

Programme of the 45th Risø International

Symposium on Materials Science:

**Advancement in composites through characterisation,
modelling and digitalisation**

September 1st-4th, DTU Risø campus



Organizing committee: Ruben I. Erives, Rob Pierce, Lars P. Mikkelsen, Maksim Larionov, Rajnish Kumar

Introduction

The focus of the 45th Risø symposium is on the advancement of composites materials. As such, all the fields and applications related to composite materials are welcomed. In particular, this symposium will consider multiple length scales, from fiber/matrix to components with an emphasis on composite mechanics, testing and processing.

Acknowledgement

The 45th International Risø Symposium on Material Science is organised by the Wind Energy Materials and Components Division at the Department of Wind and Energy Systems, Technical University of Denmark (DTU).

The Horizon Europe, the European Union's Framework Programme for Research and Innovation, grant Agreement No. 101058054: Towards tURbine Blade production with zero waste (**TURBO**), <https://turboproject.eu/>, is organizing and financing the 4th day of the Symposium, which is greatly acknowledged.

We would also like to acknowledge the Danish Center for Applied Mathematics and Mechanics (DCAMM) <http://www.dcammm.dk/> for their financial support in the organization of the symposium.

Links in the program:

Links on presenter names: Link to presenter video (if available)

Links on titles: Link to paper (if available)

Link to the entire proceedings: [Issue 1 - Volume 1338 - IOP Conference Series: Materials Science and Engineering - IOPscience](#)

Link to pictures: [pictures](#)

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<https://www.conferencemanager.dk/45thsymposium/>

Program overview and symposium topics

The colour code is the following:

Mechanics ■ Testing ■ Processing ■

	Monday sep-01	Tuesday sep-02	Wednesday sep-03	Thursday sep-04
09:00-10:10	Arrival	M1: Fatigue Fracture and Damage 1	M4: Composite Strength 1	P3: Infusion
10:10-10:30	10:00 welcome address	Coffee break		
10:30-11:40	T1: Small-scale testing 1	M2: Fatigue Fracture and Damage 2	M5: Composite Strength 2	P4: Curing
11:40-12:00	Coffee break			
12:00-13:00	T2: Small-scale testing 2	M3: Fatigue Fracture and Damage 3	P2: Environmental Effects/Degradation	P5: Infusion & Curing
13:00-14:00	Lunch			13:00 Award presentations
14:00-15:30	T3: Structural testing	P1: Bio-based and Recycling	Mini oral presentations	13:05 Closing remarks
15:30-15:50	Coffee break	15:30 Group photo	Visit lab facilities	13:15 Lunch
15:50-17:20	T4: NDT, X-ray and Tomography 1	15:45 Bus 16:00 Social event 18:00 Conf dinner 22:00 Bus	17:00 Poster session & and finger-food	

Day 1 (Monday, September 1st):	
09:00-10:00	Arrival and Coffee
10:00-10:30	Opening Remarks & Welcome Address
10:30-11:40	Session T1: Small-scale Composite Testing 1 (<i>Chairperson: Soraia Pimenta</i>)
	<p>10:30-11:00 Keynote - Soraia Pimenta (Imperial College London), <i><u>Virtual testing of real composite microstructures</u></i></p> <p>11:00-11:20 Rajnish Kumar (DTU Wind) <i>Influence of non-constant fibre cross-sectional area on Weibull analysis of fibre strength</i></p> <p>11:20-11:40 Beth Malone (University of Strathclyde) <i>Investigating the contribution of physical versus chemical adhesion in the measured value of the fibre-matrix interfacial shear strength of glass-epoxy composites</i></p>
11:40-12:00	Coffee break
12:00-13:00	Session T2: Small-scale Composite Testing 2 (<i>Chairperson: Ashish K. Bangaru</i>)
	<p>12:00-12:20 Jesse Savolainen (Tampere University) <i>Microbond data analysis: comparative assessment of different approaches to determine IFSS</i></p> <p>12:20-12:40 Anthony Fraisse (DTU Wind) <i>Precision of thermographic surface temperature measurements on composite materials considering convective heat transfer</i></p> <p>12:40-13:00 Andreas J. Brunner (ETH-Rat) <i>Size-estimates for distributions of microscopic damage from fracture tests on fiber-reinforced polymer-matrix composites: Insight from acoustic emission monitoring</i></p>
13:00-14:00	Lunch
14:00-15:30	Session T3: Structural Testing (<i>Chairperson: Philipp Haselbach</i>)
	<p>14:00-14:30 Keynote - <u>Xiao Chen</u> (DTU Wind), <i><u>Virtual testing for failure prediction of large-scale composite wind turbine blades</u></i></p> <p>14:30-14:50 Erik Lund (Aalborg University) <i>Inclusion of fatigue constraints in structural optimization of wind turbine blades</i></p> <p>14:50-15:10 David Melcher (Fraunhofer Institute for Wind Energy Systems IWES) <i>Elliptical biaxial testing: Overcoming the limitations of uniaxial methods in wind turbine rotor blade fatigue assessment</i></p> <p>15:10-15:30 Sebastian Hermansen (Gurit/Aalborg University) <i>On the use of structural optimization to drive the transition to sustainable core materials in wind turbine blades</i></p>
15:30-15:50	Coffee Break

15:50-17:20	Session T4: NDT, X-Ray and Tomography 1 (<i>Chairperson: Janice M. Barton</i>)
	<p>15:50-16:20 Keynote - Janice M. Barton (University of Bristol), <i>Can thermoelastic stress analysis be used for quantitative studies of CFRP components?</i></p> <p>16:20–16:40 Ramesh Talreja (Texas A&M University System) <i>Stress wave factors for assessing transverse cracking and delamination in cross ply laminates</i></p> <p>16:40–17:00 Valter Carvelli (Politecnico di Milano) <i>2D Convolutional neural network and laser ultrasonic imaging for delamination detection in CFRP laminates</i></p> <p>17:00–17:20 Steen Arnfred Nielsen (Force Technology) <i>Hybrid NDT strategies for wind turbine blades: Combining robotic ultrasonic inspection with aerial imaging to enhance resilience and reduce service costs</i></p>

Day 2 (Tuesday, September 2nd):	
09:00-10:10	Session M1: Fatigue Fracture and Damage 1 (<i>Chairperson: Ramesh Talreja</i>)
	<p>09:00-09:30 Keynote - Bent F. Sørensen (DTU Wind), <i>Advancement of composites by enhancing damage tolerance in composite materials</i></p> <p>09:30–09:50 Jan Keck (German Aerospace Center DLR) <i>Simulation-based design of mixed-mode specimens for fracture mechanics tests on fiber-metal laminates</i></p> <p>09:50–10:10 Helmuth L. Toftegaard (DTU Wind) <i>J integral solution for a fracture specimen including residual stresses and graded materials</i></p>
10:10-10:30	Coffee break
10:30-11:30	Session M2: Fatigue, Fracture and Damage 2 (<i>Chairperson: Kristine M. Jespersen</i>)
	<p>10:30–10:50 Rubén I. Erives (DTU Wind) <i>Numerical study of the transition from stable to unstable crack propagation of composites with fibre bridging</i></p> <p>10:50–11:10 Joran van Blokland (Swedish University of Agricultural Sciences) <i>Fracture resistance of wood adhesive bonds: Experimental insights into the J-integral approach using acoustic emission testing</i></p> <p>11:10–11:30 Pouya Valizadeh (Ferdowsi University of Mashhad) <i>From modal parameters to residual Stiffness: A hybrid analytical-experimental approach to fatigue damage modelling in laminated composites</i></p>

11:40-12:00	Coffee break
12:00-13:00	Session M3: Fatigue Fracture and Damage 3 (<i>Chairperson: Bent F. Sørensen</i>)
	<p>12:00–12:20 Nicolas Dubary (DTU Wind) <i>Repair potential of recyclable resins and the impact on fatigue performance</i></p> <p>12:20–12:40 Morten Fogtmann Kristiansen (Aarhus Universitet) <i>Transforming load-controlled fatigue test data into a strain-based S-N curve: Results for unidirectional non-crimp glass fiber/epoxy composites tested in tension–tension</i></p> <p>12:40–13:00 Steffen Rasmussen (DTU Wind) <i>Development of a new generation of specimens for high-frequency fatigue characterization of high-performance fiber-polymer composite materials</i></p>
13:00-14:00	Lunch
14:00-15:30	Session P1: Bio-based and Recycling (<i>Chairperson: Aart van Vuure</i>)
	<p>14:00-14:30 Keynote - <u>Aart van Vuure</u> (KU Leuven), <i><u>Understanding and improving hygro-thermal durability of bio-based composites for structural applications</u></i></p> <p>14:30–14:50 Kristine Munk Jespersen (DTU Wind) <i>Polymer composites with short recycled glass fibres for wind turbine nacelle cover application</i></p> <p>14:50–15:10 Bo Madsen (DTU Wind) <i>Manufacturing of Sustainable Sisal Fibre Composites by Filament Winding and Compression Moulding</i></p> <p>15:10–15:30 Rafael Carnicero Gómez (Centro de Investigaciones Energéticas, Medioambientales y Tecnológicas) <i>Manufacturing of a sustainable wind turbine blade with the recovery materials from original blade</i></p>
15:30-15:45	Group Photo
16:00-17:30	Social event
18:00-22:00	Conference Dinner

Day 3 (Wednesday, September 3rd):	
09:00-10:10	Session M4: Composite Strength 1 (<i>Chairperson: Albert Turon</i>)
	<p>09:00-09:30 Keynote - Abert Turon (University of Girona), <i>Characterization and modelling of delamination with large fracture process zone</i></p> <p>09:30–09:50 Can Muyan (Leibniz Universitat Hannover) <i>Comparison of numerical approaches for the strength prediction of an open hole tension laminate</i></p> <p>09:50–10:10 Ole Ferguson (DTU Wind) <i>Fuzz ball defects in unidirectional carbon fibre-reinforced pultruded profiles: Numerical compressive strength predictions</i></p>
10:10-10:30	Coffee break
10:30-11:30	Session M5: Composite Strength 2 (<i>Chairperson: Lars P. Mikkelsen</i>)
	<p>10:30–10:50 Pinelopi Mageira (DTU Wind) <i>From 3D X-ray CT scans to mesh independent numerical compressive strength predictions of uni-directional carbon fiber composites</i></p> <p>10:50–11:10 Adriaan R. van Roosmalen (Xnovo Technology) <i>Enhanced characterization of fiber orientation in CFRP profiles using X-ray scattering tensor tomography</i></p> <p>11:10–11:30 Souvik Chakraborty (German Aerospace Center, DLR) <i>Erosion in wind turbine blades during service life: A quantification approach</i></p>
11:40-12:00	Coffee break
12:00-13:10	Session P2: Environmental Effects/Degradation (<i>Chairperson: Nick Warrior</i>)
	<p>12:00-12:30 Keynote - <u>Nicholas Warrior</u> (University of Nottingham), <i>The future of composites manufacturing</i></p> <p>12:30–12:50 Melissa Walter (Hamburg University of Technology) <i>Environmental and chemical ageing of epoxy resins cured with bio-based amino acids</i></p> <p>12:50–13:10 Dennis Gibhardt (Hamburg University of Technology) <i>Single-sided water absorption in thick GFRP structures: Mechanical effects and diffusion monitoring by integrated smart sensors</i></p>
13:00-14:00	Lunch
14:00-14:45	<p>Mini-oral presentations (3 min. per presenter) (<i>Chairperson: Ruben I. Erives</i>)</p> <ul style="list-style-type: none"> • Basem Rajjoub (Leibniz Universitat Hannover) <i>On the role of random number generation algorithms in the micromechanical modeling of fiber</i>

	<p><i>composites</i></p> <ul style="list-style-type: none"> • Abdul Wasay Khan (Leibniz Universitat Hannover) <i>Deciphering AI behaviors in microstructural material modeling of composites using diffusion models</i> • Anna Letcher Hartman (DTU Wind) <i>Terahertz cross-correlation spectroscopy for non-destructive testing of thick glass fiber epoxy composites</i> • Rasmus Kaalund Schøn (DTU Wind) <i>From factory to field: Failure analysis of wind turbine blade with manufacturing uncertainties</i> • August Prahll (DTU Construct) <i>Ultrasonic spot welding for binder-stabilised glass-fibre preform manufacturing</i> • Maksim Larionov (DTU Wind) <i>Analysis of the flow interaction between fiber-reinforcement fabrics and the open channels in core materials for the vacuum infusion of composite sandwich structures</i> • Davide Angelini (Politecnico di Torino) <i>High-fidelity meshing and stochastic simulation for enhanced surface stress concentration prediction</i> • Miguel Camacho (Universitat Politecnica de Valencia) <i>Reinforcement learning for synchronised flow control in a dual-gate resin infusion system</i> • Hans-Henrik Benzou (DTU Wind) <i>Sliding Spectrum extraction of simulated elastic waves for damage location in composites</i>
15:15-16:45	Visit to lab facilities
17:00-19:30	Poster Session, Networking and Finger-Food

Day 4 (Thursday, September 4th – Half Day) Organized by EU Horizon: TURBO Project: Free TURBO Day	
09:00-10:10	Session P3: Infusion (<i>Chairperson: Rob Pierce</i>)
	<p>09:00-09:30 Keynote - <u>Grégoire Lebreton</u> (Siemens Gamesa Renewable Energy), <i>Reducing repairs on wind turbine blades through casting process improvements</i></p> <p>09:30-09:50 Jesper Lisegaard (DTU Construct) <i>Resin flow models for reinforcement learning for optimal control of LCM</i></p> <p>09:50-10:10 Charlie Yelland (National Composites Centre) <i>Targeting cost-effective and efficient infusion control with advanced sensing modelling</i></p>
10:10-10:30	Coffee Break
10:30-11:40	Session P4: Curing (<i>Chairperson: Lars P. Mikkelsen</i>)
	<p>10:30-10:50 Nikos Pantelelis (Synthesites) <i>Industrial and intelligent process monitoring to reduce defects and shorten the cure cycle</i></p> <p>10:50-11:10 Jesper Kjær Jørgensen (DTU Wind) <i>How geometrical imperfections and thermal gradients affect wrinkle formation during curing of thick composite laminates</i></p> <p>11:10-11:30 Lisa-Marie Brand (German Aerospace Center, DLR) <i>Evaluating water-based release agents through full-scale demolding test for wind turbine rotor blades</i></p>
11:40-12:00	Coffee break
12:00-13:00	Session P5: Infusion & curing (<i>Chairperson: Tom L. Andersen</i>)
	<p>12:00-12:20 Doug Cairns (Montana State University) <i>Stretch broken carbon fiber for primary composite structures</i></p> <p>12:20-12:40 Debabrata Adhikari (DTU Construct) <i>Reduced order model and high-fidelity CFD simulation of resin infusion within fiber layups for fast determination of meso-scale permeability</i></p> <p>12:40-13:00 Lucie Laborderie (DTU Wind) <i>Investigation and development of experimental methods for the characterisation of flow mesh permeability</i></p>
13:00-13:05	Award for young researchers (best paper, best presentation, and best poster)
13:05-13:15	Closing Remarks & Conference Summary
13:15-14:00	Lunch