

36th Technical Conference of the American Society for Composites 2021

Composites Ingenuity Taking on Challenges
in Environment-Energy-Economy

College Station, Texas, USA
20 - 22 September 2021

Volume 1 of 4

Editor:

Ozden Ochoa

ISBN: 978-1-7138-3759-6

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.

Copyright© (2021) by DEStech Publications, Inc.
All rights reserved.

Printed with permission by Curran Associates, Inc. (2021)

For permission requests, please contact DEStech Publications, Inc.
at the address below.

DEStech Publications, Inc.
439 North Duke Street
Lancaster PA 17602-4967
USA

Phone: (717) 290-1660
Fax: (717) 509-6100

info@destechpub.com

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
Web: www.proceedings.com

Table of Contents

ADVANCED MANUFACTURING TECHNOLOGIES

Manufacturing Method of the Morphing Wing Structure for UAV by CFRP with Applying the Electroformed Resin Molding Method (020)	3
KAZUAKI KATAGIRI, CHOONG SIK PARK, SHIMPEI YAMAGUCHI, SONOMI KAWAKITA, KIM DAEKWI, SHINYA HONDA, KATSUHIKO SASAKI and MASATO TAMAYAMA	
Heating Rate Prediction for Induction Welding Magnetic Susceptors (058)	11
ROMAIN G. MARTIN, CHRISTER JOHANSSON, JASON R. TAVARES and MARTINE DUBÉ	
A Novel, Scalable Production of Multifunctional Nanocomposite Polymer Filaments for Additive Manufacturing (109)	24
MIA CARROLA and AMIR ASADI	

APPLICATIONS IN EXTREME ENVIRONMENTS

Bond Strength Degradation of Adhesive-Bonded CFRP Composite Lap Joints after Lightning Strike (119)	37
WENHUA LIN, YEQING WANG, SPENCER LAMPKIN, SRIHARI GANESH PRASAD, OLESYA ZHUPANSKA and BARRY DAVIDSON	
Experimental Study of Lightning Damage Resistance of Unprotected and Protected Stitched Warp-Knit Carbon-Epoxy Composites (148)	50
DOUNIA BOUSHAB, KHARI HARRISON, ANIKET MOTE, THOMAS E. LACY, JR. and CHARLES U. PITTMAN, JR.	
Thermal Ablation Modelling of C/SiC for Hypersonic Applications (234)	63
EDGAR AVALOS and ALEJANDRA G. CASTELLANOS	

Investigating the Influence of Environmental Conditioning on Epoxy Resins at Quasistatic and High Strain Rates for Material Operating Limit (325)	75
SAGAR M. DOSHI, NITHUNKUMAR MANOHARAN, BAZLE Z. (GAMA) HAQUE, JOSEPH M. DEITZEL and JOHN W. GILLESPIE, JR.	

ARCHITECTED AND MORPHING COMPOSITES

What if Spiders Made Metamaterial Webs Using Materials with Mechanical Size-Effects? (019)	91
ERIC ROBERT BEHLING, ASHUTOSH SRIVASTAVA, RAPHAËL GLAESNER, SIDDHANT KUMAR and ANIRUDDH VASHISTH	

Dynamic Responses of Architectural Kerf Structures (059)	101
ZARYAB SHAHID, MOLLY SAYLOR JOHNSON, COLEMAN GUSTAV BOND, JAMES HUBBARD, JR., NEGAR KALANTAR and ANASTASIA MULIANA	

Cross-Longitudinal Reinforcement Structure Inspired by Dragonfly Wing (126)	111
HIROKI KAWABE, YUICHIRO AOKI and TOSHIYA NAKAMURA	

Viscoelastic Responses of MDF Kerf Structures (142)	129
ARYABHAT DARNAL, ZARYAB SHAHID, JIWAN HAN, MICHAEL MORENO and ANASTASIA MULIANA	

Development of a Frangible Design of Small Fixed-Wing Unmanned Aerial System (274)	139
ANURAG, KALYAN RAJ KOTA and THOMAS E. LACY	

Characterizing Dual Matrix Composite Origami Deployment (330)	154
GREYSON HODGES and MARK PANKOW	

AUTOMATED AND ADDITIVE MANUFACTURING

Manufacturing of Aircraft Wing Stiffeners Using 4D Printing of Composites (027)	165
SUONG VAN HOA, BHARGAVI REDDY and DANIEL IOSIF ROSCA	

Additive Manufacturing of High-Loading Polymer Nanocomposites with Multiscale Alignment (044)	171
SOYEON PARK and KUN (KELVIN) FU	

Performance of Additively Manufactured Chopped Fiber Composites as a Function of Porosity (085)	178
LUKE GEISE, ANDREW ABBOTT, DANIEL RAPKING and MARK FLORES	

3D Printed Continuous Fibre Composite Research at Deakin University: Design and Analysis Methods for UD, Hybrid and Pseudo-Woven Ply Architectures (237) 196
MATHEW JOOSTEN, ZI LI and CHENG HUANG

Three-Dimensional Heat Transfer Analysis of Hot Gas Torch (HGT)-Assisted Automated Fiber Placement of Thermoplastic Composites (241) 210
LORENZ ZACHERL, ALLYSON FONTES and FARJAD SHADMEHRI

Modelling Compaction Behavior of Toughened Prepreg During Automated Fibre Placement (242) 225
SARTHAK MAHAPATRA, JONATHAN P.-H. BELNOUE, JAMES KRATZ, DMITRY S. IVANOV and STEPHEN R. HALLETT

Modeling and Calibration of Uncertainty in Material Properties of Additively Manufactured Composites (243) 236
EMIL PITZ, SEAN ROONEY and KISHORE POCHIRAJU

Reactive Extrusion Additive Manufacturing of a Short Fiber Reinforced Thermoset Composite (289). 256
PRATIK KOIRALA, OLIVER LIAM UITZ, ADEMOLA A. ORIDATE, CAROLYN CONNER SEEPERSAD and MEHRAN TEHRANI

Direct-Ink-Writing (DIW) of Higher Weight Concentration of Milled Carbon Fiber (MCF) Reinforced Epoxy Composite (320) 268
ANIRBAN MONDAL, KUNTAL MAITY, MRINAL C. SAHA and YINGTAO LIU

Analysis of Printing Parameters in 3D Printed Carbon Fiber Composites Using Design of Experiments (323) 279
JAKUB SYCHLA, CHAO ZHANG and K. T. TAN

BATTERY AND MULTIFUNCTIONAL COMPOSITES

Influence of Carbon in Lead Matrix for Lead Acid Battery Application: A Density Functional Theory Approach (091). 293
KAUSHIK YANAMANDRA, RAKESH K. BEHERA and NIKHIL GUPTA

Non-Destructive Evaluation of Mechanical Damage of Adhesives Using Magneto-Electric Nanoparticles (134). 303
GONZALO SEISDEDOS, BRIAN HERNANDEZ, JULIETTE DUBON, MARIANA ONTIVEROS, BENJAMIN BOESL and DWAYNE MCDANIEL

Energy-Based Multifunctional Efficiency Metric for Multifunctional Composite Anodes in Structural Batteries (332) 312
TIANYANG ZHOU, JAMES G. BOYD and DIMITRIS C. LAGOUDAS

Bridging of Carbon Fibers in CF/Epoxy Composites Using Electrostatically Induced CNT Alignment (335) 323
DANDAN ZHANG, XINGKANG SHE, YIPENG HE, WESLEY A. CHAPKIN, AVI T. BREGMAN, RUMIN WANG and ALAN TAUB

BUCKLING AND POSTBUCKLING OF COMPOSITE STRUCTURES

Design and Analysis of an Integrated Three-Bay Thermoplastic Composite Wingbox (064).....337
VINCENZO OLIVERI, GIOVANNI ZUCCO, MOHAMMAD ROUHI,
ENZO COSENTINO, RONAN O’HIGGINS, TREVOR M. YOUNG
and PAUL M. WEAVER

Classification of Buckling Modes in Stiffened Functionally Graded Composite Tubes Subject to Bending (075)356
LUAN TRINH and PAUL WEAVER

Design of a Composite Panel with Continuous Tow Steering Around an Elliptical Cut-Out (099)367
GIOVANNI ZUCCO, MOHAMMAD ROUHI, OLIVERI VINCENZO,
ENZO COSENTINO, RONAN O’HIGGINS and PAUL M. WEAVER

Scaling Methodology for Buckling of Composite Conical Shells in Axial Compression (106).....388
KAAT PAREYNS, CHIARA BISAGNI, MICHELLE T. RUDD
and MARC R. SCHULTZ

Experimental Evaluation of Compressive Strength of PAN-Based Carbon Monofilament by Poisson’s Deformation in Cruciform Specimen (108).....399
YUSUKE ODAIRA, HIROSHI SAITO and ISAO KIMPARA

Design and Analysis of Thermoplastic Welded Stiffened Panels in Post-Buckling (175).....406
KEVIN S. VAN DOOREN and CHIARA BISAGNI

Experimental Study on Post-Buckled Composite Single-Stringer Specimens with Initial Delamination under Fatigue Loads (261)..... 418
ANTONIO RAIMONDO, JAVIER PAZ MENDEZ
and CHIARA BISAGNI

Progressive Damage Failure Analysis of Post-Buckled Composite Single-Stringer Panel with Teflon Inserts (262) 429
VIJAY K. GOYAL, AUSTIN PENNINGTON and JASON ACTION

C³HARME INVITED EU PROJECT

Aero-Thermo-Dynamic Study of Ultra-High-Temperature Ceramic Composites for Thermal Protection Systems and Rocket Nozzles (076)447
STEFANO MUNGIGUERRA, ANSELMO CECERE
and RAFFAELE SAVINO

Processing of Ultra-High Temperature Ceramic Matrix Composites (UHTCMCs) Through RF Enhanced Chemical Vapour Infiltration (RF-CVI) (135)448
VINOETHINI VENKATACHALAM, JON BINNER, THOMAS REIMER,
BURKARD ESSER, STEFANO MUNGIGUERRA
and RAFFAELE SAVINO

Fabrication and Characterization of UHTCMCs (191) 450
ANTONIO VINCI, LUCA ZOLI, PIETRO GALIZIA, LAURA SILVESTRONI,
CARLOS GUTIÉRREZ, SERGIO RIVERA and DILETTA SCITI

Introduction to C³HARME Project (203) 458
LUCA ZOLI and DILETTA SCITI

COMPOSITE CURING AND THERMAL STRESS

Effect of Curing Temperature of Epoxy Resin on the Electrical Response of Carbon Nanotube Yarn Monofilament Composites (034)471
OMAR RODRIGUEZ-UICAB, JANDRO L. ABOT
and FRANCIS AVILÉS

Thermal Stresses for Functionally Graded Materials (FGMs)Z Subject to Heat Flux (226)..... 483
NILABH KRISHNA and SEIICHI NOMURA

DURABILITY AND DAMAGE TOLERANCE

Hierarchical Electrospun Veils as Potential Toughening Materials for Structural Composite Laminates (065) 497
IRENE BAVASSO, FRANCESCA SBARDELLA, MARIA PAOLA BRACCIALE,
JACOPO TIRILLÒ, LUCA DI PALMA, LUCA LAMPANI
and FABRIZIO SARASINI

A Size Effect Study on the Splitting Crack Initiation and Propagation in Off-Axis Layers of Composite Laminates (111)..... 506
YAO QIAO, QIWEI ZHANG, TROY NAKAGAWA and MARCO SALVIATO

Mode-I Fatigue Crack Healing in CFRP Composites Using Thermoplastic Healant (165) 519
NILESH J. VISHE, SAMEER B. MULANI and SAMIT ROY

Data-Driven Discovery of Material States in Composites Under Fatigue Loads (206)..... 531
MUTHU RAM PRABHU ELENCHZHIAN, VAMSEE VADLAMUDI,
RASSEL RAIHAN and KENNETH REIFSNIDER

Impact Damage Detection in Composite Aerospace Structures by Multi-Resolution NDE Inspections (328) 542
MARGHERITA CAPRIOTTI, ANDREW ELLISON, HYUNGSUK E. KIM,
FRANCESCO LANZA DI SCALEA and HYONNY KIM

Self-Healing of Woven Composite Laminates via In Situ Thermal Remending (337)555
ALEXANDER D. SNYDER, ZACHARY J. PHILLIPS
and JASON F. PATRICK

Exploration of Cumulative Damage Evolution Under Variable Amplitude Fatigue Loading Based on Wöhler Curve (340) 567
RUI MIRANDA GUEDES

EFFECTS OF DEFECTS

Mechanical Performance of Variable Stiffness Plates Subjected to Multiscale Defects (024).585
ALFONSO PAGANI, ALBERTO RACIONERO SANCHEZ-MAJANO
and IGNACIO SANCHEZ ZARATA

Damage Detection in Laminated Composites by Neural Networks and High order Finite Elements (041) 597
ALFONSO PAGANI, MARCO ENEA and ERASMO CARRERA

Peridynamic Unit Cell Enabled Finite Element Modeling of Fiber Steered Composites (115). 608
ERDOGAN MADENCI, ATILA BARUT, NAM PHAN and ZAFER GURDAL

Residual Plastic Strain State and Delamination Pattern of Composite Laminates with Automated Induced-Gap Subjected to Hemi-Spherical Impact Loading (150). 631
MOHAMMADHOSSEIN GHAYOUR, MEHDI HOJJATI
and RAJAMOCHAN GANESAN

Efficient Numerical Analysis Based on Perturbation Method for the Effect of Waviness in CFRP (217). 644
TAKANORI SUGIURA, AKINORI YOSHIMURA, MASAHIRO ARAI
and KEITA GOTO

Variability in the Failure of Composite Tubes Subjected to Combined Axial and Torsional Loadings Due to Manufacturing Defects and Nondeterministic Material Properties (236) 654
AJEESH SURESH NAIR and RAJAMOCHAN GANESAN

The Effect of Out-of-Plane Waviness Asymmetry on Laminate Strength (240). 670
VINCENT K. MAES, BASSAM ELSAID, STEPHEN R. HALLETT
and JAMES KRATZ

ENERGY DISSIPATION

Stability and Vibration Analyses of an Internally Damped Tapered Composite Driveshaft Using the Finite Element Method (198) 685
MOHSEN NAJAFI and RAJAMOCHAN GANESAN

Microstructural Simulation of Superelastic Zirconia-Reinforced Metal Composite for Energy Dissipation Applications (302) 699
MARWA YACOUTI and MARYAM SHAKIBA

IMPACT DYNAMIC RESPONSE

Automatic Image Segmentation of CT Data from the Low Velocity Impact Tests of CFRP Composites (036) 721
OLESYA I. ZHUPANSKA and PAVLO A. KROKHMAL

High Energy Wide Area Blunt Impact of Composite Aircraft Structures—Part A: Design and Analysis Methodology of Representative Substructure (117) 729
CHAIANE WIGGERS DE SOUZA, MOONHEE NAM and HYONNY KIM

Impact Response Analysis of Composite Plate with Different Fiber Orientation Angles (125) 753
SHO KAJIHARA, TAKAHIRA AOKI, TOMOHIRO YOKOZEKI and RYO HIGUCHI

Dynamic Impact Resistance of Composite Sandwich Panels with 3-D Printed Polymer Syntactic Foam Cores (137) 762
H. R. TEWANI, DILEEP BONTHU, H. S. BHARATH, MRITYUNJAY DODDAMANI and P. PRABHAKAR

Hypervelocity Impact Response of Stitched CFRP Laminates (144) 781
KHARI HARRISON, KALYAN RAJ KOTA, JACOB A. ROGERS, PAUL T. MEAD, ANIKET MOTE, WARUNA D. KULATILAKA and THOMAS E. LACY, JR.

Experimental Investigation of High Velocity Impact on CNT Reinforced Composites Employing Single State Gas Gun (179) 792
D. MUNIRAJ, S. MUGHILARASAN and V. M. SREEHARI

Strain Rate-Dependent Characterization of the In-Plane Shear Response of a Unidirectional Non-Crimp Fabric Carbon Fiber/Snap-Cure Epoxy Composite (180) 800
KHIZAR ROUF, MICHAEL J. WORSWICK and JOHN MONTESANO

High Energy Wide Area Blunt Impact of Composite Aircraft Structures Part B: Testing and Internal Damage Modes (223) 809
MOONHEE NAM, CHAIANE WIGGERS DE SOUZA and HYONNY KIM

Dynamic Response of Photopolymer Resins Cores for Naval Applications in Extreme Environments (232) 835
ZACKERY NIETO and ALEJANDRA G. CASTELLANOS

Dynamic Fracture of Hydrothermally Degraded Carbon-Epoxy Composites (254) 848
EMILY PITTMAN, STYLIANOS KOUMLIS and LESLIE LAMBERSON

Effect of Impactor Mass on CFRP in Arctic Condition under Low-Velocity Impact (300) 857
ARNOB BANIK, CHAO ZHANG and K. T. TAN

Experimental Analysis of Low Velocity Impact Near the BVID Limit on Carbon Fiber Reinforced Polymer Panels (301) 865
ANDREW SEAMONE, ANTHONY M. WAAS, PAUL DAVIDSON and VIPUL RANATUNGA

Fracture Analysis of Rubber Toughened Additively Manufactured Thermosets (318) 871
MEGAN SHEPHERD, KAMRAN MAKARIAN, GIUSEPPE PALMESE, NICHOLAS BRUNSTAD and LESLIE LAMBERSON

Numerical Model of Tubular Composite Sandwich Structures under Low-Velocity Impact (319). 882
CHAO ZHANG, ISAIAH KAISER and K. T. TAN

Damage Identification in Carbon Fiber-Reinforced Polymer (CRFP) Composite Plates Under Repetitive Impact Loading (321). 891
ISABELLA MENDOZA and LESLIE LAMBERSON

An Image Based Inertial Impact Test to Extract Viscoelastic Constitutive Parameters (324) 904
ANDREW MATEJUNAS, LLOYD FLETCHER and LESLIE LAMBERSON

INTEGRATED COMPUTATIONAL MATERIALS ENGINEERING

Process Modelling the Cure of Bisphenol-A Epoxy/Jeffamine System Using ICME (067). 917
P. P. DESHPANDE, S. SHAH, S. U. PATIL, M. OLAYA, G. M. ODEGARD and M. MAIARÙ

Prediction of PEEK Resin Properties for Processing Modeling Using Molecular Dynamics (101) 929
KHATEREH KASHMARI, PRATHAMESH DESHPANDE, SAGAR PATIL, SAGAR SHAH, MARIANNA MAIARÙ and GREGORY M. ODEGARD

A Unique Approach to Experimental Characterization of a Thermosetting Polymer Matrix for ICME Frameworks (312). 948
MICHAEL N. OLAYA, SAGAR PATIL, GREGORY M. ODEGARD and MARIANNA MAIARÙ

MACHINE LEARNING AND ARTIFICIAL INTELLIGENCE FOR COMPOSITES

Using Data Science to Evaluate Nano-Reinforced Epoxy Surfaces (030). 965
JONATHAN THEIM, DANIEL P. COLE, UTKARSH DUBEY, ASHUTOSH SRIVASTAVA, CHOWDHURY ASHRAF, TODD C. HENRY, CHARLES E. BAKIS and ANIRUDDH VASHISTH

Deep Learning Framework for Woven Composite Analysis (060)	980
HAOTIAN FENG, SABARINATHAN PUSHPARAJ SUBRAMANIYAN and PAVANA PRABHAKAR	
Comprehensive Property Determination for Fiber-Reinforced Polymer Composites in Extrusion Deposition Additive Manufacturing—Bayesian vs Deterministic (136)	992
AKSHAY J. THOMAS, EDUARDO BAROCIO, ILIAS BILIONIS and R. BYRON PIPES	
Internal Damage Prediction in CFRP Laminates Using BVID Profiles and Machine Learning (168)	1009
SAKI HASEBE, RYO HIGUCHI, TOMOHIRO YOKOZEKI and SHIN-ICHI TAKEDA	
Artificial Neural Network (ANN)-Based Predictive Tool for Estimating Lightning Damage in Composites (170)	1019
DEVIN NIELSEN, TYLER LOTT, SOM DUTTA and JUHYEONG LEE	
Ordinary Differential Equations with Machine Learning for Prediction of Smart Composite Fracture Toughness (173)	1035
RELEBOHILE GEORGE QHOBOSHEANE, MUTHU RAM PRABHU ELENCHZHIAN, VAMSEE VADLAMUDI, KENNETH REIFSNIDER and RASSEL RAIHAN	
Discovering Failure Criteria of Composites by Sparse Identification and Compressed Sensing (190)	1048
FEI TAO, XIN LIU, HAODONG DU and WENBIN YU	
Failure Prediction of Composite Materials Using Deep Neural Networks (228)	1068
ALLYSON FONTES and FARJAD SHADMEHRI	
Deep Convolutional Neural Network for Segmenting μCT Images of Fiber Reinforcements (239)	1080
MUHAMMAD A. ALI and REHAN UMER	
Deep Learning for Topology Optimization of Triply Periodic Minimal Surface Based Gyroid-Like Structures (287)	1088
ASHA VISWANATH, MOHAMAD MODREK, KAMRAN A. KHAN and RASHID K. ABU AL-RUB	

MANUFACTURING AND PROCESS MONITORING

Effect of Thermal Input on the Temperature Distribution of Thermoplastic Composites Made by Automated Fiber Placement (AFP) (035)	1103
MEHRSHAD MOGHADAMAZAD and SUONG V. HOA	

Improved Tow-End Detection for Fiber Placement Inspection Using Machine Learning (050)	1117
ADRIANA W. (AGNES) BLOM-SCHIEBER, WEI GUO, EKTA SAMANI and ASHIS BANERJEE	
Optimization of Injection Process Parameters of Plastic Reinforced Composites Using Response Surface Methodology and Central Composite Design (053)	1135
ADEFEMI O. ADEODU, MUKONDELELI G. KANAKANA-KATUMBA, RENDANI W. MALADZHI and ILESANMI A. DANIIYAN	
Effect of Processing Parameters on the Widths and Thicknesses of Thermoplastic Composites Made by Automated Fiber Placement (054)	1157
DUC MINH HOANG and SUONG VAN HOA	
Yield Point and Stress Relaxation Behavior of Ply-Ply Interaction of Thermoset Prepregs (088)	1166
YUNPEI YANG, TARA FAHY and JONATHAN COLTON	
Robotic Sequential Ultrasonic Welding of Thermoplastic Composites: Process Development and Testing (114)	1178
ABHAS CHOUDHARY and IRENE FERNANDEZ	
Modeling and Simulation of the Curing Process of Epoxy Resins and Fiber Composites (221)	1191
ANASTASIA MULIANA	
Representation, Characterization and Simulation of Tool-Part Interaction and Its Effects on Process-Induced Deformations in Composites (246)	1204
CALEB SCHOENHOLZ, DANIEL SLADE, ENRICO ZAPPINO, MARCO PETROLO and NAVID ZOBELRY	
 METALLIC AND COMPOSITE BONDED JOINTS	
Dynamic Performance of Adhesively Bonded Single Lap Joints with Different Fiber Angle Orientations of Adherends (039)	1219
S. BUSE KARAAHMET and FERHAT KADIOGLU	
Mechanical Behavior of Adhesively-Bonded Joints under High Loading Rates (040)	1230
MEHMET EMIN ERCAN and FERHAT KADIOGLU	
Enhanced Fracture Toughness of Adhesive Joints with Doping Epoxy by Graphene Nanoplatelets (074)	1242
SABRINE KHAMMASSI and MOSTAPHA TARFAOUI	

Effects of Surface Characteristics on Mechanical and Dielectric Properties of Adhesively Bonded Carbon Fiber Composites (199) 1266
MINHAZUR RAHMAN, GAYATHRI KOLA, MONJUR MORSHED RABBY,
MUTHU RAM PRABHU ELENCHZHIAN,
RELEBOHILE GEORGE QHOBOSHEANE,
VAMSEE VADLAMUDI, KENNETH REIFSNIDER
and RASSEL RAIHAN

Crush Characteristics of Adhesively Bonded Composite-Aluminum Tubes (208) 1278
MONISH URAPAKAM RAMAKRISHNAN and PANKAJ K. MALLICK

MICROMECHANICS

Effects of As-Received Defects on Ceramic Matrix Composites Properties Using High-Fidelity Microstructures with Periodic Boundary Conditions (103) 1293
KHALED H. KHAFAGY and ADITI CHATTOPADHYAY

Micromechanical Finite Element Modeling of Unidirectional Composites in Three Dimensions: Prediction of Transverse Tensile & Compressive, Transverse Shear & In-Plane Shear Progressive Damage Behavior (273) 1305
BAZLE Z. (GAMA) HAQUE, TAM NGUYEN, ISABEL CATUGAS,
DANIEL J. O'BRIEN and JOHN W. GILLESPIE, JR.

Effect of Manufacturing on the Transverse Response of Thermoset Composites (278) 1324
SAGAR P. SHAH and MARIANNA MAIARÙ

MODEL-BASED DESIGN FOR MANUFACTURING

Study on Cooling Rate-Dependent Mechanical Properties of Thermoplastic Composites (052) 1341
RYO HIGUCHI, SOTA OSHIMA, SHU MINAKUCHI,
TOMOHIRO YOKOZEKI and TAKAHIRA AOKI

Optimization of Process Parameters During Co-Cure of Honeycomb Sandwich Structures (141) 1353
NAVID NIKNAFS KERMANI, PAVEL SIMACEK and SURESH G. ADVANI

Predicting Processing Induced Residual-Stresses in Carbon Fiber-Thermoplastic Micro-Composites (207) 1371
NITHIN K. PARAMBIL, BRANNDON R. CHEN, JOSEPH M. DEITZEL,
JOHN W. GILLESPIE, JR., LOAN T. VO and PETER SAROSI

Bending Simulation of Pre-Gelled Composites Using an Explicit Cosserat Continuum Model (331) 1383
HUBERT COURTEAU-GODMAIRE, ANOUSH POURSAARTIP
and REZA VAZIRI

MULTISCALE METHODS

Effects of Stoichiometry on Properties of DGEBF/DETDA Epoxy Using Molecular Dynamics (066) 1399
SAGAR PATIL, MICHAEL OLAYA, PRATHAMESH DESHPANDE,
MARIANNA MAIARÙ and GREGORY ODEGARD

Computational Modeling of Epoxy-Based Hybrid Composites Reinforced with Carbon Fibers and Functionalized Graphene Nanoplatelets (073) 1407
HASHIM AL MAHMUD, MATTHEW RADUE, WILLIAM PISANI
and GREGORY ODEGARD

Molecular Dynamic Simulations of Furan Resin (Polyfurfuryl Alcohol): Predicting Mechanical Properties (086). 1422
JOSH KEMPPAINEN, IVAN GALLEGOS, PRATHAMESH DESHPANDE,
JACOB GISSINGER and GREGORY ODEGARD

Effect of Microstructure on Initiation of Delamination in Cross Ply Laminates from a Transverse Crack (100) 1429
LINQI ZHUANG, LUCIO MARAGONI and RAMESH TALREJA

Molecular Dynamics Simulation of Polybenzoxazine Resin for Process Modeling (130) 1444
PRASHIK S. GAIKWAD, AARON S. KRIEG, JULIA A. KING,
MARIANNA MAIARÙ and GREGORY M. ODEGARD

Mechanical Properties Prediction of Phenolic Resin: A Molecular Dynamics Study (145) 1452
IVAN GALLEGOS, JOSHUA KEMPPAINEN, SAGAR U. PATIL,
PRATHAMESH DESHPANDE, JACOB GISSINGER
and GREGORY ODEGARD

Wetting Simulations of High-Performance Polymer Resins on Carbon Nanotube Surfaces Using Molecular Dynamics (213) 1463
SWAPNIL BAMANE, PRASHIK GAIKWAD, MATTHEW RADUE,
S. GOWTHAM and GREGORY ODEGARD

Multiscale Damage in Co-Cured Composites—Perspectives from Experiments and Modelling (263) 1479
NITHYA SUBRAMANIAN and CHIARA BISAGNI

Effect of Boundary Conditions on Process-Induced Stresses in a Plain Weave Unit Cell (309). 1493
K. BUKENYA, M. N. OLAYA, E. J. PINEDA and M. MAIARÙ

NANOSCALE AND NANOSTRUCTURED COMPOSITES

Carbon Nanocomposite Coated Textile-Based Sensor: Sensing Mechanism and Durability (048) 1507
AMIT CHAUDHARI, SAGAR DOSHI, MADISON WEISS,
DAE HAN SUNG and ERIK THOSTENSON

Stabilization of TuFF Material by Electrospinning of Low Areal Weight TPU Veil Material (077)	1520
JOSEPH DEITZEL, DIRK HEIDER, ROGER CRANE and TEKIN OZDEMIR	
Enhancing Single-Lap Composite Joints Life Estimation by Graphene Addition: An Hybrid Approach Analysis (090)	1532
MILVIA O. REIS, LIDIANNE DE P. P. MAPA, SUCHILLA G. LEÃO, THAIANE O. T. XIMENES, ELVIS C. MONTEIRO and ANTONIO F. AVILA	
Fracture Simulation in Polymer Nanocomposites Using Molecular Dynamics (120)	1545
SAMIT ROY and TANVIR SOHAIL	
Parameterization of ReaxFF Potential of Mg/Al/Si/O Interaction and Investigation of Mechanical Properties for S-Glass (147)	1559
JEJOON YEON, SANJIB C. CHOWDHURY, CHAITANYA M. DAKSHA, DONATO BELMONTE, ADRI VAN DUIN and JOHN W. GILLESPIE, JR.	
Effects of Strain Rate, Transverse Pressure and Fiber Surface Roughness on Traction Laws of Glass Fiber Epoxy Interphases (169)	1575
SANJIB C. CHOWDHURY, MICHAEL HEMPHILL, MUNETAKA KUBOTA and JOHN W. GILLESPIE, JR.	
A Computational Model for the Piezoresistive Response of Hybrid Carbon Nanostructured Networks (192)	1588
ANGEL MORA, CARLOS MEDINA and FRANCIS AVILÉS	
Computational Description of the Geometry of Aligned Carbon Nanotubes in Polymer Nanocomposites (222)	1606
STEPAN V. LOMOV, JEONYOON LEE, BRIAN L. WARDLE, NIKITA A. GUDKOV, ISKANDER S. AKHATOV and SERGEY G. ABAIMOV	
Investigating Stress Transfer and Failure Mechanisms in Graphene Oxide-Cellulose Nanocrystals Films (293)	1614
GEHAN JAYATILAKA, MOHAMMAD MOEIN MOHAMMADI and MEHRAN TEHRANI	
Designing Multifunctional Interfaces to Bridge Heterogeneous Materials to Reduce Thermal Fatigue (341)	1623
JOHN B. FERGUSON, AJIT K. ROY, SABYASACHI GANGULI, JOHN G. JONES, SERGEI V. SHENOGIN, SANGWOOK SIHN and KRISHNAMURTHY MAHALINGAM	
Structural and Electronic Properties of BCN Nanoflakes via Graph Theory (342)	1635
SHUSIL BHUSAL, JONGHOON LEE and AJIT K. ROY	

NATURAL, BIO-BASED AND BIODEGRADABLE COMPOSITES

A Case Study of Biocomposite Material Use in Automotive Applications (098)1645
DANIEL WALCZYK, RONALD BUCINELL, STEVEN FLEISHMAN
and SHARMAD JOSHI

Improvement of Flexural Strength and Fatigue Properties of Glass Fiber/Epoxy Composites by Grafting Cellulose Nanofibers onto the Reinforcing Fibers (265)1665
MOUHAMADOU MOUSTAPHA SARR, HIRAKU INOUE
and TATSURO KOSAKA

Optimization of Retting and Extraction Through Constitutive Material Modelling of Plant Stems for Variability Reduction in Extracted Natural Fibers (290).1673
ANSHUL SINGHAL, AMY LANGHORST, ANKUSH BANSAL,
MIHAELA BANU and ALAN TAUB

Nanoparticle Modification of Natural Fibers for Structural Composites (327)1688
AMY LANGHORST, ANSHUL SINGHAL, DEBORAH MIELEWSKI,
MIHAELA BANU and ALAN TAUB

ONR COMPOSITES IN NAVAL AVIATION

ONR Review: Architected Composites for Damage Tolerance in Extreme Conditions (021)1701
PAVANA PRABHAKAR, VINAY DAMODARAN
and SABARINATHAN PUSHPARAJ SUBRAMANIYAN

Synergistic Effects of Plasma Polymerization and Covalent Surface Modification of Carbon Fibers (022)1711
DANIEL J. EYCKENS, LACHLAN SOULSBY, FILIP STOJCEVSKI,
ATHULYA WICKRAMASINGHA and LUKE C. HENDERSON

Multifunctional Ceramic Composite System for Simultaneous Thermal Protection and Electromagnetic Interference (EMI) Shielding for Carbon Fiber Reinforced Polymer Composites (CFRP) (025)1719
TOSIN D. AJAYI, YUJUN JIA and CHERYL XU

Seminal Developments in the Durability and Damage Tolerance Assessment of Bonded Joints (026).1734
RHYS JONES, ANTHONY J. KINLOCH, J. MICHPOULOS
and A. P. ILIOPOULOS

Strength Size Effect in Fiber Composites Failing Under Longitudinal and Transverse Compression (033)1744
JING XUE and KEDAR KIRANE

Fatigue Failure of Fibrous Composite Based on Multiscale Approach (045)	1764
LAUREN KADLEC, CASSANDRA HALLER, YOUNG KWON, SOO-JEONG PARK and YUN-HAE KIM	
The Effects of Structural-Induced Deformation on the Resonance of Patch Antennas (047)	1776
KELVIN NICHOLSON, JOHN WANG, ROWAN HEALEY, TAYLOR LYNCH, JOEL PATNIOTIS and WINGKONG CHIU	
Bond Quality Evaluation Using Adhesive Doped with Magneto-Electric Nanoparticles (068)	1789
JULIETTE DUBON, GONZALO SEISDEDOS, MARIANA ONTIVEROS, BENJAMIN BOESL and DWAYNE MCDANIEL	
Toughening of Boron Carbide Composites by Hierarchical Microstructuring (069)	1802
JINGYAO DAI, EVAN PINEDA, BRETT BEDNARCYK, JOGENDER SINGH and NAMIKO YAMAMOTO	
Topology Optimization of Plate Structures with Anisotropic Materials (089)	1815
HOLLIS A. SMITH and JULIÁN A. NORATO	
A Multiscale Modeling and X-Ray CT Exploration of Bearing Failure Mechanisms in a Countersunk Bolted Composite Structure (127)	1825
XIAODONG CUI, JIAN XIAO, JIM LUA, SUPUN KARIYAWASAM, ETHAN FULGHUM, CALEB SAATHOFF and WARUNA SENEVIRATNE	
Progress on the Development of Shape-Memory-Alloy Metacomposites (140)	1838
DUSAN MILOSAVLJEVIC, QIANLONG ZHANG, MARCO MOSENER, HONGFEI ZHU, NORA LECIS, SIMONE CINQUEMANI and FABIO SEMPERLOTTI	
Electroplating Polymer Based Additive Manufactured Parts for Enhanced Structural Performance (155)	1859
WARUNA SENEVIRATNE, JOHN TOMBLIN and BRANDON SAATHOFF	
Low Thermal Conductivity Composite Skin Materials (171)	1872
STEVE SCHOENHOLTZ, ARTHUR GAVRIN and CHENGGANG CHEN	
Vertically-Aligned Carbon Nanotube (VACNT)-Reinforcement for Strength and Life Enhancement of Composite Aerostructures (205)	1888
PRANAV D. SHAH and RICHARD LI	

**High Fidelity Building Block and Validation Protocols for
NextGen Composite Methods (214) 1897**
JOSEPH D. SCHAEFER and BRIAN P. JUSTUSSON

Impact Damage and Injection Repair Strength Restoration (286). 1914
JUSTIN MASSEY, BARRETT ROMASKO and HYONNY KIM

**A Paris Law Based Mesh Independent Numerical Methodology
for the Simulation of Fatigue Driven Delamination
in Composites (344) 1931**
ANGELA RUSSO, ANDREA SELLITTO and ANIELLO RICCIO

PROGRESSIVE DAMAGE AND FAILURE ANALYSIS

**Global-Local Progressive Damage Analysis of Composite Laminates
Using Layer-Wise Higher-Order Structural Models (032) 1947**
MANISH H. NAGARAJ, ERASMO CARRERA and MARCO PETROLO

**Orthotropic Damage Model Using Tsai-Wu Failure
Criteria (055) 1956**
M. R. T. ARRUDA, L. ALMEIDA-FERNANDES, L. CASTRO
and J. R. CORREIA

**Failure Performance of Bend-Free Variable Stiffness Composite
Pressure Vessels (093) 1973**
SHAHRZAD DAGHIGHI and PAUL M. WEAVER

**Post Mechanical Failure Fire Damage Characterization of
Graphite/Epoxy Composites (143) 1986**
ANIKET MOTE, HASNAA OUIDADI, DOUNIA BOUSHAB,
MATTHEW PRIDDY, SANTANU KUNDU, CHARLES PITTMAN, JR.,
JAIME GRUNLAN, QINGSHENG WANG and THOMAS E. LACY, JR.

**Damage Evolution in Cross-Ply Laminates Under Variable
Amplitude Cyclic Loadings (151) 2001**
PAOLO ANDREA CARRARO, SIMONETTO MIRKO,
LUCIO MARAGONI and MARINO QUARESIMIN

**Numerical Prediction of Stiffness Degradation of Thin-Ply CFRP
Laminates Under Fatigue Loading (212) 2007**
RYOMA AOKI, RYO HIGUCHI and TOMOHIRO YOKOZEKI

**Fatigue Damage Modeling in Laminated Composites by Using
Rx-FEM and Strength Tracking Method (294) 2016**
WEI-TSEN LU, ZHENJIA GAO, HARI K. ADLURU, KEVIN H. HOOS,
WARUNA SENEVIRATNE, DAVID MOLLENHAUER and ENDEL V. IARVE

**Computational Investigation of Energy Dissipation Through
Progressive Failure in Tailored Composite Structures via
Explicit Finite Element Analysis (310) 2033**
ANIRUDH SRINIVAS and D. STEFAN DANCILA

STRUCTURAL MULTIFUNCTIONALITY AND MATERIALS BY DESIGN

Cure Behavior of Nanostructured Hierarchical Composites with Functionalized Carbon Nanotubes (042) 2057
DAE HAN SUNG, SAGAR M. DOSHI, ANDREW N. RIDER
and ERIK T. THOSTENSON

Evaluation of Effect of Surface Modification on Correlation Between Permeability of Glass Fiber/Resin and Capillary Number (072) 2070
TAKUYA SAITO, KENJI MIZUTANI, HIROSHI SAITO
and ISAO KIMPARA

Nanoengineered Glass Fiber Reinforced Composite Laminates with Integrated Multifunctionality (275) 2078
PALAK PATEL, CAROLINA FURTADO, MEGAN COOPER,
LUIZ ACAUAN, STEPAN LOMOV, ISKANDER AKHATOV,
SERGEY ABAIMOV, JEONYOON LEE and BRIAN WARDLE

A Multifunctional and Reconfigurable Microvascular Composite (336) 2091
URMI DEVI, REZA PEJAM, ZACHARY J. PHILLIPS,
KALYANA B. NAKSHATRALA, AHMAD R. NAJAFI,
KURT R. SCHAB and JASON F. PATRICK

TESTING AND MATERIAL CHARACTERIZATION

In Situ Characterization of Fiber-Matrix Interface Debonding via Full-Field Measurements (017) 2105
ROBERT LIVINGSTON and BEHRAD KOOHBOR

Cyclic Thermoresistivity of Carbon Nanotube Yarn/Silicone Rubber Matrix Monofilament Composites (031) 2113
TANNAZ TAYYARIAN, OMAR RODRIGUEZ-UICAB,
TANJEE AFREEN and JANDRO L. ABOT

Benchmarking Virtual Permeability Predictions of Real Fibrous Microstructure (062) 2123
DAVID MAY, ELENA SYERKO, TIM SCHMIDT, CHRISTOPHE BINETRUY,
LUISA ROCHA DA SILVA, STEPAN LOMOV and SURESH ADVANI

Sub-Microscale Speckle Pattern Creation on Single Carbon Fibers for In-Situ DIC Experiments (079) 2133
KARAN SHAH, GENE YANG, MOHAMMAD EL LOUBANI,
SUBRAMANI SOCKALINGAM and DONGKYU LEE

Plasma Polymerization on Unsized Basalt Fibres for Improving the Interfacial Strength with Polymer Matrices (080) 2146
MATTEO LILLI, MILAN ZVONEK, VLADIMIR CECH,
CHRISTINA SCHEFFLER, JACOPO TIRILLÒ
and FABRIZIO SARASINI

Analyzing the Mechanical Properties of Thermoplastic Reinforced with Natural Fibers (082)	2154
NIDHI M. THANKI, ABIGAIL HENDERSON, JOE FEHRENBACH, CHAD ULVAN and ALI AMIRI	
Dispersion of Cobalt Ferrite Functionalized Graphene Nanoplatelets in PLA for EMI Shielding Applications (095)	2163
KANAT ANURAKPARADORN, ALAN TAUB and ERIC MICHIELSSEN	
A Complex Potential Approach to Micromechanics of Unidirectional Composites (096)	2193
STEVEN G. RUSSELL	
In-Situ Measurement of Permeability between Carbon Fiber/Resin (105)	2216
MASAKI ENDO, HIROSHI SAITO and ISAO KIMPARA	
Effects of Number of Plies on Lightning Strike Protection of Electrically Conductive Layer-Wise Hybrid Laminates (123)	2226
SIWAT MANOMASANTIPHAP and TOMOHIRO YOKOZEKI	
Influence of Negative Poisson's Ratio on Fracture Morphologies in CFRP Laminates (124)	2241
DAIKI IWASAKI, SHUICHIRO NISHIO, HIROSHI SAITO, MANATO KANESAKI and ISAO KIMPARA	
Micro-CT Image-Based Reconstruction Model for Failure Analysis of Sheet Molding Compound (SMC) Composites (128)	2250
HYOUNG JUN LIM, HO-IL CHOI and GUN JIN YUN	
Modeling CFRP Open-Hole Compression Strength Using Artificial Neural-Network with Manually Derived Layer (132)	2261
SU YU and JONATHAN S. COLTON	
Stress Relaxation Behavior of Thermoset Polymers at Large Strains (153)	2281
RASHEDUL ISLAM, DONALD W. RADFORD, PATRICK RODRIGUEZ and THOMAS W. MURPHEY	
Multiscale Analysis of Thermo-Mechanical Behavior of Boron Nitride-Reinforced Epoxy Nanocomposites (159)	2299
OLANREWAJU ALUKO, S. GOWTHAM, EVAN J. PINEDA and GREGORY M. ODEGARD	
Assessing the Multiaxial Deformation Response of Unidirectional Non-Crimp Fabrics (177)	2313
MEHDI GHAZIMORADI, VALTER CARVELLI and JOHN MONTESANO	

Mechanical Properties of the Woven Natural Fiber Reinforced Sheet Stocks Used for the Laminated Object Manufacturing (LOM) Rapid Prototyping Process (183)	2318
LAI JIANG, ANANDA S. AMARASEKARA, QUINTEN D. JACKSON and DEPING WANG	
Influence of GNP on the Tensile Response of Stitched Composites (224)	2331
RADWA ALAZIZ, SHUVAM SAHA and RANI W. SULLIVAN	
Fiber Reinforced Asphalt (231)	2342
RYAN COY, RAFAEL GOMEZ CONSARNAU, IAN HOLMES and DANIEL WHISLER	
Prediction of Number of Cycles from Fatigue Test Conditions and Transverse Crack Density of CFRP Cross-Ply Laminates (238)	2357
YOUZOU KITAGAWA, KOTARO HIRAIWA, MASAHIRO ARAI, AKINORI YOSHIMURA and KEITA GOTO	
A Fast Method for Evaluating Effects of Process Parameters on Morphology of Semi-Crystalline Thermoplastic Composites (247)	2365
MATHEW WYNN and NAVID ZOBEIRY	
Microstructural Correlations in Short-Aligned Glass Fiber Composites (281)	2375
CAMILO A. ROJAS G., ERICH SCHÖBERL, MARCO L. LONGANA, STEPAN LAMOV and YENTL SWOLFS	
Damage Evolution in Non-Crimp Fabric Carbon Fiber/Epoxy Multi-Directional Laminates Under Quasi-Static Tension (295)	2387
AADITYA SURATKAR, JOHN MONTESANO and JEFFREY WOOD	
Interfacial Properties of Hybrid Cellulose Nanocrystal/Carbonaceous Nanomaterial Composites (305)	2397
OZGE KAYNAN, LISA PEREZ and AMIR ASADI	
Optimisation of Tab Geometry to Minimise Longitudinal Stress Concentration During Tensile Testing of Unidirectional CFRP (313)	2405
SHAILEE UPADHYAY, FRANCISCO MESQUITA, BABAK FAZLALI, LARISSA GORBATIKH and YENTL SWOLFS	
Preliminary Experimental/Analytical Correlations of the Forming of Stretch Broken Carbon Fiber Tows and Laminates (314)	2418
YONI SHCHEMELININ, RACHEL EISGRUBER, JARD W. NELSON, DOUGLAS CAIRNS, MATT EGLOFF, JOSEPH JANICKI, BRYAN FEIGEL, ROBERTA AMENDOLA, DILPREET S. BAJWA, CECILY RYAN and JUHYEONG LEE	

Closed-Form J-Integral and Its Applications for Measurement of Mode I Interlaminar Fracture Toughness of Composites (322) 2436
WU XU and JIANCAN DING

VERIFICATION AND VALIDATION OF ANALYSIS TOOLS

Vibrations of Prestressed Variable Stiffness Composite Aerospace Structures by Ritz Approach (061) 2453
GIUSEPPE SCIASCIA, VINCENZO OLIVERI and PAUL WEAVER

Analyzing Micro-Macro Transitional Length Scale in Unidirectional Composites (110) 2482
NAND KISHORE SINGH, KAZI ZAHIR UDDIN, RATNESHWAR JHA and BEHRAD KOOHBOR

Experimental and Numerical Investigations of Stochastic Thickness Effects in Discontinuous Fiber Composites (112) 2490
SEUNGHYUN KO, TROY NAKAGAWA, ZHISONG CHEN, JAMES DAVEY, TALAL ABDULLAH, LUKE KUKLENSKI, EBONNI J. ADAMS, MATTHEW R. SOJA, CHUL Y. PARK, WILLIAM B. AVERY, JUNKYU YANG and MARCO SALVIATO

Skin/Stringer Interface Damage Characterization of Stiffened Composite Structures (154) 2505
WARUNA SENEVIRATNE, VISHNU SASEENDRAN, MOHAMED SHAFIE and JOHN TOMBLIN

Induction Heating of CF/PEEK Laminates Using Homogenization Techniques (158) 2528
WARUNA SENEVIRATNE, JOHN TOMBLIN, JEROME J. C. TEOH, NICHOLAS A. SMITH and BRANDON L. SAATHOFF

Growth Monitoring of Delamination and Adhesive Debonding of CFRP Structures by Rayleigh Scattering-Based Distribution Sensors (245) 2540
KAZUKI OHNISHI, TATSURO KOSAKA and GENKO FUJIOKA

Development of Degree-of-Cure Measurement Method by Thin-Diameter Fresnel's Reflection Optical Fiber Sensor (248) 2555
GENKO FUJIOKA and TATSURO KOSAKA

Impact Damage Detection Limits of Microwave NDE Technique for Polymer Composites (308) 2568
KATHERINE BERKOWITZ, RISHABH D. GUHA, OGHENEVO IDOLOR, MARK PANKOW and LANDON GRACE

WOVEN COMPOSITES MANUFACTURING MODELING AND TESTING

High Damping Values of Sandwich Structures with Polymer Composite Face Sheets and Foam Cores (038) 2585
TUNCAY AYDOGAN, FERHAT KADIOGLU
and MEHMET EMIN DALFESOGLU

Stress and Failure Analysis of Woven Composites Using an Automated Conformal Mesh Method (049). 2594
AGNIPROBHO MAZUMDER, QIBANG LIU, YOUQI WANG
and CHIAN-FONG YEN

Multiscale Modeling of the Effective Thermal Conductivity of 2D Woven Composites by Mechanics of Structure Genome and Neural Networks (087) 2611
XIN LIU, BO PENG and WENBIN YU

Effects of Temperature Environment on Mode II Interlaminar Fracture Toughness in Asymmetric CFRP Laminates (118). 2628
RYOSUKE IWAMA, HIROSHI SAITO and ISAO KIMPARA

Influence of Temperature-Dependent Resin Behavior on Numerical Prediction of Effective CTEs of 3D Woven Composites (164) 2636
KOSTIANTYN VASYLEVSKYI, BORYS DRACH and IGOR TSUKROV

Finite Element Analysis for Textile Composites Using Fiber-Bundles/Matrix-Resin Separated Mesh (211) 2652
AKINORI YOSHIMURA, KENJI IWATA, KEITA GOTO
and MASHIRO ARAI

Hybrid Experimental and Numerical Characterization of the 3D Response of Woven Polymer Matrix Composites (218). 2658
JAVIER BUENROSTRO, HYONNY KIM, ROBERT K. GOLDBERG
and TRENTON M. RICKS

Micromechanical Finite Element Prediction of Interlaminar Traction-Separation Laws Using J-Integral Approach (285) 2676
CHRISTOPHER S. MEYER, BAZLE Z. HAQUE, DANIEL J. O'BRIEN
and JOHN W. GILLESPIE, JR.

A Fast, Automatic Meshing Procedure for Composites with Interpenetrating Geometry (306) 2687
M. KEITH BALLARD, KEVIN HOOS, HARI ADLURU, ENDEL IARVE
and DAVID MOLLENHAUER

Progressive Damage Response of 3D Woven Composites via the Multiscale Recursive Micromechanics Solution with Tailored Fidelity (338) 2712
BRETT A. BEDNARCYK, EVAN J. PINEDA, TRENTON M. RICKS
and SUBODH K. MITAL

**Experimentally Validated Simulations of Blind Hole Drilling
in 3D Woven Carbon/Epoxy Composite with Processing-Induced
Residual Stresses (339).....2724**
ARTURO LEOS, KOSTIANTYN VASYLEVSKYI, IGOR TSUKROV,
TODD GROSS and BORYS DRACH

SOLVAY BEST STUDENT PAPER ENTRIES

**Achieving Realistic Tow Fiber Volume Fractions in Textile
Composite Models by Inducing Fiber Entanglement 2741**
GEORGE BARLOW, MATHEW SCHEY and SCOTT STAPLETON

**A Radiation Sensitive Adhesive System for Functionally Graded
Composite Joints2751**
SAMUEL B. HURVITZ, SCOTT STAPLETON and JAMAL HUSSEINI

**Artificial Generation of 2-D Fiber Reinforced Composite
Microstructures with Statistically Equivalent Features 2759**
JAMAL F. HUSSEINI, SCOTT E. STAPLETON and EVAN J. PINEDA

**Failure of CFRP and Titanium Tubular Adhesive Lap Joints at
Extreme Temperatures2776**
ISAIAH KAISER, CHAO ZHANG and K. T. TAN

**3D Printing of Short Carbon Fiber Composites via Frontal
Polymerization.....2793**
MORTEZA ZIAEE and MOSTAFA YOURDKHANI

**Rate-Dependent Compaction and Relaxation Response of Uncured
Prepregs under High-Pressure Conditions 2800**
NOORA ALAHMED, KAMRAN A. KHAN and REHAN UMER

**The Effects of Debulking on the Microstructure of Carbon Fiber
Reinforced Composites2814**
MATHEW SCHEY, SCOTT STAPLETON and TIBOR BEKE

**Quasi-Linear Viscoelastic Modelling of Uncured Prepregs under
Compaction2841**
SIDDHESH S. KULKARNI, KAMRAN A. KHAN and REHAN UMER

**Hydraulic Bulge Testing to Compare Formability of Continuous and
Stretch Broken Carbon Fiber Prepreg Laminates 2851**
YONI SHCHEMELININ, JARED W. NELSON
and ROBERTA AMENDOLA

**Uncertainty Quantification for the Manufacturing of Carbon
Fiber/Vinyl Ester Laminates.....2864**
ZACHERY NIETO and ALEJANDRA CASTELLANOS

Author Index