

30th Annual Technical Conference of the American Society for Composites 2015

East Lansing, Michigan, USA
28-30 September 2015

Volume 1 of 4

Editors:

**Xinran Xiao
Alfred Loos**

Dahsin Liu

ISBN: 978-1-5108-1352-6

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© (2015) by DEStech Publications, Inc.
All rights reserved.

Printed by Curran Associates, Inc. (2016)

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

Page #		Paper ID
	CRASHWORTHINESS	
1	A Shell-Beam Modeling Method for Crash Simulation of Thin-Walled Composite Tubes	1493
	DANGHE SHI and XINRAN XIAO	
16	Characteristics of Thermoplastic Composite Tube Under Axial Loading.	1574
	SIMONETTA BORIA, ALESSANDRO SCATTINA and GIOVANNI BELINGARDI	
29	Axial Crush and Bending Collapse Analysis of Non-Crimped Fabric Composite Structures	1646
	VENKAT AITHARAJU, SATVIR AASHAT, HAMID KIA, ARUNKUMAR SATYANARAYANA and PHILIP BOGERT	
	DAMAGE MODELING I	
49	Comparative Composite Fatigue Damage Models for Life Prediction of Laminated Composite Structures.	1571
	EUGENE FANG, XIAODONG CUI and JIM LUA	
59	A Fatigue Damage Model for Failure Analysis of Single-lap Multi-bolt Joints	1640
	CHI HOU, YINHUA ZHOU, XIAOPENG WAN and MEIYING ZHAO	
70	Closed-form Solutions for Cohesive Zone Modeling.	1825
	JIAWEN XIE, ANTHONY M. WAAS and MOSTAFA RASSAIAN	
	IMPACT & DYNAMIC RESPONSES I	
90	Hypervelocity Impacts of Shear Thickening Fluid Imbibed Metallic Foam Core Sandwich Panels	1492
	JUSTIN WARREN, KALYAN RAJ KOTA, STEPHEN M. WESTBERG, THOMAS LACY, SANTANU KUNDU, HOSSEIN TOGHIANI and CHARLES U. PITTMAN, JR.	

Page #		Paper ID
99	Impact Testing and Simulation of a Sinusoid Foam Sandwich Energy Absorber	1556
	KAREN E. JACKSON, EDWIN L. FASANELLA and JUSTIN D. LITTELL	
118	Internal Impact Damage to Lightweight Composite Sandwich Panels	1631
	HYONNY KIM, KONSTANTINOS ANAGNOSTOPOULOS, MONICA CHAN and SEAN LUONG	
MULTIFUNCTIONAL COMPOSITES I		
135	Autonomic Cooling of Composites Using Transpiration	1674
	ANTHONY M. COPPOLA, NANCY R. SOTTOS and SCOTT R. WHITE	
142	Nonlinear Deformations of Smart Plates Under Electro-Mechanical Actuations	1814
	VAHID TAJEDDINI and ANASTASIA MULIANA	
NANOCOMPOSITES I		
154	Effect of Nanoclay Addition on Fatigue Behavior of Glass/Epoxy Tapered Laminates	1511
	M. SAMEH HELMY and SUONG V. HOA	
164	Environmental Degradation of Nano Enhanced Polymers in Low Earth Orbit	1618
	MOHAMMED JARADAT, XIAOBING LI, AHMED AL-OSTAZ, HUNAIN ALKHATEB and ALEXANDER CHENG	
177	Carbon Based Hybrid Nanostructures for High Performance Composites: The Surfactant Investigation	1644
	VIVIANE MUNHOZ, ALINE OLIVEIRA, ELVIS MONTEIRO and ANTONIO ÁVILA	
TEMPERATURE EFFECT I		
187	Thermal Evaluation of Epoxy Resin Using n-hexadecane Based Shape Stabilized PCM for Energy Saving in Building	1568
	SU-GWANG JEONG and SUMIN KIM	
194	High Temperature Nanocharacterization of Al/SiC Laminated Composite	1745
	ANAHITA EMAMI, AYOUB YARI BOROJENI and MARWAN AL-HAIK	
204	Manufacturing Process Induced Effects on the Strength of Carbon Fiber-Epoxy Composites	1848
	MARIANNA MAIARU, ROYAN J. D'MELLO and ANTHONY M. WAAS	
WIND ENERGY		
213	Failure Modes and Strength of Composite Box Beam Structures	1719
	BILL COLE, AKIRA MIYASE, TUNG-PEI YU, KING HIM LO and SU SU WANG	

Page #		Paper ID
230	Fatigue Life Prediction in Composite Wind Turbine Blades: Effects of Variable Wind Load and Non-proportional Multi-axial Stress States	1789
	WEIFEI HU, OLESYA I. ZHUPANSKA, K. K. CHOI and JAMES H. J. BUCHHOLZ	
243	Lightning-Strike-Induced Heat Transfer in Glass Fiber Polymer Matrix Composite Blades	1813
	YEQING WANG and OLESYA I. ZHUPANSKA	
 CYTEC STUDENT PAPERS		
262	Thermoforming Process Optimization for Reduction of Inter-Ply Friction of Out-of-Autoclave Material	1596
	HARINDERPAL SINGH GREWAL and MEHDI HOJJATI	
275	Residual Cure Stress Buildup in Thermosetting Composite: Modeling and Experimental Validation	1597
	OLEKSANDR G. KRAVCHENKO, SERGII G. KRAVCHENKO and R. BYRON PIPES	
292	A Novel Through-Thickness Reinforcement Method of Cured Composites	1598
	SERGII G. KRAVCHENKO, OLEKSANDR G. KRAVCHENKO and R. BYRON PIPES	
306	Polymer Derived In-Situ Nano Metal Matrix Composites Obtained by Friction Stir Processing	1822
	P. AJAY KUMAR, RISHI RAJ and SATISH V. KAILAS	
 DAMAGE MODELING II		
321	Progressive Composite Damage Modeling in LS-DYNA Using MAT162: Part A—Properties and Parameters	1833
	BAZLE Z. (GAMA) HAQUE and JOHN W. GILLESPIE JR.	
332	Progressive Composite Damage Modeling in LS-DYNA Using MAT162: Part B—Model Validating Experiments	1834
	BAZLE Z. (GAMA) HAQUE and JOHN W. GILLESPIE JR.	
342	Simulating the Mixed-Mode Progressive Delamination in Composite Laminates	1846
	ZHENYUAN GAO, LIANG ZHANG and WENBIN YU	
 DESIGN & MANUFACTURING		
355	Top Down Design Using Bayesian Network Classifiers for Composite Panels	1565
	KAYLA VON HAGEL, SHREYAS JOGLEKAR, SCOTT FERGUSON and MARK PANKOW	

Page #	Paper ID
363	Modeling to Predict Micro-scale Permeability for Fiber Reinforcement in Liquid Composite Molding 1580 TIMOTHY LUCHINI, STEPHEN SOMMERLOT and ALFRED LOOS
376	Manufacturing of Carbon/Epoxy IsoBeam Lattice Structures. 1666 BRANDON ASAY and DAVID W. JENSEN
394	Development of Stitched Composite Structure for Advanced Aircraft. 1840 DAWN JEGLEY, ADAM PRZEKOP, MARSHALL ROUSE, ANDREW LOVEJOY, ALEX VELICKI, KIM LINTON, HSI-YUNG WU, JAIME BARAJA, PATRICK THRASH and KRISHNA HOFFMAN
IMPACT & DYNAMIC RESPONSES II	
413	Impact-induced Damage in Tri-axially Woven Composites1505 COREY ANDERSON and DAHSIN LIU
421	Incorporation of Plasticity and Damage Into an Orthotropic Three-Dimensional Model with Tabulated Input Suitable for Use in Composite Impact Problems 1527 ROBERT K. GOLDBERG, KELLY S. CARNEY, PAUL DUBOIS, CANIO HOFFARTH, SUBRAMANIAM RAJAN and GUNTHER BLANKENHORN
438	Characterizing Composites at Low Strain Rates. 1648 DAHSIN LIU, JIANXIAO ZHENG, DAN SCHLEH and GUOJING LI
446	Impact Crush Modeling of Chopped Fiber Reinforced Polymers 1899 SABER DORMOHAMMADI, FRANK ABDI, RAGHURAM MANDAPATI, HARSH K. BAID, MIKE LEE and UMESH GANDHI
MULTIFUNCTIONAL COMPOSITES II	
466	Hysteresis and Time-Dependent Effects on the Coupled Mechanical-Electrical Response of Unconstrained Carbon Nanotube Yarns Subjected to Uniaxial Tensile Loading 1603 A. BAJAR, J. ANIKE and J. L. ABOT
483	Structural and Conductive Adhesives Enabled by Single-Walled Carbon Nanotubes.1668 BEHNAM ASHRAFI, MICHAEL B. JAKUBINEK, YADIENKA MARTINEZ-RUBI, YUNFA ZHANG, CHRISTOPHER T. KINGSTON, ANDREW JOHNSTON and BENOIT SIMARD
494	Development and Implementation of the Experimental Procedure to Examine the Response of CFRP Composites Subjected to a High-intensity Pulsed Electric Field 1693 ROBERT J. HART, OLESYA I. ZHUPANSKA

NANOCOMPOSITES II

- 513 **Carbon Nanotube Based Network Heaters for Composite Adhesive Bonding** 1632
MICHAEL B. JAKUBINEK, MEYSAM RAHMAT, BEHNAM ASHRAFI,
MARC GENEST, BENOIT SIMARD, ANDREW JOHNSTON and CHUN LI
- 524 **A Study of Mechanical Behavior of Polycarbonate Nanocomposites Using Molded Disk Specimens** 1699
YUNFA ZHANG, YADIENKA MARTINEZ-RUBI, SALIM DERDOURI,
BENOIT SIMARD, QI YANG and ANDREW JOHNSTON
- 536 **Effects of Nanoparticles on the Shear Properties of Polymer Composites** 1730
ADDIS TESSEMA, WILLIAM MITCHELL, BEHRAD KOOHBOR,
SURAJ RAVINDRA, ADDIS KIDANE and MICHEL VAN TOOREN

TEMPERATURE EFFECT II

- 544 **A Novel Computational Framework for the Oxidation of C/C Composites Under Thermal Shock** 1600
ALMA L. LEANOS and PAVANA PRABHAKAR
- 561 **Effect of Curing Induced Parameters During Manufacturing of Textile Composites** 1606
MD SHARIFUL ISLAM, A. G. CASTELLANOS
and PAVANA PRABHAKAR
- 568 **Effect of Elevated Temperature on Adhesively Bonded Lightweight Material Single Lap Joints** 1689
ZHIJUN WU, MOUSTAPHA DIAB and SAYED A. NASSAR
- 579 **Thermo-Mechanical Behavior of Spatially Tailored Functionally Graded Materials in a High Temperature Environment** 1690
PHILLIP DEIERLING, OLESYA I. ZHUPANSKA
and CRYSTAL L. PASILIAO

AUTOMOTIVE COMPOSITES I

- 590 **New Method to Analyze Numerical Crash Simulation Data to Assess the Suitability of Hybrid Composite Structures in Automotive Applications** 1554
MICHAEL DLUGOSCH, JENS FRITSCH, DIRK LUKASZEWICZ
and STEFAN HIERMAIER
- 604 **Screw Geometry Design and Performance Effects on Fiber Breakage Study** 1659
CHAO-TSAI HUANG, HUAN-CHANG TSENG, MENG-CHIH CHEN
and JIRI VLCEK

- 614 **Design and Development of Automotive Bumper Subsystem for Light Weight and Vehicular Crashworthiness** 1605
GIOVANNI BELINGARDI, ALEM T. BEYENE, GIADA FALCINELLI
and BRUNETTO MARTORANA

COMPOSITES EDUCATION

- 629 **Extended Lamination Theory for Bridging Laminate Analysis to Composite Structures in Teaching Fundamentals of Composite Materials** 1522
WEN S. CHAN
- 644 **Student Simulation Challenge: A Competition-based Composites Education Opportunity** 1649
KISHORE POCHIRAJU, ENDEL IARVE, BAZLE HAQUE
and MARK PANKOW
- 655 **Composite Catapult Arm Design: A Case Study of Composite Design, Manufacture, and Education** 1782
DAVID MOLLENHAUER, RYAN EMERSON, JOHN CAMPING
and JAMES SANDS
- 674 **Laminate Strain Allowables as Design Parameters in Teaching an Introductory Course on Composite Materials** 1785
RANI W. SULLIVAN and THOMAS E. LACY, JR.

DAMAGE MODELING III

- 682 **Reducing the Notch Sensitivity of Quasi-isotropic layups Using Thin-ply Hybrid Laminates** 1517
MEISAM JALALVAND, GERGELY CZÉL and MICHAEL R. WISNOM
- 691 **Composite Patch Repair of Cracked Aluminum Structures** 1685
XIAODONG CUI, PHILIP LIU, EUGENE FANG, JIM LUA
and DANIEL C. HART
- 707 **Simulation of Progressive Damage in Composites Using the Enhanced Embedded Element Technique** 1758
MATHEW W. JOOSTEN, ANDRIAN MOURITZ, AKBAR AFAGHI KHATIBI,
STEVEN AGIUS, MATTHEW DINGLE, ASHLEIGH DENMEAD,
MICHAEL SILCOCK, BARRY TRIPPIT and CHUN H. WANG

DOW STUDENT PAPERS

- 727 **Characterization of Fracture Properties of Nanographene Reinforced EPON 862 Polymer and Their Carbon Fiber Composites** 1566
ABHISHEK KUMAR
- 743 **Nanoscale Self Assembly of Triblock Copolymers in Epoxy Polymer Composites: A Comparison to Traditional Rubber Toughening** 1707
NICHOLAS T. KAMAR and LAWRENCE T. DRZAL

Page #		Paper ID
760	Smart Hybrid ZnO Nanowire/carbon Fiber Reinforced Polymer Composites with In-situ Structural Health Monitoring Capability.	1721
	AYOUB YARI BOROJENI, MICHAEL PHILEN and MARWAN AL-HAIK	
771	Experimental and Computational Investigations of Hybrid Interfaces in Hybrid Composite Laminates.	1878
	HIEU TRUONG, MARCIAS MARTINEZ, OZDEN OCHOA and DIMITRIS LAGOUDAS	
DURABILITY AND DAMAGE TOLERANCE I		
783	Improving Damage Tolerance with Energy Absorbing Mesh in Composite Laminates: An Experimental Study	1624
	RAVI GONDALIYA, DAE WON KIM and DAVID SYPECK	
794	Damage Tolerance of Sandwich Foam Cores: Experimental Characterization and Numerical Modelling	1703
	LUIGI GIGLIOTTI and SILVESTRE T. PINHO	
811	A Numerical Study on the Effect of Facesheet-Core Disbonds on the Buckling Load of Curved Honeycomb Sandwich Panels	1713
	EVAN J. PINEDA, DAVID E. MYERS, BRETT A. BEDNARCYK and THOMAS M. KRIVANEK	
831	Degradation of Carbon Fiber Composite Materials Due to Electrical Current and Potential Impact on Synergistic Durability.	1716
	MOHAMMAD FAISAL HAIDER, PRASUN K. MAJUMDAR and STEPHANIE ANGELONI	
IMPACT & DYNAMIC RESPONSES III		
848	Characterization of Delamination in Translaminar Reinforced Composites Due to Low Velocity Impact	1552
	VIPUL RANATUNGA, SHREYAS JOGLEKAR, MARK PANKOW and STEPHEN CLAY	
860	Evaluation of Test Methods for Triaxially Braided Composites Using a Meso-scale Finite Element Model	1560
	CHAO ZHANG	
871	Characterization of the Mechanical and Impact Response of a New-Generation 3D Fiberglass Fabric.	1563
	ZOHREH ASAEI and FARID TAHERI	
882	High-Velocity Impact Behavior of Stitched CFRP Laminates	1866
	AKINORI YOSHIMURA, SHO FUKUDA, YASUHITO MIKAMI, RYOHEI TSUJI, MASAHIRO NAKAYAMA, SHINJI OGIHARA, TOSHIO OGASAWARA and NAOYUKI WATANABE	

MULTIFUNCTIONAL COMPOSITES III

- 895 **Enhancement of Electrical Conductivity and Assessment of Thermal and Mechanical Properties of Graphene/Epoxy Nanocomposites** 1530
KAZI AL IMRAN and KUNIGAL N. SHIVAKUMAR
- 912 **High Shear Strain Characterization of Plain Weave Fiber Reinforced Lamina** 1621
MICHAEL E. PETERSON, THOMAS W. MURPHEY
and MAHMOUD REDA TAHA
- 924 **Asymptotical Modelling of Thermopiezoelastic Laminates** 1800
YUFEI LONG and WENBIN YU

AUTOMOTIVE COMPOSITES II

- 944 **Methodology for the Design and Optimization of Hybrid Structures in the Early Phase of Vehicle Development** 1641
MARCO OXENBAUER and KLEMENS ROTHER
- 957 **Cyclic Corrosion of Composite-Based Lightweight Material Single Lap Joints**. 1743
SAYED A. NASSAR and EMAD MAZHARI
- 969 **Non-destructive Evaluation and Bonds Between Fiberglass Composites and Metals** 1828
SELINA ZHAO, KESTUTIS SONTA, DANIEL F. PEREY,
K. ELLIOTT CRAMER and LIBBY BERGER
- 980 **The Flexural Strength and Modulus of a Randomly Oriented Carbon Fiber PEEK Composite**. 1831
MARTIN DUCOTE and ALFRED LOOS

DURABILITY AND DAMAGE TOLERANCE II

- 989 **Micro-Scale Chemical, Morphological and Mechanical Characterization of Polymer-Matrix Textile Composites** 1784
DHRITI NEPAL, GYANESHWAR P. TANDON, TIMOTHY D. BREITZMAN,
RICHARD B. HALL and DAVID MOLLENHAUER
- 998 **High-Speed 3D Digital Image Correlation of Low-Velocity Impacts on Composite Plates**. 1786
MARK D. FLORES, DAVID MOLLENHAUER, VIPUL RUNATUNGA,
TIMOTHY BERBENISS, DANIEL RAPKING and MARK PANKOW
- 1014 **Repeated Tensile Loading of Thin-ply Pseudo-ductile Laminates**. 1815
MICHAEL R. WISNOM, JONATHAN FULLER, PUTU SUWARTA
and GERGELY CZÉL

1022	Experimental and Theoretical Investigation of Discrete Damage and Residual Strength Prediction in Fatigue-Loaded CFRP Specimens	1886
	KEVIN H. HOOS, ENDEL V. IARVE, MICHAEL BRAGINSKY, ERIC ZHOU and DAVID MOLLENHAUER	

IMPACT & DYNAMIC RESPONSES IV

1036	Low Velocity Impact Damage Analysis of Nylon-66 Nanofiber Interleaf Composite Laminate	1550
	HIBA AHMED and KUNIGAL SHIVAKUMAR	
1055	Low Velocity Impact Response of Bio-inspired Fiberglass Woven Composites	1710
	RAVI PRATAP SINGH TOMAR, MAHDI GHAZIZADEH, EARL H. MARTIN and AJIT D. KELKAR	
1064	Impact Performance of a Hybrid ZnO Nanorod/Carbon Nanotube/Carbon Fiber Reinforced Polymer Composite	1722
	AYOUB YARI BOROUJENI, AMIR ALIPOUR SKANDANI, ANAHITA EMAMI and MARWAN AL-HAIK	
1075	Low Velocity Impact Strength of CFRP Composites Incorporating Nanoclay	1766
	SHERIF H. ABOUBAKR, CHRISTINA SALAS and MAHMOUD M. REDA TAHA	

MICROMECHANICS

1086	The Role of Phase Shifts on Homogenized Modulus and Maximum Strength of Woven Laminated Composites	1516
	H. SAM HUANG	
1100	CZM-Based FVDAM Analysis of Damage Evolution in Cross-Ply Laminates	1542
	WENQIONG TU and MAREK-JERZY PINDERA	
1116	Challenge Problems for the Benchmarking of Micromechanics Analysis	1652
	ANDREW J. RITCHEY, JOHNATHAN GOODSSELL, HAMSASEW M. SERTSE, WENBIN YU and R. BYRON PIPES	
1136	Effective Characteristics of Composites with Non-linearly Elastic Components	1671
	ANDREY BEYLE and ANDREW GREEN	
1153	A New Micromechanics Theory for Homogenization and Dehomogenization of Heterogeneous Materials	1798
	BO PENG and WENBIN YU	

PROCESSING I

1172 **Rapid Consolidation and Curing of Advanced Composites with Electron Beam Irradiation** 1496
ROBERT RIZZOLO, DANIEL WALCZYK and JARON KUPPERS

1186 **An Integrated Modeling Approach for Composite Processing**..... 1520
LIANGKAI MA, SIDDHARTH RAM ATHREYA, RUJUL MEHTA, DEV BARPANDA and ASJAD SHAFI

1198 **Electrospun Carbon Nanofibers from Polyacrylonitrile Solution: Influence of Relative Humidity on Morphology and Mechanical Properties**..... 1748
MEHMET S. DEMIRTAS, BIPUL BARUA and MRINAL C. SAHA

1206 **Influence of Skin-core Effects on Residual Stress/Strain Distribution in Thick CFRTP Laminates** 1818
TAKUHEI TSUKADA, KENTAROU IWANAGA, SHU MINAKUCHI and NOBUO TAKEDA

1220 **A Model for Electromagnetic Induction of Composites** 1888
JEROME T. TZENG and KUO-TA HSIEH

ARMOR AND PROTECTION I

1230 **Force Attenuation of Aluminum Foam Core and Stainless Honeycomb Armored Sandwich Specimens Subject to Dynamic Loading** 1612
DANIEL WHISLER and HYONNY KIM

1249 **Mesoscale Simulations of Ballistic Impact: From Woven Fabrics to Unidirectional Composites** 1613
SIDNEY CHOCRON, ALEXANDER J. CARPENTER and JAMES D. WALKER

BONDED JOINT

1260 **Practical and Robust Bonded Joint Analysis Methodology: Application to Durable Redundant Joints**..... 1854
VINAY K. GOYAL, ERIC C. LUNDGREN, OSCAR ESQUIVEL, JACOB I. ROME and JOHN C. KLUG

1274 **Improving the Damage Tolerance of Durable Redundant Joints**..... 1855
ERIC C. LUNDGREN, VINAY K. GOYAL, DHRUV N. PATEL and CATHERINE N. PHAN

1286 **Failure Predictions of Out-of-Autoclave Sandwich Joints with Delaminations under Flexure Loads** 1856
NIKOLAS NORDENDALE, VINAY GOYAL, ERIC LUNDGREN, DHRUV PATEL, BABAK FARROKH, JUSTIN JONES, GRACE FISCHETTI and KENNETH SEGAL

DRZAL SYMPOSIUM I

- 1306 **Plasma Coating of Glass Fibers to Improve the Interfacial Shear Strength in GF/Polyester Composites. 1529**
VLADIMIR CECH, ANTONIN KNOB, TOMAS LASOTA,
JAROSLAV LUKES and LAWRENCE T. DRZAL
- 1321 **An Assessment of the SFFT in Hierarchical Composite Materials 1787**
LUIS A. HERNÁNDEZ-RAMÍREZ, ALEX VALADEZ-GONZÁLEZ
and PEDRO J. HERRERA-FRANCO

IMPACT & DYNAMIC RESPONSES V

- 1339 **Determination of Key Mechanical Properties for Simulating Delamination Damage in Impacted Bonded Joints of Composites. 1608**
R. S. CHOUDHRY, S. LI, R. DAY and SYED F. HASSAN
- 1358 **Study of Low Velocity Impact Damage in CFRP Laminates Using 3D Computed Tomography 1692**
BRANDON M. DEMERATH and OLESYA I. ZHUPANSKA

NANOCOMPOSITES III

- 1376 **Structural CNT Composites Part II: Assessment of CNT Yarns as Reinforcement for Composite Overwrapped Pressure Vessels 1698**
JAE-WOO KIM, GODFREY SAUTI, ROBERTO J. CANO,
RUSSELL A. WINCHESKI, JAMES G. RATCLIFFE,
MICHAEL CZABAJ and EMILIE J. SIOCHI
- 1386 **Structural CNT Composites Part I: Developing a Carbon Nanotube Filament Winder 1788**
GODFREY SAUTI, JAE-WOO KIM, RUSSELL A. WINCHESKI,
ANDREW ANTCZAK, JAMIE C. CAMPERO, HOA H. LUONG,
MICHELLE H. SHANAHAN, CHRISTOPHER J. STELTER
and EMILIE J. SIOCHI
- 1395 **Effect of MWCNTs on Creep of Epoxy for CFRP Deployable Composites. 1867**
AMY GARNER, ARAFAT I. KHAN and MAHMOUD REDA TAHA

PREDICTION & CHARACTERIZATION OF DAMAGE I

- 1407 **An Enriched Shell Element for Delamination Simulation in Composite Laminates 1544**
MARK MCELROY
- 1424 **Challenges in Experimental Validation of Composite Damage Progression Models 1546**
STEPHEN CLAY, VIPUL RANATUNGA, MICHAEL WILKINSON
and PHILIP KNOTH

Page #		Paper ID
1436	Composite Bonded and Bolted Joint Analysis Toolkit Based on Discrete Crack Network	1558
	NEETHI SIMON, EUGENE FANG, PHILLIP LIU and JIM LUA	
 TESTING AND CHARACTERIZATION I		
1456	Buckling Characteristics of Composite Sandwich Plates with Corrugated Core	1533
	RAJESH K. BOORLE and P. K. MALLICK	
1465	Evaluation of Adhesively Bonded Repair and Scarf-Type Infused Repair of Impact Damaged Fiber Reinforced Composites	1769
	ERMIAS G. KORICHO, ANTON KHOMENKO and MAHMOODUL HAQ	
1473	Nonlinear Analysis and Preliminary Testing Results of a Hybrid Wing Body Center Section Test Article	1838
	ADAM PRZEKOP, DAWN C. JEGLEY, MARSHALL ROUSE, ANDREW E. LOVEJOY and HSI-YUNG T. WU	
 ARMOR AND PROTECTION II		
1493	Extending Service Life and Detecting Degradation of Poly(p-phenylene-2,6-benzobisoxazole) (PBO) Fiber	1510
	JEFFREY L. ELLIS, JAY R. SAYRE, KELLY J. JENKINS, TIMOTHY B. HUTSON, RUSSELL E. ANTEL, BYRON TOLBERT, VINCENT MCGINNISS, STEVEN M. RISSER and RACHEL M. THURSTON	
1502	Ballistic Modeling of S-2 Glass/SC-15 Epoxy Composites Using Mesoscale Models	1581
	ALEXANDER J. CARPENTER, SIDNEY CHOCRON and CHARLES E. ANDERSON, JR.	
1510	Comparison Between Numerical and Experimental Results on Ballistic Strength of Multi-layer Fabric Body Armors	1779
	MARIO DIPPOLITO, YOUQI WANG, CHIAN-FONG YEN, JAMES Q. ZHENG and VIRGINIA HALLS	
1522	Modeling Transverse Impact on Multi-Layer UHMWPE Soft Ballistic Armor Pack (SBAP)	1832
	BAZLE Z. (GAMA) HAQUE, MOLLA A. ALI and JOHN W. GILLESPIE, JR.	
 DRZAL SYMPOSIUM II		
1533	Phenylethynyl-Terminated Polyimide (LaRC PETI-5), Exfoliated Graphite Nanoplatelets (xGnP), and Their Composites: An Overview	1607
	DONGHWAN CHO and LAWRENCE T. DRZAL	

Page #		Paper ID
1542	Polylactic Acid Based Blends and Biocomposites with Improved Performance.	1697
	VIDHYA NAGARAJAN, KUNYU ZHANG, MANJUSRI MISRA and AMAR K. MOHANTY	
1553	Advanced Biorefinery Towards a New Innovation in Biocomposites Uses: How Sustainable this Journey is!	1704
	AMAR K. MOHANTY, SINGARAVELU VIVEKANANDHAN and MANJUSRI MISRA	
1562	Exfoliated Graphite Nanoplatelets (xGnP) Based Nanocomposites: Its Past, Present, and Future.	1739
	HIROYUKI FUKUSHIMA and INHWAN DO	
MULTI-MATERIAL JOINING		
1578	A Numerical Study on the Mechanical Behavior of Composite Suture Joint Structure.	1628
	WENZHI WANG, LIJUN HE and WEI MAO	
1587	Development of Reversible Bonded Joints Using Nano-Ferromagnetic Particles	1760
	ERMIAS G. KORICHO, ANTON KHOMENKO, MAHMOODUL HAQ and MICHAEL DAY	
1597	Failure Analysis of Adhesively Bonded GFRP Single Lap Joints After Cyclic Environmental Loading.	1820
	KAORI SAKAI and SAYED A. NASSAR	
NAFEMS		
1610	End-to-End FE Based Homogenization of Woven Composites	1497
	MAXIME A. MELCHIOR, MARC DUFLOT, JEAN-SÉBASTIEN GERARD, SAMUEL MELCHIOR, PHILIPPE HEBERT, LAURENT ADAM and ROGER ASSAKER	
1618	Multi-Scale Modeling of Failure of Continuous Carbon Fiber Composites for Virtual Allowables.	1853
	ANTHONY CHERUET, PHILIPPE HEBERT and LAURENT ADAM	
1632	The Effects of Extrudate Swell, Nozzle Shape, and the Nozzle Convergence Zone on Fiber Orientation in Fused Deposition Modeling Nozzle Flow.	1861
	BLAKE HELLER, DOUGLAS E. SMITH and DAVID A. JACK	
1643	The Integration of Composite Constituent-Level Failure Models During Composite Size Optimization.	1905
	JEFFREY A. WOLLSCHLAGER, ROBERT N. YANCEY, ROGER ASAKER, PIERRE-PAUL JEUNECHAMPS, GUILLAUME BOISOT, JEAN-SEBASTIEN GERARD, FRANK ABDI and MOHIT GARG	

NANOCOMPOSITES IV

- 1661 **Prediction of Fracture Properties in Nanographene Reinforced Polymers Using Atomistic Simulations** 1536
SAMIT ROY and AVINASH REDDY AKEPATI
- 1675 **Modeling of Fracture Behavior in Polymer Composite Using Concurrent Multi-Scale Coupling Approach** 1578
SHIBO LI and SAMIT ROY
- 1691 **Nanowire Stiffening of Woven Composites Towards Enhancing Interlaminar Fracture Toughness**..... 1602
ALEJANDRA CASTELLANOS, MD SHARIFUL ISLAM,
SERGIO QUEVEDO, MOHAMMED A. I. SHUVO,
YIRONG LIN and PAVANA PRABHAKAR
- 1700 **Magnetically Recoverable Antibacterial Silver-Doped Magnetite/Zinc Oxide Core/Shell Composite Nanosheets for Photocatalytic Removal of Pollutants** 1902
C. KARUNAKARAN and P. VINAYAGAMOORTHY

PREDICTION & CHARACTERIZATION DAMAGE II

- 1716 **Certification of Discontinuous Composite Material Forms for Aircraft Structures: Stiffness and Strength Predictions** 1625
KAREN HARBAN and MARK TUTTLE
- 1730 **Limit State Design of Composite Structures Based on Characteristic States in Damage Evolution** 1651
YONGXIN HUANG and RAMESH TALREJA
- 1741 **Experimental Study of the Meso-Scale Heterogeneous Deformation Response of Polymer Composites**..... 1680
BEHRAD KOOHBOR, SURAJ RAVINDRAN and ADDIS KIDANE
- 1751 **Damage Analysis of Laminated Composites with SAMCEF: Validation on Industrial Applications** 1715
MICHAEL BRUYNEEL, JEAN-PIERRE DELSEMME, PHILIPPE JETTEUR,
CÉDRIC LEQUESNE, BENOIT MAGNEVILLE, LOUIS SOPPELSA,
SCOTT MCDUGALL, TADASHI NAITO and YUTA URUSHIYAMA

TESTING AND CHARACTERIZATION II

- 1762 **Allocation of Samples Between Exploration and Replication for Open-Hole-Tension Test** 1679
YIMING ZHANG, RAPHAEL T. HAFTKA, NAM-HO KIM,
JACO F. SCHUTTE and WARUNA P. SENEVIRATNE
- 1775 **Transverse Mechanical Properties of Unidirectional Hybrid Fiber Composites**..... 1762
CHARLES E. BAKIS and MAXIMILIAN J. RIPEPI

Page #		Paper ID
1787	Using Full-Field Measurement Capability of Digital Image Correlation to Assess 3D Properties of Composites.	1869
	GUILLAUME SEON, ANDREW MAKEEV, JULIA CLINE, BRIAN SHONKWILER and ERIAN ARMANIOS	
ARMOR AND PROTECTION III		
1803	Carbon Fiber Textile Composite Solutions for High Speed Armor Piercing Ammunition	1531
	FRANÇOIS BOUSSU, PIERRE GARIN, JONATHAN PARIENTE and SÉBASTIEN LEMERCIER	
1813	Processing and Mechanical Properties Investigation of Epoxy-Impregnated Graphene Paper	1616
	LIGUANG CAI, ALHARITH MANASRAH, AHMED AL-OSTAZ, XIAOBING LI, LAWRENCE T. DRZAL, BRIAN ROOK, ALEXANDER H.-D. CHENG and HUNAIN ALKHATEB	
1832	Nano-Modified Hybrid Recycled Composite: An Alternative for Ballistic Shields	1658
	ALINE OLIVEIRA, VIVIANE MUNHOZ, ELVIS MONTEIRO and ANTONIO ÁVILA	
1846	Dynamic Compressive Response of Polymeric Foams Subjected to Direct Impact Loading	1717
	BEHRAD KOOHBOR, ADDIS KIDANE and WEI-YANG LU	
DRZAL SYMPOSIUM III		
1857	Synthesis of Bipolar Plates for Fuel Cells Based on Exfoliated Graphene Nanoplatelets Filled Polymer Nanocomposites	1515
	XIAN JIANG and LAWRENCE T. DRZAL	
1867	Damping Behavior and Mechanical Property of Graphene Nanoplatelet Paper	1617
	XIAOBING LI, ALHARITH MANASRAH, AHMED AL-OSTAZ, HUNAIN ALKHATEB and ALEXANDER CHENG	
1880	The Effect of Processing on the Electrical Properties of Exfoliated Graphite Nanoplatelet/Polylactic Acid Nanocomposite Films	1677
	ERIN M. SULLIVAN, RICHARD FLOWERS, YUN JU OH, ROSARIO A. GERHARDT, BEN WANG and KYRIAKI KALAITZIDOU	
1889	Polymer Nanocomposite for Strain Resilient Solder	1829
	AJIT K. ROY, CHENGGANG CHEN, SABYASACHI GANGULI and JASON R. FOLEY	

EFFECTS AND DEFECTS

- 1900 **Assessment of Composite Manufacturing Defects—Current Approaches and Future Challenges** 1619
CAIHUA CAO, ALLEN J. FAWCETT, MARK C. IDEN
and ADAM J. SAWICKI
- 1915 **Effect of Manufacturing on the Dielectric Properties of Composite Materials** 1645
JEFFREY BAKER, MOHAMMAD FAISAL HAIDER, RASSEL RAIHAN
and KENNETH REIFSNIDER
- 1924 **Investigation of the Fiber Reinforced Laminates Stiffness Reduction Due to Internal Defects and Matrix Cracks**..... 1724
MOHAMMEDMAHDI SALAVATIAN and LLOYD V. SMITH
- 1930 **Stress and Failure Analysis of Trailing Edge Joints in Wind Turbine Blades Containing Manufacturing Defects** 1746
CHANG CHEN and RAMESH TALREJA

FOAM CORES AND SANDWICHES I

- 1943 **Tensile Properties of Cenosphere/HDPE Syntactic Foams Manufactured Using an Industrial Scale Injection Molding Technique**..... 1498
B. R. BHARATH KUMAR, MRITYUNJAY DODDAMANI
and NIKHIL GUPTA
- 1955 **Stiffness and Strength Models for Rigid PVC Structural Foams** 1575
KING HIM LO, AKIRA MIYASE and SU SU WANG
- 1975 **Test Method Development, Deformation and Failure Strength of Rigid PVC Structural Foams** 1584
AKIRA MIYASE and SU SU WANG
- 1996 **Characterization and Simulation of Divinycell H80 Closed-Cell Foam**..... 1687
ALI A. SAEID and STEVEN L. DONALDSON

MULTISCALE MODELING I

- 2013 **Multi-Scale Characterization of an Adhesive Bondline with Fabrication Induced Defects**..... 1572
EUGENE FANG, JIM LUA, YONGJIE JESSICA ZHANG, YICONG LAI
and WARUNA SENEVIRATNE
- 2022 **Remove Homogeneous Layer Assumption from Lamination Theories** 1799
BO PENG and WENBIN YU
- 2037 **Loss of Accuracy Using Smeared Properties in Composite Beam Modeling**..... 1801
NING LIU and WENBIN YU

Page #		Paper ID
2055	Experimental and Theoretical Evaluation of Stiffness Properties of Fused Deposition Modeling Parts	1850
	T. OSBORN, E. ZHOU, R. GERZESKI, D. MOLLENHAUER, G. P. TANDON, T. J. WHITNEY and E. V. IARVE	
 ONR I		
2065	Whole Field 3D Internal Strain Distribution in a Composite Beam Under Three-Point Bent	1811
	FU-PEN CHIANG and LINGTAO MAO	
2073	Role of Microstructure and Sea Water Confinement on Damage Evolution of Vinyl Ester Based Carbon Fiber Marine Composites	1862
	AKAWUT SIRIRUK and DAYAKAR PENUMADU	
 STRUCTURAL RESPONSE		
2085	Equivalent Mechanical and Thermal Properties of Composite Materials in Lamina, Laminate and Structure Levels	1523
	KAMRAN TAVAKOLDAVANI, PETER L. LEBOULLUEC and WEN S. CHAN	
2101	Dynamic Behavior of Metacomposites	1573
	K. T. TAN	
2109	A Bridge Between Finite Element and Shear Lag Analyses for Fiber Pull Out	1688
	GEORGE AVERY and WILLIAM T. RIDDELL	
2122	A Novel Composite Tube Design with Bend-Twist Coupling	1883
	SEAN ROHDE, PETER IFJU and BHAVANI SANKAR	
 DRZAL SYMPOSIUM IV		
2136	Use of Electrochemical Impedance Spectroscopy to Monitor Delamination and Moisture Uptake in CFRP-Reinforced Concrete Structures	1540
	GUY D. DAVIS, MICHAEL J. RICH and LAWRENCE T. DRZAL	
2148	Functionalization of Graphene and Its Reinforced Nanocomposite	1629
	WANJUN LIU and LAWRENCE T. DRZAL	
2156	Barrier and Mechanical Property Enhancement of High Density Polyethylene Through the Addition of Graphene Nanoplatelets	1675
	KEITH HONAKER, LAWRENCE DRZAL and FREDERIC VAUTARD	
2166	Optimized Fiber-Reinforced Polymer Composites for High-Performance Applications: Toughening of Aromatic Epoxy Polymers via Aliphatic Epoxy Copolymers	1676
	MARKUS A. DOWNEY and LAWRENCE T. DRZAL	

- 2176 **Tailorable Adhesives for Multi-material Joining, Facile Repair and Re-assembly** 1757
 MAHMOODUL HAQ, ERMIAS G. KORICHO, ANTON KHOMENKO, RICHARD GERTH and LAWRENCE T. DRZAL

GENERAL TOPIC

- 2186 **Creep Behavior of Insulated Concrete Sandwich Panels** 1755
 PAUL M. HOPKINS, THOMAS NORRIS, AN CHEN and MOSTAFA YOSSEF
- 2201 **Effective Width of Insulated Sandwich Panels with Flexible FRP Shear Connectors Considering Partial Degree of Composite Action.** 1756
 MOSTAFA YOSSEF and AN CHEN
- 2220 **A Study on Failure Behavior of Unidirectional Carbon Fiber Reinforced Thermosetting and Thermoplastic Composite** 1824
 YAN MA, TOSHI SUGAHARA, YIYI ZHANG, YUQIU YANG and HIROYUKI HAMADA
- 2230 **Effect of Water on the Mechanical Properties of Fiber Reinforced Polymers.** 1859
 ASHLEY L. SHEPP, SCOTT K. PEDERSEN, KEVIN D. DAHM and WILLIAM T. RIDDELL

MOLECULAR MODELING I

- 2244 **Understanding the Damage of Polymer Matrix Composites by Integrating Chemical, Morphological and Mechanical Properties** 1881
 DHRITI NEPAL, ALLISON ECKER, STEVE BARR, JAMES MOLLER, JACK CHALKER, BRITTANIE ROOTH, EVAN MUNGALL, GARY KEDZIORA, RAJIV BERRY and TIM BREITZMAN
- 2257 **Mechanical Properties of Graphene Nanoplatelet/Carbon Fiber/Epoxy Hybrid Composites: Multiscale Modeling and Experiments** 1661
 CAMERON M. HADDEN, DANIELLE R. KLIMEK-MCDONALD, EVAN J. PINEDA, JULIE A. KING, ALEX M. REICHANADTER, IBRAHIM MISKIOGLU, S. GOWTHAM and GREGORY M. ODEGARD
- 2273 **Fracture of Carbon Nanotube—Amorphous Carbon Composites: Molecular Modeling** 1802
 BENJAMIN D. JENSEN, KRISTOPHER E. WISE and GREGORY M. ODEGARD
- 2289 **Computational Design of Carbon Enriched Ceramics for Improved Strength and Toughness** 1733
 SHEIKH FAHAD FERDOUS and ASHFAQ ADNAN

- 2300 **Viscoelastic Response of Microtubule—Tau Proteins Assembly During Axonal Stretch: Combined Atomistic and Continuum Predictions** 1879
ASHFAQ ADNAN, SIDDIQ QIDWAI and AMIT BAGCHI

MULTISCALE MODELING II

- 2310 **WSFE-based User-Defined Elements in ABAQUS for Modeling 2D Laminated Composites with Complex Features** 1665
ASHKAN KHALILI, DULIP SAMARATUNGA, RATNESHWAR JHA, THOMAS E. LACY and S. GOPALAKRISHNAN
- 2321 **Computationally Efficient Solution of the High-Fidelity Generalized Method of Cells Micromechanics Relations**..... 1700
TRENTON M. RICKS, THOMAS E. LACY, JR., EVAN J. PINEDA, BRETT A. BEDNARCYK and STEVEN M. ARNOLD
- 2333 **Effect of Notch-Induced Strain Gradients on the Applicability of Multiscale Approaches for Woven Composites**..... 1742
GEETA MONPARA, DON H. ROBBINS, JR. and RAY S. FERTIG III

ONR II

- 2342 **Mechanical Performance of Fiber-reinforced Polymer Composites Under Concurrent Hygro-thermo-mechanical Loading**..... 1750
ROBERT PIRES, STEPHANIE ZHU, BENTOHOLDA DAVOODI, VALERIA LA SAPONARA and ANASTASIA MULIANA
- 2351 **Seawater Effects on Transverse Tensile Properties of a Carbon/Vinylester Composite**..... 1780
MARYANN FICHERA, KYLE TOTTEN and LEIF A. CARLSSON
- 2361 **Dynamic Response of Composite Plates Moving in Water**..... 1810
Y. W. KWON, S. C. MILLHOUSE, S. C. KNUTTON and S. ARCENEUX
- 2372 **The Effect of Single Fiber Elastic Modulus Distribution and Modulus Strain Dependency on Carbon Fiber Tow Behavior** 1865
MATTHEW KANT and DAYAKAR PENUMADU

PROCESSING II

- 2382 **Prediction of Capillary Pressure for Resin Flow within Fiber Unit Cells** 1576
MICHAEL YEAGER, WOOK RYOL HWANG and SURESH ADVANI
- 2396 **Permeability of Glass Fabric Reinforced Vinyl Ester Composite by VARIM Process**..... 1583
ETHAN PEDNEAU and SU SU WANG

Page #		Paper ID
2416	Effects of Processing Conditions on Mechanical Properties of Quartz/BMI Laminates	1744
	KEITH R. HURDELBRINK II, JACOB P. ANDERSON, ZAHED SIDDIQUE and M. CENGIZ ALTAN	
2425	Ultrasonic Energy Assisted Synthesis of Zinc Oxide Nanoparticles	1751
	JOSHUA W. WEBSTER, BIPUL BARUA and MRINAL C. SAHA	
2433	Internal Strain Monitoring of Vacuum Bag Only Process Using Optical Fiber Sensors	1863
	KAZUNORI TAKAGAKI, SHINSAKU HISADA, SHU MINAKUCHI and NOBUO TAKEDA	
BIOCOMPOSITES I		
2444	Modeling Arterial Walls as Composite Structures, and Their Interaction with Pulsatile Blood Flow	1582
	MARTINA BUKAC, SUNCICA CANIC and BORIS MUHA	
2452	Two-component Dissipative Particle Dynamics Model of Red Blood Cell Membranes	1622
	ZHANGLI PENG, XUEJIN LI, IGOR PIVKIN and GEORGE KARNIADAKIS	
2460	Thermal Properties of Mycology Materials	1633
	SONIA TRAVAGLINI, C. K. H. DHARAN and PHILIP G. ROSS	
FOAM CORES AND SANDWICHES II		
2476	Tribological Response of Cenosphere/Epoxy Syntactic Foams	1503
	VYASARAJ MANAKARI, GURURAJ PARANDE, KEERTI BAFNA, MRITYUNJAY DODDAMANI and NIKHIL GUPTA	
2487	Influence of Exothermic and Endothermic Chemical Foaming Agents on the Physical and Mechanical Properties of the Polypropylene-Based Thermoplastic Structures	1518
	MOHAMMADREZA AZAD, MEHDI HOJJATI and HOSSEIN BORAZGHI	
2499	Fixed Stiffness Weight and Cost Tradeoff of Hybrid Sandwich Structures	1738
	ADEL I. SALEM and STEVEN L. DONALDSON	
MOLECULAR MODELING II		
2519	Applying Reactive Molecular Dynamics to Predict and Compare the Mechanical Response of Di-, Tri-, and Tetra-functional Resin Epoxies	1663
	M. S. RADUE, B. D. JENSEN, S. GOWTHAM, G. M. ODEGARD, D. R. KLIMEK and J. A. KING	
2530	Computational Design and Mechanical Behavior of Carbon Nanotube Reinforced LDPE/Nylon 6 Hybrid Polymer Nanocomposites	1734
	ASHFAQ ADNAN, SHEIKH F. FERDOUS and MUJIBUR R. KHAN	

- 2541 **A Computational Approach for Linking Molecular Dynamics to Finite Element Simulation of Polymer Chains in Polyethylene Fibers** 1836
 SANJIB C. CHOWDHURY, JEFFREY STANISZEWSKI, EVAN M. MARTZ, RAJA H. GANESH, SUBRAMANI SOCKALINGAM, BAZLE Z. (GAMA) HAQUE, TRAVIS A. BOGETTI and JOHN W. GILLESPIE, JR.

NDT AND HEALTH MONITORING I

- 2556 **Quantitative NDE of Composite Structures at NASA** 1623
 K. ELLIOTT CRAMER, CARA A. C. LECKEY, PATRICIA A. HOWELL, PATRICK H. JOHNSTON, ERIC R. BURKE, JOSEPH N. ZALAMEDA, WILLIAM P. WINFREE and JEFFERY P. SEEBO
- 2566 **Time Reversal Microwave Methods for Detecting Disbonds in Adhesively Bonded Metal-composite Structures** 1826
 SAPTARSHI MUKHERJEE, MAHMOOD HAQ and LALITA UDPA
- 2580 **Guided Wave Structural Health Monitoring for Impact Damage Detection and Characterization** 1864
 GERGES DIB, OLEKSII KARPENKO, ERMIAK KORICHO, MAHMOODUL HAQ, LALITA UDPA and SATISH UDPA

PREDICTION & CHARACTERIZATION OF DAMAGE III

- 2592 **Quantitative Description of Damage Evolution and Property Degradation of Fiber Reinforced Composite Materials** 1711
 PRASUN K. MAJUMDAR, JALLISA CLIFFORD, MOHAMMAD FAISAL HAIDER and KENNETH REIFSNIDER
- 2604 **3D Progressive Damage Modeling for Laminated Composite Based on Crack Band Theory and Continuum Damage Mechanics** 1729
 JOHN T. WANG, EVAN J. PINEDA, VIPUL RANATUNGA and STANLEY S. SMELTZER
- 2621 **On Nonlocal Mechanics Based Ultrasonic Methods for the Detection of Inception of Damage in Composites** 1775
 SUBIR PATRA and SOURAV BANERJEE

TEXTILE COMPOSITES I

- 2632 **Experimental and Numerical Analysis of Triaxially Braided Composites Utilizing a Modified Subcell Modeling Approach** 1545
 CHRISTOPHER CATER, XINRAN XIAO, ROBERT K. GOLDBERG and LEE W. KOLHMAN
- 2652 **Modeling of 3D Woven Composites with Realistic Geometry for Accurate Prediction of Kinking under Compressive Loads** 1577
 SHREYAS JOGLEKAR and MARK PANKOW

Page #		Paper ID
2672	Simulation of the Manufacturing Process of Braided Composite Tubes for Realistic Microstructure Representation.	1696
	CHRISTIAN HEINRICH and ANTHONY M. WAAS	
 BIOCOMPOSITES II		
2690	Biochar and Its Size Effects on Polyamide 6/Biochar Composites	1521
	TIM HUBER, MANJUSRI MISRA and AMAR KUMAR MOHANTY	
2708	The Opportunities of Biofuel Coproducts in Value-Added Biocomposite Applications	1749
	NIMA ZARRINBAKHSI, AMAR K. MOHANTY and MANJUSRI MISRA	
2720	Evaluation of Mechanical and Interfacial Properties of Individual Lignin Carbon Fiber and Composites	1851
	NATHAN MEEK, DAYAKAR PENUMADU, DAVID HARPER, OMID HOSSEINAEI and TIMOTHY RIALS	
 FOAM CORES AND SANDWICHES III		
2737	Influence of Multiwalled Carbon Nanotube on Mixed Mode Fracture of Sandwich Composite	1642
	ALAK KUMAR PATRA and NILANJAN MITRA	
2751	Facesheet to Core Interface Characterization of Sandwich Structures	1686
	ALI A. SAEID and STEVEN L. DONALDSON	
 MOLECULAR MODELING III		
2767	Partially Reacted Substructures Method for Thermoset Epoxies Studied Using Molecular Dynamics Simulations.	1723
	CHANGWOON JANG, MAJID SHARIFI, GIUSEPPE R. PALMESE and CAMERON F. ABRAMS	
2776	Effect of Cross-Linker Length of EPON 828 Resin Properties Using Molecular Dynamics Simulation	1835
	SANJIB C. CHOWDHURY, ROBERT M. ELDER, TIMOTHY W. SIRK, BAZLE Z. (GAMA) HAQUE, JAN W. ANDZELM and JOHN W. GILLESPIE, JR.	
2789	A Computational Molecular Dynamic Study on Epoxy-Based Network: Thermo-Mechanical Properties	1906
	OLANREWAJU ALUKO, S. GOTHAM, SORAYOT CHINKANJANAROT, MATTHEW RADUE and GREGORY M. ODEGARD	
2802	Computational Insights into High Strain Rate Self-stiffening Mechanism in Nacre	1774
	JIALIN LIU, XIAODONG LI and YUE QI	

NDT AND HEALTH MONITORING II

- 2813 **Vibration Characteristics and Damage Detection of Composite Structures with Anisotropic Damage Using Unified Particle Swarm Optimization Technique** 1569
T. R. JEBIESHIA, D. K. MAITI and D. MAITY
- 2833 **Ultrasonic and X-ray Inspection of a High Performance Carbon Fiber Composite for Automotive Applications** 1662
CAMERON J. DASCH, GEORGE J. HARMON and MARTIN H. JONES
- 2843 **Non-Destructive X-ray Computed Microtomography Inspection of Composites Containing Manufacturing Defects** 1684
JEFFREY T. CHAMBERS and KONSTANTINE A. FETFATSIDIS

PREDICTION & CHARACTERIZATION OF DAMAGE IV

- 2853 **Quantitative Acoustics Approach for Damage Detection in Hard Armor Protective Inserts** 1770
SHANE ESOLA, IVAN BARTOLI, SUZANNE E. HORNER,
JAMES Q. ZHENG and ANTONIOS KONTOSOS
- 2865 **Three-Dimensional Analysis of Damage Propagation in Unidirectional Polymer Composites Using X-ray Computed Tomography and Digital Volume Correlation** 1830
SIRINA SAFRIET, TORIN QUICK, DAVID MOLLENHAUER
and CHAD RYTHER
- 2875 **Tortuosity of Fracture Surfaces in Composite Microstructures** 1887
TIMOTHY D. BREITZMAN and ERIC ZHOU

TEXTILE COMPOSITES II

- 2883 **Mechanical Properties and Initial Fracture Behavior of Multilayer Laminated Intra-Hybrid Woven Fabric Composite** 1588
ZHILAN XU, DAIKI ICHIKAWA, YAN MA, YUQIU YANG
and HIROYUKI HAMADA
- 2896 **Dynamic Yarn Pull-Out from In- and Out-of-Plane Directions** 1599
ZHERUI GUO, JIHYE HONG, JAMES ZHENG and WEINONG CHEN
- 2916 **Composite Belleville Springs** 1808
WATCHARAPONG PATANGTALO, MICHAEL W. HYER
and SONTIPEE AIMMANEE
- 2935 **Progressive Damage and Failure Responses of Hybrid 3D Textile Composites Subjected to Dynamic Flexural Loading** 1873
DIANYUN ZHANG, ANTHONY M. WAAS and CHIAN-FONG YEN