
Two Park Avenue \* New York, NY. 10016**

Printed from e-media with permission by:

Curran Associates, Inc.  
57 Morehouse Lane  
Red Hook, NY 12571



Some format issues inherent in the e-media version may also appear in this print version.

Statement from By-Laws: The Society shall not be responsible for statements or opinions Advanced in papers. . . or printed in its publications (7.1.3)

INFORMATION CONTAINED IN THIS WORK HAS BEEN OBTAINED BY ASME 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.

For authorization to photocopy material for internal or personal use under 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

Requests for special permission or bulk reproduction should be addressed to [permissions@asme.org](mailto:permissions@asme.org).

**ISBN NO. 978-\$-7918-5949-0**

**© 2019 ASME  
All rights reserved.**

**Printed in U.S.A with permission by Curran Associates, Inc. (2020)**

**Additional copies of this publication are available from:**

Curran Associates, Inc.  
57 Morehouse Lane  
Red Hook, NY 12571 USA  
Phone: 845-758-0400  
Fax: 845-758-2633  
Email: [curran@proceedings.com](mailto:curran@proceedings.com)  
Web: [www.proceedings.com](http://www.proceedings.com)

## CONTENTS

### ADVANCED MATERIALS, DESIGN, PROCESSING, CHARACTERIZATION, AND APPLICATIONS

#### BIOINSPIRED MATERIALS, STRUCTURES, AND APPLICATIONS

**IMECE2019-10395..... V012T10A001**

Combinatorial Investigation of Mechanical Properties of Biomimicked Composites

*Seyed M. Allameh, Roger Miller, Abdullah Almuzaini*

**IMECE2019-10766..... V012T10A002**

Automatic Design in Matlab Using PDE Toolbox for Shape and Topology Optimization

*Yilun Sun, Lingji Xu, Jingru Yang, Tim C. Lueth*

**IMECE2019-11694..... V012T10A003**

Numerical Study on the Interfacial Modification Effects of Soy Protein on

Poly(Vinylidene Fluoride)

*Zhuoyuan Zheng, Chen Xin, Yumeng Li*

#### FRACTURE AND DAMAGE: NANO- TO MACRO-SCALE

**IMECE2019-10230..... V012T10A004**

Effect of Sea-Water Environment on the Tensile and Fatigue Properties of Synthetic  
Yarns

*Raghu V. Prakash, Vishnu Viswanath*

**IMECE2019-10298..... V012T10A005**

Fracture Behavior of Cracked Ring Specimen at Different Crack Positions

*Abdulmohsen M. Alqahtani, Thamer K. Albulayhid, Mutlaq N. Alotaibi, Ibrahim M. Alarifi, Tarek  
M. A. A. El-Bagory*

**IMECE2019-10307..... V012T10A006**

Evaluate the Mechanical and Thermal Behavioural Deformation of Auxetic Composite  
Nano-Carbon Fibers

*Mohammed Oudah E. Al-Harbi, Mohammed Saleh M. Almansour, Yousef Ali M. Alomair,  
Fahad Nabat B. Altulohi, M. Osman, Ibrahim M. Alarifi*

**IMECE2019-10901..... V012T10A007**

Study on Fracture Mechanism and Fatigue Life Prediction for Cutting In-Situ  
TiB<sub>2</sub>/7050Al MMCs

*Yi-feng Xiong, Wen-hu Wang, Kun-yang Lin, Xiao-fen Liu, Rui-song Jiang, Chu-quan Deng*

**IMECE2019-11145..... V012T10A008**

Evaluation of Interfacial Fatigue Strength of Hard Coating by Using Repeated Laser  
Shock Adhesion Test

*Kohei Kanamori, Yusaku Saito, Akio Yonezu*

**IMECE2019-11174..... V012T10A009**

The Effect of Creep-Fatigue Interactions on Thermo-Mechanical Fatigue Life and Reliability Estimates for a Typical Gas Turbine Engine Component

*Esakk Muthu Shanmugam, Raghu V. Prakash*

**IMECE2019-11222..... V012T10A010**

Contact Stress Analysis During Fretting of a Surface Modified Flat-on-Flat With Round Edge

*Pankaj Dhaka, Raghu V. Prakash*

## **IN-SITU TECHNIQUES IN EXPERIMENTAL MECHANICS**

**IMECE2019-11655..... V012T10A011**

Low-Cost Measurement Technique of Poisson's Ratio of Thin, Solvent-Sensitive Polymer Membranes

*Lara L. Dienemann, Anil Saigal, Michael A. Zimmerman*

**IMECE2019-11816..... V012T10A012**

Evaluation Method of Surface-Rigidity Distribution in Elastic Body by Surface-Probing

*Shohei Fujita, Atsushi Sakuma*

## **LITHIUM-ION BATTERY SAFETY UNDER ABUSIVE CONDITIONS**

**IMECE2019-11429..... V012T10A013**

Experimental and Computational Study on the Failure Behavior of Vehicle Battery Modules Subject to Wedge Cutting

*Feng Zhu, Marian Bulla, Jianyin Lei, Xianping Du, Patrick Currier, David Sypeck*

## **MATERIALS PROCESSING AND CHARACTERIZATION**

**IMECE2019-10051..... V012T10A014**

Ultrasonic Casting of Off-Eutectic Tin Bismuth Solder Alloy for Mechanical Property Testing

*Laura Smith, Jeff Jennings*

**IMECE2019-10162..... V012T10A015**

Enhancing the Frictional Behaviour of H-BN Reinforced Nanocomposites Through Laser Shock Peening

*J. Joel, M. Anthony Xavior*

**IMECE2019-10303..... V012T10A016**

Mechanical Properties of 3D Printed Fiber Reinforced Thermoplastic

*Seyed Hamid Reza Sanei, Zack Lash, Josh Servey, Frank Gardone, Chetan P. Nikhare*

**IMECE2019-10308..... V012T10A017**

Fabrication and Characterization of the Recycling of Composite Palm Materials, Shell, Leaves and Branches in Saudi Arabia

*Khaled Alhummidy G. Almotery, Waleed Saeed M. Alsaiari, Yazeed Abdulrahman Y. Alyoussef, Mohammad Farraj M. Alsahli, Meshal Mohammed O. Alharbi, Tarek M. A. A. El-Bagory, Ibrahim M. Alarifi*

**IMECE2019-10384..... V012T10A018**

Design and Analysis of Epoxy Based Cable Terminations for Marine Cables

*Raghu V. Prakash, Padmanabhan G. Vibhu*

**IMECE2019-10512..... V012T10A019**

3D Printing and Stretching Effects on Alignment Microstructure in PDMS/CNT  
Nanocomposites

*Blake Herren, Tingting Gu, Qinggong Tang, Mrinal Saha, Yingtao Liu*

**IMECE2019-10837..... V012T10A020**

Study on Surface Roughness of Milling In-Situ TiB<sub>2</sub> Particle Reinforced Al Matrix  
Composites

*Xiao-fen Liu, Wen-hu Wang, Rui-song Jiang, Yi-feng Xiong, Kun-yang Lin, Zhan-fei Zhang*

**IMECE2019-10939..... V012T10A021**

Effect of Graphene Nanoplatelets Incorporation on Microstructural and Tribological  
Properties of Aluminium Metal Matrix Composites

*Ankit Sharma, Amrita Priyadarshini, Ravindran Sujith, M. V. Sankara Subrahmanyam, P. Alen  
Thomas, Amit Kumar Gupta*

**IMECE2019-11120..... V012T10A022**

Effect of Coating Process Parameters on the Development of Residual Stresses in  
Ceramic Coatings

*Ali Gadelmoula, Khaled Al-Athel*

**IMECE2019-11163..... V012T10A023**

Numerical Investigation on Strain Properties of Ti6Al4V Alloy Processed by  
Constrained Bending and Straightening Severe Plastic Deformation

*W. M. Mwita, E. T. Akinlabi*

**IMECE2019-11201..... V012T10A024**

Influence of Precipitation and Dislocation Density on Flow Stress Characteristics  
Under Compression Deformation of Heat-Treated 17-4 PH Stainless Steel Alloy

*Athul Sathyanath, Anil Meena*

**IMECE2019-11356..... V012T10A025**

Influence of the Applied Load on the Creep Behaviour of Tin-Silver-Copper Solder

*Delfim F. Soares, Pedro E. Ribeiro, Pauline Capela, Daniel A. Barros, Maria F. Cerqueira,  
Senhorinha Teixeira, Francisco Macedo, Jose C. Teixeira*

**IMECE2019-11408..... V012T10A026**

Wear Behavior of In-Situ Mg<sub>2</sub>Si/Al-Si Composite

*Balasivanandha Prabu Shanmugavel, Vijayakumar Mohan*

**IMECE2019-11411..... V012T10A027**

Three-Dimensional Printing of Carbon Nanostructures

*Alex Resnick, Jungkyu Park, Biya Haile, Eduardo B. Farfan*

**IMECE2019-11608..... V012T10A028**

Structure-Property Relationships Between Morphological Anisotropy and Mechanical, Thermal, and Dielectric Behavior in Liquid Crystal Polymers

*Anthony Sullivan, Anil Saigal, Michael A. Zimmerman*

**IMECE2019-11612..... V012T10A029**

Effect of Annealing on the Microstructure and Mechanical Properties of Mg-9Al% Alloy Plates Processed With Symmetrical and Asymmetrical Rolling

*Zhigang Xu, Honglin Zhang, Sergey Yarmolenko, Qiuming Wei, Laszlo Kecske, Jagannathan Sankar*

**IMECE2019-11689..... V012T10A030**

Cold Spray Deposition of Pure Titanium Coating Onto High Strength Substrate With Ultra-High Bond Strength

*Davoud M. Jafarou, Gehn Ferguson, Aaron Nardi, Victor Champagne, Ian R. Grosse*

**IMECE2019-11783..... V012T10A031**

Effect of Sample Preparation on Volta Potential Measurements of Plastically Deformed Mg-Al Alloys

*Svitlana Fialkova, Honglin Zhang, Zhigang Xu, Jagannathan Sankar*

**IMECE2019-11919..... V012T10A032**

Experimental Determination of Axial Viscoelasticity of Braided Steel Cables Through the Design of a Special Purpose Machine

*Diego A. Zamora-Garcia, Luis Miguel Acosta-Carrion, Ma. Pilar Corona-Lira, Alejandro C. Ramirez-Reivich*

**IMECE2019-12096..... V012T10A033**

Energy Absorption Characteristics of a Nested Curved Column Reinforced Elastomer Composite

*Owen F. Van Valkenburgh, Thomas C. Ekstrom, Erica M. Goodman, Cameryn C. Leborte, Kevin M. Haaland, Nathan K. Yasuda, Frank J. Shih*

**IMECE2019-12102..... V012T10A034**

Evaluation and Characterization of ASS316L at Sub-Zero Temperature

*Satyanarayana Kosaraju, Anil Kalluri, Swadesh Kumar Singh, Ahsan ul Haq*

**IMECE2019-12109..... V012T10A035**

Atomistic Investigation on Mechanical Properties of Sn-Ag-Cu Based Nanocrystalline Solder Material

*Mohammad Motalab, Rafsan A. S. I. Subad, Ayesha Ahmed, Pritom Bose, Ratul Paul, Jeffrey C. Suhling*

## **MECHANICAL METAMATERIALS**

**IMECE2019-10865..... V012T10A036**

Dynamic Impact Properties of a Novel Auxetic Metamaterial

*Zeyao Chen, Zhe Wang, Xian Wu, Jianwang Shao, Shiwei Zhou*

## **MECHANICS IN MANUFACTURING OF MULTIFUNCTIONAL MATERIALS AND STRUCTURE**

**IMECE2019-11042..... V012T10A037**

Characterization of GRE Pipes Fatigue Failure Subjected to HTHP Loading Conditions

*Jamil Abdo, Edris Hassan, Jan Kwak*

## **MODELING, SIMULATION, AND DESIGN OF MULTIFUNCTIONAL MATERIALS**

**IMECE2019-10690..... V012T10A038**

Quantitative Characterisation of Pearlite Morphology in Hot-Rolled Carbon Steel

*Vincent Musonda, Esther T. Akinlabi*

**IMECE2019-11098..... V012T10A039**

Analysis of Symmetric Angle-Ply Laminated Composite Skew Plates Using Hybrid Trefftz Finite Element

*Subhasankar Dwibedi*

**IMECE2019-11361..... V012T10A040**

Nonlinearity of Enhanced Cell Structures Having Auxetic Material Properties

*Chulho Yang, Young Bae Chang, Dongchan Lee*

**IMECE2019-11526..... V012T10A041**

A Systematic Material Design Approach to Develop Self-Lubricating Ceramic-Composite Tool Inserts for Dry Cutting Conditions

*Syed Sohail Akhtar*

**IMECE2019-12123..... V012T10A042**

A Finite Element Simulation Study on the Properties of a Multi-Material Based Auxetic Metamaterial

*Yutai Su, Xin Wu, Jing Shi, Jin Wang*

## **MULTIFUNCTIONAL COMPOSITE MATERIALS AND STRUCTURES**

**IMECE2019-10083..... V012T10A043**

Modeling and Simulation of a Superconductive Linear Motor

*Aiman Al-Allaq, Nebojsa Jaksic*

**IMECE2019-10433..... V012T10A044**

Design and Synthesis of a High Performance Coating

*Swarn Jha, Yan Chen, Rick Wang, Mohamed Gharib, Hong Liang*

**IMECE2019-10960..... V012T10A045**

An Improved Predictive Model for Effective Thermal Conductivity of Polymer Composites With Non-Dilute Filler Concentrations

*Kabeer Raza, Syed Sohail Akhtar, Abul Fazal M. Arif, Abbas Saeed Hakeem*

**IMECE2019-11081..... V012T10A046**

Dynamic and Static Fracture Toughness of Al/Epoxy Resin Interface  
*Yusaku Saito, Kosuke Sudo, Kohel Kanamori, Akio Yonezu*

**IMECE2019-11099..... V012T10A047**

Anisotropic Deformation Behavior of Porous Polymeric Membranes Under Uni-Axial  
and Bi-Axial Loadings  
*Kanako Emori, Akio Yonezu, Takumi Nagakura, Tatsuma Miura*

**IMECE2019-11116..... V012T10A048**

A New Trefftz Based Finite Element for Static Analysis of Laminated Composite  
Structures  
*Subhasankar Dwibedi*

**IMECE2019-11141..... V012T10A049**

Experimental Investigation of Spontaneous Buckling-Driven Delamination of Thin  
Films on Soft Spherical Substrate  
*Yusaku Saito, Shuhei Yoshioka, Kanako Emori, Brenda Teoh Rui Ern, Akio Yonezu*

**IMECE2019-11143..... V012T10A050**

Large Deformation Behavior of Porous Polymer Materials With 3D Random Pore  
Structure: Experimental Investigation and FEM Modeling  
*Kanako Emori, Tatsuma Miura, Akio Yonezu*

**IMECE2019-11720..... V012T10A051**

Design of a Composite Encapsulation for Concentrated Photovoltaic Systems With  
Improved Performance  
*Kabeer Raza, Syed Sohail Akhtar, Abul Fazal M. Arif, Abbas Saeed Hakeem*

**IMECE2019-12259..... V012T10A052**

Mechanical Strength Degradation of Carbon Fiber Polymer Matrix Composites  
Exposed to Constant Low-Density Direct Current  
*Sai Tharun Kotikalapudi, Raman P. Singh*

## **MULTIFUNCTIONAL NANOMATERIALS**

**IMECE2019-11590..... V012T10A053**

High Thermo-Mechanical Stability in Polybenzoxazine Aerogels  
*Sadeq Malakooti, Guoqiang Qin, Chandana Mandal, Chariklia Sotiriou-Leventis, Nicholas  
Leventis, Hongbing Lu*

**IMECE2019-12053..... V012T10A054**

Effect of Graphene Nanoplatelet Addition on the Conductive Behavior of Solution  
Mixing Processed Polylactide Biopolymer Nanocomposites  
*Qi Zhang, Pierre Mertiny*

## MULTISCALE MODELING FOR MATERIALS DESIGN

**IMECE2019-10913.....** **V012T10A055**  
Thermo-Mechanical Modeling of 3D Woven Fabric Composites Using Two-Step  
Homogenization Approach  
*Nagappa Siddgonde, Anup Ghosh*

**IMECE2019-11013.....** **V012T10A056**  
Investigating Density Functional Theory's Effectiveness in Studying Metal-Organic  
Frameworks Structures  
*Kendric Roberts, Yen-Lin Han*

## NANOENGINEERED, NANO MODIFIED, HIERARCHICAL, MULTI-SCALE MATERIALS AND STRUCTURES

**IMECE2019-11441.....** **V012T10A057**  
Innovative Hole Making Process in Woven Composite Laminates  
*Vishwas S. Jadhav, Ajit D. Kelkar*

**IMECE2019-11492.....** **V012T10A058**  
Mechanical Behavior of Collagen Mimetic Peptides Under Fraying Deformation via  
Molecular Dynamics  
*Atul Rawal, Kristen L. Rhinehardt, Ram V. Mohan*

**IMECE2019-11556.....** **V012T10A059**  
Development of Thermally Conductive Polymer/CNF Nanocomposite Materials via  
PolyJet Additive Manufacturing by Improvement of Digital Material Design  
*Furkan Ismail Ulu, Ram Mohan, Ravi Pratap Singh Tomar*

**IMECE2019-11639.....** **V012T10A060**  
Investigation of Process Induced Variations in PolyJet Printing With Digital  
Polypropylene via Homogeneous 3D Tensile Test Coupon  
*Ravi Pratap Singh Tomar, Furkan I. Ulu, Ajit Kelkar, Ram V. Mohan*

**IMECE2019-11673.....** **V012T10A061**  
Effect of Current Density and Temperature on Template Assisted Cobalt Nanowire  
*Ali Imran Shiave, Ram Mohan, Mahendran Samykano*

## NANOMATERIALS FOR ENERGY

**IMECE2019-11152.....** **V012T10A062**  
Precise Control of Precursor Sticking Coefficient on Substrates With Large Aspect  
Ratios in ALD  
*T. J. Kunene, L. Tartibu, T. C. Jen*

## PHASE TRANSFORMATIONS IN MATERIALS PROCESSING

**IMECE2019-10721.....** **V012T10A063**  
Structural and Mechanical Analysis of Silane Compounds Coatings on AISI 304  
*Akinsanya Damilare Baruwa, Esther Titilayo Akinlabi, O. P. Oladijo, Frederick Mwema*

**IMECE2019-11695..... V012T10A064**

Anisotropic Phase-Field Modeling of Crack Growth in Shape Memory Ceramics:  
Application to Zirconia  
*Ehsan Moshkelgosha, Mahmood Mamivand*

**IMECE2019-12045..... V012T10A065**

Optimization of Heat Treatment Aging Process Parameters for 7050 and 7075  
Aluminum Alloys  
*Sagil James, Ambarneil Roy*

## **POSTER**

**IMECE2019-10423..... V012T10A066**

Evaluation of Thermal Effects in Turning Processes: Numerical and Experimental  
Approach  
*Aruna Prabha Kolluri, Srinivasa Prasad Balla, Satya Prasad Paruchuru*

## **RECENT DEVELOPMENTS IN TRIBOLOGY**

**IMECE2019-10137..... V012T10A067**

Experimental Pre-Rolling Friction Determination of Corundum Balls on Silicium  
Wafers Using Highly Stable Pendulum  
*Samir Mekid, Igor Gilavdary, Natalya Riznoukaya*

**IMECE2019-10163..... V012T10A068**

Assortment of Hydroforming Fluid for Extreme Pressure and Anti Wear Properties  
*S. P. Rudraksha, S. H. Gawande*

**IMECE2019-10645..... V012T10A069**

Tribological Properties of Ammonium Protic Ionic Liquids As Additives in  
Polyalphaolefin for Steel-Steel Contact  
*Hong Guo, Patricia Iglesias*

**IMECE2019-10647..... V012T10A070**

Ionic Liquid As Cutting Fluid Additive Using Minimum Quantity Lubricant (MQL) in  
Titanium-Ceramic Contact  
*Sameer A. Magar, Hong Guo, Patricia Iglesias*

**IMECE2019-11895..... V012T10A071**

A Test Rig to Characterize the Friction Force of Reciprocating Seals Under Dynamic  
Linear Motion  
*Jon Keegan, Madhumitha Ramachandran, Adam Flenniken, Geoffrey Page, Zahed Siddique*

## **SOFT ROBOTICS AND SOFT MACHINES**

**IMECE2019-10084..... V012T10A072**

Modified Nernst-Plank-Poisson Model for IPMC With Back-Relaxation Effects  
*Aiman Al-Allaq, Nebojsa Jaksic, Bahaa Ansaf, Jude DePalma, Trung Duong*

**IMECE2019-10400..... V012T10A073**

Design of a Deformable Smart Tire Using Soft Actuator

*Vidya K. Nandikolla, Michael Costa, Nathan Boyd, Gilberto Rosales*

**IMECE2019-11340..... V012T10A074**

Mechanical Properties of Interlocking Cell Structure for Soft Exoskeleton Suits

*Dongchan Lee, Chulho Yang*