

28th Annual Technical Conference of the American Society for Composites 2013

**State College, Pennsylvania, USA
9-11 September 2013**

Volume 1 of 2

Editor:

Charles E. Bakis

ISBN: 978-1-62993-143-2

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© (2013) by DEStech Publications, Inc.
All rights reserved.

Printed by Curran Associates, Inc. (2013)

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

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

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: 845-758-2634
Email: curran@proceedings.com
Web: www.proceedings.com

TABLE OF CONTENTS

VOLUME 1

STRUCTURAL HEALTH MONITORING—ELECTRICAL

Mode II Delamination Detection in Laminated Composite Materials Using Carbon Nanotube Yarn: State-of-the-Art and Challenges	1
<i>J. Abot, K. Wynter, K. Belay, M.-D. Lamos, G. Seidel, B. Vondrasek</i>	
Enhanced Damage Detection in Conductive Polymer-Based Composites Through Piezoresistive Coupling	16
<i>T. Tallman, F. Semperlotti, K.-W. Wang</i>	

MULTIFUNCTIONAL COMPOSITES

Self-Sealing Composite Sandwich Structures	25
<i>C. Mangun, S. White, N. Sottos, H. Jin, J. Moll</i>	
Biomimetic Vascular Pathways Embedded within Multifunctional Sandwich Composites	40
<i>J. Tye, C. Hansen</i>	
Dispenser Printed Circular Thermoelectric Devices for Wireless Condition Monitoring Sensor Applications	49
<i>D. Madan, Z. Wang, A. Chen, P. Wright, J. Evans</i>	

INTEGRATED COMPUTATIONAL MATERIALS ENGINEERING (ICME)

An Intrinsic Flaw Model for Failure-Site Prediction	58
<i>J. Goodsell, R. Pipes</i>	
The Effect of Fiber Strength Stochastics and Local Fiber Volume Fraction on Multiscale Progressive Failure of Composites	77
<i>T. Ricks, T. Lacy Jr., B. Bednarczyk, S. Arnold</i>	
Multiphysics Analysis of Mechanical and Physical Property Changes During Progressive Damage of Composite Materials	86
<i>K. Reifsnider, R. Raithan, Q. Liu</i>	
Prediction of the Delamination Area of a Composite Panel Subjected to Lightning Strike: Effects of Temperature-Dependent Fracture Properties	102
<i>P. Naghipour, E. Pineda, S. Arnold</i>	
Development of an ICME-Based Airframe Digital Twin Model of an All-Composite Air Vehicle	114
<i>K. McWilliams, T. Lacy Jr., S. Roy, R. Jha</i>	
Multiscale Modeling for Initial Cracking at the Free Edge of Angle-Ply CFRP Laminates	126
<i>Y. Sato, T. Okabe, K. Yoshioka</i>	
Modeling Composite Damage Process with Peridynamics	140
<i>T. Jia, D. Liu</i>	
Modeling of Fracture Properties in Nano-Particle Reinforced Polymers Using the Atomistic J-Integral	150
<i>S. Roy, A. Akepati</i>	
Micro-Level Simulation of Mode I Fracture in Polymer Matrix Composites	166
<i>D. Mollenhauer, T. Breitzman, E. Larve, K. Hoos, M. Swindeman, E. Zhou</i>	
Numerical Predictions of Damage and Failure in Carbon Fiber Reinforced Laminates Using a Thermodynamically-Based Work Potential Theory	180
<i>E. Pineda, A. Waas</i>	
Energy Based Multiscale Modeling with Non-Periodic Boundary Conditions	200
<i>C. Cater, X. Xiao</i>	
Study on Mechanical Properties for Epoxy Resin by Molecular Dynamics	220
<i>M. Onodera, T. Okabe, M. Hashimoto, K. Yoshioka</i>	
Multi-Scale Finite Element Simulation of Triaxially Braided Composite	232
<i>C. Zhang, W. Binienda</i>	

TESTING—INTERLAMINAR

The Effects of Voids on Delamination Behavior Under Static and Cyclic Mode I and Mode II	252
<i>N. Abdela, S. Donaldson</i>	
Methods for Assessing Interlaminar Tensile Properties in Composite Materials	273
<i>A. Makeev, Y. Nikishkov, G. Seon, E. Armanios</i>	
Estimation of the Remaining Strength of a Z-Pinned Composite Laminate with a Fully-Developed Crack Through the Z-Pin Field.....	290
<i>V. Ranatunga, S. Clay</i>	

ANALYSIS—SHELL STRUCTURES

Behavior of Thick Composite Tubes Under Pure Bending Load	302
<i>M. El-Geuchy, S. Hoa, F. Shadmehri</i>	
Some Observations on the Influence of the Classic Failure Criteria on the Optimal Design of Pressure Vessels.....	321
<i>S. Koussios, L. Zu, I. Tapeinos, A. Beukers, M. Sippel, A. Kopp</i>	
Analysis of Debonding of Filament Wound Composite Pressure Vessels	341
<i>V. Akula, M. Shubert</i>	

STRUCTURAL HEALTH MONITORING—ULTRASOUND

Simulation of Detecting Damage in Composite Stiffened Panel Using Lamb Waves.....	355
<i>J. Wang, R. Ross, G. Huang, F. Yuan</i>	
Mode Selection for Structural Health Monitoring of Composite T-Joint Using Ultrasonic Guided Waves.....	375
<i>B. Ren, C. Lissenden</i>	
SHM of Composite Skin-Stiffener Structures Using Wavelet Spectral Finite Element Method.....	386
<i>D. Samaratunga, R. Jha, S. Gopalakrishnan</i>	

THERMOPLASTIC MATRIX

Fiber Orientation Measurement of Injection Molded Long-Glass-Fiber Reinforced Thermoplastics.....	405
<i>D. Shi, X. Xiao, W. Lee, I. Jasiuk</i>	
Injection-Molded Long-Fiber Thermoplastic Composites: From Process Modeling to Prediction of Mechanical Properties.....	419
<i>B. Nguyen, V. Kunc, X. Jin, C. Tucker III, F. Costa</i>	
Evaluation of Adhesive Property in Glass Fiber Reinforced Thermoplastic Inserted Injection Moldings.....	437
<i>C. Wang, P. Uawongsuwan, H. Mori, Y. Yang, A. Nakai, H. Hamada</i>	
Elevated-Temperature Dynamic Mechanical Behavior of PTFE/PEEK Composite	444
<i>G. Liu, S. Wang</i>	
Effect of Processing Parameters on the Bending Behavior of Thermoplastic Composite Tubes Made by Automated Fiber Placement Process	463
<i>J. Fortin-Simpson, M. El-Geuchy, F. Shadmehri, S. Hoa</i>	

ANALYSIS—NONCLASSICAL LAMINATES

Snap-Through of Unsymmetric Cross-Ply Laminates.....	475
<i>G. Vogl, M. Hyer</i>	
Cure Induced Curvature of Unbalanced Carbon Fiber Laminates Due to Processing Thermal Variations	492
<i>S. Stair, R. Mailen, D. Jack</i>	

BIO-BASED COMPOSITES

Short- and Long-Term Mechanical Characteristics of Glass Fibre Reinforced Polymer Made of Furfuryl Alcohol Bio-Resin.....	506
<i>A. Fam, A. Eldridge</i>	
Mycology Matrix Composites	517
<i>S. Travagliani, J. Noble, P. Ross, C. Dharan</i>	

Thermo-Mechanical Characterization of Sustainable Composites Made from Bio-Based Polyester Resins and Nitroxide Mediated Hydroperoxide Initiators	536
<i>E. Triggs II, A. Tcherbi-Narte, M. Hosur, S. Jeelani</i>	
Acoustic and Damping Performance in Natural Cork Core Sandwich Composite Structures	550
<i>J. Walsh, H.-I. Kim, J. Sargianis, J. Suhr</i>	
Effect of Surface Functionalization of Hemp Fiber on Mechanical Properties of Fiber and Composites with Poly Lactic Acid (PLA) Matrix	557
<i>S. Oza, A. Carlson, M. Tajabadi, N. Lu</i>	
Effect of Compaction Pressure on Water Absorption Behaviour and Mechanical Properties of Hemp Fiber Reinforced Vinyl Ester Composites	566
<i>H. Dhakal, Z. Zhang, H. Ghasemnejad</i>	
Mechanical Properties and Prediction of Elastic Modulus of Glass Short Fiber/Wood Powder/Polypropylene Hybrid Composites	581
<i>Y. Yu, Y. Yang, M. Nomura, H. Hamada</i>	

THERMAL/ELECTRICAL PROPERTIES

Measurement of Thermal Conductivity of Carbon Fibers Using Wire-Based 3Ω Method	593
<i>J. Liang, M. Saha, M. Altan</i>	
Modeling and Characterization of the Through-Thickness Thermal Conductivity of Polymer Composites Using Infrared Camera	600
<i>H. Yu, A. Nonn, D. Heider, S. Advani</i>	
Mechanical, Thermal and Electrical Properties of Graphene/Epoxy Nanocomposites: An Experimental and Theoretical Study	614
<i>R. Rahman, D. Hawkins Jr., D. Donewar, A. Haque</i>	

DYNAMIC BEHAVIOR

Design of a Fluidic Flexible Matrix Composite Damping Treatment for a Cantilever Beam	633
<i>B. Zhu, C. Rahn, C. Bakis</i>	
Performance of a Composite Softball Bat as a Function of Ball Type and Bat Construction	652
<i>J. Yee, J. Sherwood, S. Fitzgerald</i>	
Free Vibrations of Variable-Thickness Variable-Width Laminated Composite Beams with Elastic Supports	671
<i>P. Salajegheh, R. Ganeshan</i>	
Rotordynamic Response of Tapered Composite Driveshaft Based on a Conventional Composite Timoshenko Finite Element	686
<i>M. Al Muslmani, R. Ganeshan</i>	

ANALYSIS—DAMAGE AND FAILURE

Micromechanistic Analysis of Ply Thickness Effect on Transverse Cracking	706
<i>A. Hussien, C. Sun</i>	
Analysis of the Shear Modulus Reduction of a Cracked Composite Laminate Including Crack Surfaces Friction	714
<i>M. Salavatian, L. Smith</i>	
Statistical Aspects of Progressive Fiber Failure Simulation in Composite Laminates	726
<i>E. Iarve, D. Mollenhauer, T. Breitzman, K. Hoos, M. Swindeman</i>	
Probabilistic Investigation of Composite Damage Progression and Failure Predictions	739
<i>R. Haynes, M. Shiao, K. Liu</i>	

TEXTILE ARMOR

Modeling the Transverse Compression Response of Kevlar KM2	749
<i>S. Sockalingam, J. Gillespie Jr., M. Keefe</i>	
Continuous Filament Knit Aramids for Extremity Ballistic Protection	767
<i>A. Dwivedi, M. Dalzell, L. Long, K. Slusarski, S. Fossey, J. Perry, E. Wetzel</i>	

TESTING—COMPRESSION

Characterization of Compressively Loaded Filament Wound Composite Cylinders Using Digital Image Correlation.....	778
<i>T. Henry, C. Bakis, R. Emerson, J. Riddick</i>	
Compression Behavior of Ultra High-Modulus Carbon/Epoxy Composites	796
<i>M. Glaith, K. Koudela, E. Strauch</i>	
Crushing Performance of Carbon/Aramid Hybrid Composite Tube.....	815
<i>Y. Ma, Y. Yang, T. Sigahara, H. Hamada</i>	

ACTIVE COMPOSITES

Nonlinear Time Dependent Finite Element Model for Active Composites	831
<i>A. Sohrabi, A. Muliana</i>	
A Micromechanical Model for Analyzing Responses of a Piezoelectric Hybrid Composite.....	843
<i>C.-H. Lin, A. Muliana</i>	
Non-Uniform Electric Field and Nonlinear Piezoelectric Behavior in Active Fiber Composites.....	852
<i>H. Atitallah, Z. Ounaies, A. Muliana</i>	

ANALYSIS—INTERLAMINAR

Development and Applications of Benchmark Examples for Static Delamination Propagation Predictions.....	868
<i>R. Krueger</i>	
A Micromechanical Viscoelastic Cohesive Layer Model for Predicting Delamination in High Temperature Polymer Matrix Composites.....	888
<i>P. Upadhyaya, S. Roy, M. Haque, H. Lu</i>	
Stress Recovery in Composite Laminates for Periodic Dynamic Loading.....	906
<i>T. Hartman, M. Hyer, S. Case</i>	

3D REINFORCEMENT

Comparison of 2D and 3D Composites to Confined Crush Loading.....	927
<i>M. Pankow, C. Yen, A. Waas</i>	
Flexural Response of 3D Hybrid Textile Composites	939
<i>D. Zhang, A. Waas, C.-F. Yen</i>	

VOLUME 2

Improvements to the Processing and Characterization of Needled Composite Laminates	957
<i>R. Emerson, B. Lawrence, A. Montgomery, S. Safriet</i>	

TESTING—MICRO

In-Situ Micro-Compression Testing for Characterizing failure of Unidirectional Fiber Composites.....	969
<i>Y. Lu, R. Wheeler, G. Tandon, G. Schoeppner</i>	
Micromechanics of Fracture in a Toughened Epoxy	978
<i>A. Forster, C. Clerici, A. Blond, D. Hunston</i>	

ELECTRIC/DIELECTRIC NANOCOMPOSITES

In-Situ and Ex-Situ TiO₂-Based Dielectric Polymer Nanocomposites.....	992
<i>P. Khodaparast, Z. Ounaies</i>	
Effect of Graphene Oxide on the Ferroelectric Properties of P(VDF-TrFE) (56/44)	1000
<i>N. Sigamani, Z. Ounaies, H. Sodano</i>	
Improvement of Electrical Conductivity in Polymer Nanocomposites Featuring Heterogeneous Nanofillers Distribution.....	1011
<i>R. Farahani, J. Klemberg-Sapieha, D. Therriault</i>	

ANALYSIS

A Methodology for a Continuous Map of the Composite Material Properties of a Wind Turbine Blade.....	1022
<i>C. Mitchell, J. Sherwood, K. Fefatsidis</i>	
Initiation and Progression of Drilling Damages on Composite Laminates	1038
<i>S. Park, M. Nishikawa, T. Okabe, N. Takeda</i>	
Recent Advances in Repair Analysis for Composite Aircraft Structures	1050
<i>J. Lin, C. Duong</i>	

TESTING—ELECTRICAL

Study of Damage in Carbon Fiber Reinforced Composite Due to Electrical Current.....	1070
<i>M. Faisalhaider, P. Majumdar, K. Reifsnider</i>	
Effects of a Pulsed Electromagnetic Field on the Impact Response of Electrically Conductive Composites	1083
<i>A. Barakati, O. Zhupanska</i>	
Self-Sensing Time Domain Reflectometry for CFRP Composites	1100
<i>A. Todoroki, H. Kurokawa, Y. Mizutani, R. Matsuzaki</i>	

TESTING—MULTIAXIAL

Biaxial Fatigue of E-Glass/Epoxy Laminates Using Arcan-Type Specimens.....	1107
<i>R. Mandapati, P. Mallick</i>	
Investigation of the Leak Response of a Carbon-Fiber Laminate Loaded in Biaxial Tension	1116
<i>W. Jackson, J. Ratcliffe</i>	

ANALYSIS—MICROMECHANICS

Thermal Stress Analysis for Multiphase Composites	1134
<i>S. Nomura</i>	
Analytical Solution of the Dilute Strain Concentration Tensor for Coated Spherical Inclusions, and Applications for Polymer Nanocomposites	1140
<i>Z. Wang, F. Fisher</i>	
Dynamic Stress Concentration Due to a Nanosized Particle Embedded in a Large Matrix	1160
<i>S. Bugarin, R. Paskaramoorthy, R. Reid, S. Prabu</i>	
Mechanical Properties Identification of Particulate Composites Constitutive Materials Using Virtual Fields Method	1173
<i>B. Rahmani, E. Ghossein, I. Villemure, M. Levesque</i>	
Influence of Composite Microstructure on Apparent Fiber Properties	1184
<i>M. Ballard, W. McLendon, J. Whitcomb</i>	
The Interaction of Two Circular Multi-Layered Coated Fibers in a Composite Under Arbitrary Loading/Singularities in Anti-Plane Elasticity	1201
<i>E. Honein, T. Honein, H. Rai, M. Najjar</i>	
Classical Micromechanics Modeling of Functionally Graded Materials Containing Multiple Heterogeneities	1213
<i>J. Yu, A. Kindane</i>	

PROCESSING

Multi-Objective Optimization of Resin Transfer Molding Process Using Genetic Algorithm	1225
<i>J. Sato, T. Okabe, R. Matsuzaki</i>	
Reaction Kinetics and Flow Simulation of Vacuum-Assisted Resin Infusion Molding Process for Thick Glass/Polyester Composite	1237
<i>Y. Hou, S. Wang</i>	
An Investigation on Fast Curing of Braid Reinforced FRP Rebars Using a Finite Element Analysis	1257
<i>A. Hosseini, C. Ayranci, J. Carey</i>	
Forming of Composites Using Discontinuous Non-Crimp Fabrics	1271
<i>L. Dangora, J. Sherwood, A. Petrov, J. Gorczyca, C. Mitchell</i>	
Fabrication of Composite Laminates by Vacuum-Assisted Resin Transfer Molding Augmented with an Inflatable Bladder	1283
<i>J. Anderson, A. Kelly, M. Altan</i>	

An Integrated Process Model for Air Evacuation and Tow Impregnation in Out-of-Autoclave Prepreg Consolidation	1295
<i>R. Helmus, T. Centea, P. Hubert, R. Hinterholz</i>	
Experimental Investigation of Particle-Filler Distribution in Continuous Fiber-Reinforced Composites Produced via Liquid Molding	1314
<i>T. Aydil, H. Tanabi, M. Erdal</i>	

SANDWICH STRUCTURES

Specimen Size and Effective Compressive Stiffness of 3D Fiber Reinforced Foam Core Sandwich Structures	1325
<i>Z. Kier, A. Waas, J. Rome, V. Goyal</i>	
Effect of Temperature and Humidity on Indentation Property of Polymethacrylimide (PMI) Foam Core Sandwich Structures	1335
<i>J. Siivola, K. Kikuchi, S. Minakuchi, N. Takeda</i>	
Hypervelocity Impact of Honeycomb Core Sandwich Panels Filled with Shear Thickening Fluid	1352
<i>J. Warren, M. Cole, S. Offenberger, T. Lacy, H. Toghiani, M. Burchell, S. Kundu, C. Pittman Jr.</i>	

DESIGN

Design and Testing of a Composite PV Support Structure	1363
<i>T. Gentry, I. Stern, J. Goodman, P. Irudayaraj</i>	
Development of a Topology Optimized Upper Body Composite Support Structure	1377
<i>J. Tierney, J. Faull, A. Kennedy, S. Yarlagadda, J. Gillespie Jr.</i>	
Methods of Management of Energy Density per Mass and Per Designed Volume in Flywheels	1389
<i>A. Beyle, D. Cocke, A. Green</i>	
New Design Concept of Flight Control Surfaces with External Composite Trailing Edge (ECTE)	1407
<i>G. Oncul, B. Gozluklu, U. Koseoglu</i>	

COMPOSITE REINFORCEMENT FOR CONCRETE

Temperature Effect on Subcritical Crack Growth in CFRP Externally Bonded Concrete Systems.....	1428
<i>E. Jennings, J. Wang, K. Fridley, C. Chen</i>	
Evaluations of CFRP-Concrete Interface Subjected to Accelerated Ageing Test	1442
<i>F. Imani, I. Ray, A. Chen, J. Davalos</i>	
Exploratory Study on Mode II Fracture Evaluation of CFRP-Concrete Interface by a Displacement-Based Approach	1460
<i>F. Imani, A. Chen, J. Davalos, I. Ray</i>	
Design-Oriented Analysis of Slender RC Columns Strengthened with Longitudinal High Modulus CFRP Laminates.....	1472
<i>P. Sadeghian, T. Richardson, A. Fam</i>	

ANALYSIS—STRUCTURES

Applying a Stitched, Rod-Stiffened Concept to Heavily Loaded Structure	1483
<i>D. Jegley</i>	
Numerical Correlation and Strength Prediction of a Hat Stiffened Panel Compression Test	1516
<i>J. Schutte, J. Meeker, D. Adams, G. Bullegas, S. Clay</i>	
Buckling and Post-Buckling of Variable Stiffness Fiber Reinforced Textile and Pre-Preg Based Composite Plates	1530
<i>C. Kosztowny, B. Justusson, A. Waas</i>	
Torsional Analysis of a Composite I-Beam.....	1543
<i>V. Sanghavi, W. Chan</i>	

ENVIRONMENTAL EFFECTS

Anomalous Moisture Absorption in Composites: Effects of Diffusion Hindrance on Spatial Moisture Concentration	1560
<i>L. Grace, M. Altan</i>	
Damage Evolution During Thermal Oxidation of Unidirectional Composite Lamina	1575
<i>J. Liang, K. Pochiraju</i>	

The Graphene Shielding Effect Against UV Exposure: The Bonded Joint Investigation.....	1592
<i>D. Da Cruz, A. Avila</i>	
Modeling Mechanical Properties of Carbon Fiber/Vinyl Ester Composites Degraded by Ultraviolet Radiation and Moisture	1605
<i>A. Afshar, C. Korach</i>	
Behavior of Partially Cured Epoxy Composites Modified with Different Amounts of Montmorillonite Nanoclay Exposed to UV Radiation	1617
<i>A. Tcherbi-Narte, M. Hosur, E. Triggs, S. Jeelani</i>	

PHASE TRANSFORMING COMPOSITES

Thermal Properties of BaTiO₃/Ag Composites Undergoing Phase Transformation Due to Temperature Changes	1631
<i>J. Xing, A. Jang, M. Radovic, A. Muliana</i>	
NiTi-Based SMAs for Self-Post-Tensioned Bridge Girders	1640
<i>A. Lamba, R. Hamilton</i>	

ANALYSIS—MOLECULAR MODELING

Molecular Simulations of the Dynamic Impact of Graphite	1650
<i>S. Chowdhury, B. Haque, J. Gillespie Jr.</i>	
Molecular Simulations of Silica Surface in Presence of Water	1665
<i>S. Chowdhury, B. Haque, J. Gillespie Jr., T. Chantawansri, T. Rosch, R. Karkkainen</i>	
Improving Fracture Toughness of Silicon Carbide Ceramics with Nanodiamond Reinforcements.....	1677
<i>S. Ferdous, A. Adnan, M. Huda</i>	

VISCOELASTIC BEHAVIOR

Viscoelastic Properties of Syntactic Foam Reinforced with Short Sisal Fibers.....	1689
<i>A. Ghamsari, E. Zegeye, T. Dalcourt, K. Graham, E. Woldeesabet</i>	
Characterization of Viscoelastic Properties of Hollow Glass Microballoon Reinforced Polymer Composites	1698
<i>V. Shumugasamy, D. Pinisetty, N. Gupta</i>	
Coupled Multi-Inclusion and Multi-Coating Micromechanics Modeling of Viscoelastic Composite Materials.....	1709
<i>T. Ricks, J. Yu, T. Lacy Jr., R. Sullivan</i>	
Viscoelastic Creep Compliance of a Vinyl Ester Polymer with Statistical Distribution Functions.....	1720
<i>J. Simsiriwong, R. Sullivan, T. Lacy, H. Hilton</i>	
Viscoelastic Characterization of Vinyl Ester Nano-Composites Using Response Surface Modeling.....	1738
<i>D. Drake, R. Sullivan, H. Toghiani, T. Lacy, C. Pittman Jr., J. Dubien, S. Nouranian</i>	

NANOCOMPOSITES

Electrospun Polyacrylonitrile Nanofibers Containing Multiwall Carbon Nanotubes	1755
<i>B. Barua, M. Saha</i>	
Simultaneously Strong and Tough Continuous Nanofibers: Improvement of Mechanical Properties in the Intermediate Diameter Range	1764
<i>D. Papkov, Y. Dzenis</i>	
Poptube Technology: Enabling Next Generation Multiscale and Multifunctional Structural Composites	1774
<i>J. Wang, X. Zhang</i>	
Improving On and Off-Axis Tension Behavior of Woven Carbon Fiber Reinforced Epoxy Composite with ZnO Grown Nanowires.....	1783
<i>N. Masghouni, M. Al-Haik</i>	
Stronger Dental Adhesives Via Titanium Dioxide Nanocomposites.....	1795
<i>J. Sun, D. Hunston, A. Forster</i>	
A Nano-Hybrid Shish Kebab Approach to Modifying the Interface in Carbon Nanotube—Semicrystalline Polymer Nanocomposites	1804
<i>M. Nie, F. Fisher</i>	

IMPACT

2D Elastodynamic Solution for the Impact Response of Laminated Composites.....	1815
<i>J. Nie, A. Fisher</i>	
Compression Strength After Impact of Unidirectional Carbon/Epoxy Rods Consolidated with Aramid Sleeves.....	1835
<i>D. Jensen, C. Sika, K. Hinds, M. Jensen</i>	
Experimental and Modeling Investigation of Blunt Impact to Stringer-Reinforced Composite Panels.....	1848
<i>Z. Chen, H. Kim, G. Defrancisci</i>	

MECHANICAL BEHAVIOR

Creating More Gradual Failure in High Performance Composites Via Hybridisation.....	1868
<i>M. Wisnom, G. Czel, M. Jalalvand</i>	
Interlaminar Properties and Failure Strength of Thick-Section, Vacuum-Assisted Resin-Infusion Molded (VARIM) Composites.....	1875
<i>L. Li, S. Wang</i>	
Author Index	