



TexComp-15

11–13 Sep 2024 Leuven, Belgium

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Welcome

It is a great honour to welcome TexComp back to KU Leuven. Our university was founded 600 years ago, with the first lectures held in the weavers' hall, which had become obsolete due to a crisis in the local wool weaving industry at the end of the 14th century. Textiles, therefore, played a crucial role in Leuven's transition from a prosperous medieval city to one of the intellectual centers of Europe.

TexComp is an international conference dedicated to composites reinforced with textiles and other materials featuring complex fibrous architectures. Textiles offer a unique opportunity to control composite properties through reinforcement design and manufacturing, as well as cost advantages. These benefits have led to the widespread use of composites with architectured fibrous reinforcement in aeronautics, automotive, civil engineering, marine, medicine, sports, wind energy, and other applications. The TexComp conferences were initiated by Prof. Ignaas Verpoest in 1992 in Leuven and have since toured the world.

We hope you will experience the spirit of "convivialité" – the friendly and intensive collaboration from all corners of the world. This friendship, "composites without borders," is our greatest asset and will have the most enduring impact on all of us, even when our papers, patents, and presentations are covered with the dust of oblivion.

TexComp-15 Chairs

Stephen Hallett, Stepan Lomov, Mahoor Mehdikhani, Yentl Swolfs





Organising Committee

Conference Chairs



Stephen R. Hallett

University of Bristol United Kingdom



Stepan V. Lomov

KU Leuven Belgium



Mahoor Mehdikhani

KU Leuven Belgium



Yentl Swolfs

KU Leuven Belgium

Local Organising Committee



Sina A. Aghbash

KU Leuven Belgium



Christian Breite

KU Leuven Belgium



Thanasis Chatziathanasiou

KU Leuven Belgium



Rui Guo

KU Leuven Belgium



Shailee Upadhyay

KU Leuven Belgium



Volunteers

Anna Kandinskaia

KU Leuven, Belgium

Alp Sik

KU Leuven, Belgium

Susana Garcia Mayo

KU Leuven, Belgium

Panayiotis Tsokanas

KU Leuven, Belgium

Salaheddine Madi

KU Leuven, Belgium

Elise Van Vlierberghe

KU Leuven, Belgium

David Seveno

KU Leuven, Belgium

Jiakuan Zhou

KU Leuven, Belgium

International Scientific committee

Suresh Advani

U Delaware

Remko Akkerman

U Twente

Edward Archer

Ulster U

Marcin Barburski

TU Lodz

Francois Boussu

ENSAIT

Christophe Binetruy

U Nantes

Louise Brown

U Nottingham

Valter Carvelli

Polimi

Francois Charleux

SAFRAN

Christoph Greb

ITA

Luise Kärger

Karlsruhe Inst Techn

Tetsusei Kurashiki

Osaka U

Yordan Kyosev

TU Dresden

Stepan Lomov

KU Leuven

Asami Nakai

Gigu U

Prasad Potluri

U Manchester

Amit Rawal

...

Elena Syerko U Nantes

Ignaas Verpoest

KU Leuven

Masaru Zako

Osaka U

Honourable members

Alex Bogdanovich

Dominique Coupe

Brian Cox

Thomas Gries

Conference location

For nearly six centuries, KU Leuven has been a centre of learning in Belgium, at the heart of Western Europe. Founded in 1425 by Pope Martin V, KU Leuven holds the distinction of being both the world's oldest Catholic institution and the oldest university in the Low Countries. It is now Belgium's largest university. KU Leuven, a renowned European research institution and co-founder of the League of European Research Universities (LERU), provides a wide range of international master's programmes, all backed up by high-quality, innovative, interdisciplinary research. KU Leuven also has campuses in 11 Belgian cities, including Brussels (Campus Brussel), Ghent (Campus Sint-Lucas), Antwerp (Campus Sint-Andries), Bruges (Campus Brugge), and the Sint-Katelijne-Waver (Campus De Nayer), as important campuses for the Composite Materials Group.

The city's picturesque and charming medieval Centre is filled with magnificent colleges and historic buildings constructed over centuries by and for the university. There are ample cultural and recreational opportunities. The concentration of intellectual capital in Leuven, combined with its superb infrastructure and convenient location in the heart of Europe, provides a creative environment for research and innovation.



The conference will take place in the historical Maria-Theresiacollege.

• Address: Sint-Michielsstraat 6, 3000 Leuven

You can refer to the map on next page or access it via the QR code.

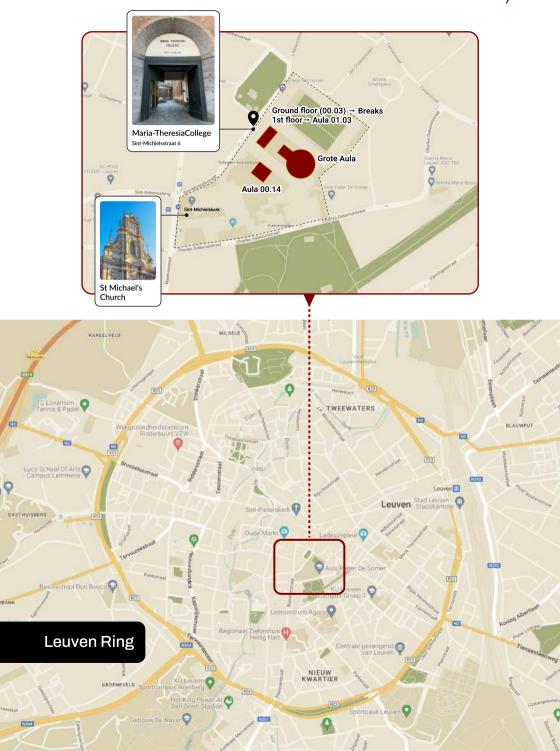
We also invite you to explore the beautiful city of Leuven. All the necessary information regarding the places to visit and how to get there can be found on the city website. Scan the QR code to access the website or collect one of the city guides at the registration desk.





We offer an online program for TexComp-15 via the Agorify App. This way you can view the detailed agenda online and connect with all attendees. To access the TexComp-15 event in the Agorify app, you need to first download the APP for free on your phone or on the web, then you need to get your free ticket using this link https://agorify.com/e/ticket-for-app-registration-924134551144 and then follow the instructions in the ticket to activate it yourself step by step.

QR codes for Wi-Fi access will be available at the venue for convenient internet connectivity.



Programme Overview

11 September Wednesday

08:30-09:00	Registrations and vveicome
09:00-09:40	Plenary talk by Yi Wan (University of Tokyo) on Recent works on CFRTP-SMC: complex internal morphology and mechanical property variations © Grote Aula
09:40-10:40	Yarn and fibre-scale modelling O Grote Aula
	Emerging composite processing Room 00.14
	Fatigue of textile composites • Room 01.03
10:40-11:10	Coffee Break
11:10-12:50	Yarn and fibre-scale modelling O Grote Aula
	Emerging composite processing • Room 00.14
	Fatigue of textile composites • Room 01.03
12:50-13:50	Lunch Break
13:50-15:30	Yarn and fibre-scale modelling O Grote Aula
	Emerging composite processing ♀ Room 00.14
	Braided Composites • Room 01.03
15:30-16:00	Coffee Break
16:00-17:20	Yarn and fibre-scale modelling O Grote Aula
	Single fibre properties and nano-reinforcements ○ Room 00.14
	Braided Composites PRoom 01.03



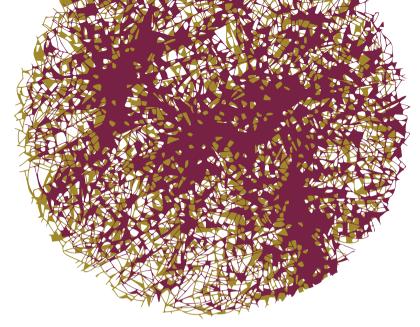
17:20 onwards Belgian Beer Reception

12 September Thursday

09:00-09:40	Plenary talk by Elena Syerko (Ecole Centrale De Nantes) on Numerical framework and key parameters of modeling of Liquid Composite Molding of textile composites: from micro-scale to macro-scale. Grote Aula
09:40-10:40	Yarn and fibre scale modelling/ Manufacturing of textile preforms © Grote Aula
	X-ray computed tomography Room 00.14
	3D textile architecture ♀ Room 01.03
10:40-11:10	Coffee Break
11:10-12:50	Manufacturing of textile preforms Grote Aula
	Special technical textile products • Room 00.14
	3D textile architecture ♀ Room 01.03
12:50-13:50	Lunch Break
13:50-15:10	Mini-oral and poster session
15:10-15:40	Coffee Break
15:40-17:00	Special technical textile products © Grote Aula
	Thermoplastic textile composites ♀ Room 00.14
	3D textile architecture Room 01.03
17:00-19:40	Ceremony and reception for emeritaat Stepan Lomov 👽 Grote Aula
0:00 onwards	Conference dinner De Hoorn

13 September Friday

09:00-09:40	Plenary talk by Philippe Sanial (Chomarat) on Textiles for composites: sustainability challenges and opportunities \mathbb{Q} Grote Aula
09:40-10:40	Manufacturing of textile preforms Grote Aula LCA of textile composites Room 00.14 3D textile architecture Room 01.03
10:40-11:10	Coffee Break
11:10-12:30	Toughness, defects and mechanical testing ♥ Grote Aula LCA of textile composites ♥ Room 00.14 Miscellaneous ♥ Room 01.03
12:30-13:30	Closing ceremony (Grote Aula) and lunch



Keynote Speakers



Recent works on CFRTP-SMC: complex internal morphology and mechanical property variations

Wednesday 11th September – 9:00-9:40 – • Grote Aula

Dr. Yi Wan belongs to the Department of Systems Innovation in the Graduate School of Engineering of the University of Tokyo. Dr. Wan has focused on the research of internal morphologies and mechanical properties of CFRP in the last decade. He has published over 30 journal papers and 100 conference proceedings. He has carried out research projects and international research collaborations on the internal geometry evaluation and mechanical modeling of carbon fiber reinforced thermoplastic sheet molding compounds (CFRTP-SMC) and the fabrication process development and mechanical property evaluation of recycled CFRTP.





Elena Syerko Ecole Centrale De Nantes

Numerical framework and key parameters of modeling of Liquid Composite Molding of textile composites: From micro-scale to macro-scale.

Thursday 12th September – 9:00-9:40 – • Grote Aula

Elena Syerko is a Research Fellow at the Research Institute in Civil Engineering and Mechanics of Ecole Centrale Nantes in France. She received a PhD degree in Mechanical Engineering from the University of Lille & Mines de Douai in France in 2012. After that her principal research activities were dedicated to structural composites for automotive applications within the framework of FAURECIA Industrial Chair. In 2018 she was a visiting scholar at the Center for Composite Materials at the University of Delaware, USA. At present Elena's research interests lie in the domain of mechanics of materials and numerical analysis, as well as 3D image processing, applied to multi-physics and multi-scale modeling of composites manufacturing processes. Currently Elena continues to lead the international benchmark on virtual permeability prediction, several stages of which have already been accomplished.



Philippe Sanial Chomarat

Textiles for composites: Sustainability challenges and opportunities

Friday 13th September – 9:00-9:40 – • Grote Aula

Philippe Sanial works as Group R&D Director at Chomarat since 2004. He is a Chemist Engineer with a Master in Composite Materials (DEA), and has been Project Manager at Chomarat and R&D Director SBU Textiles from 1993 to 2004. Philippe is President of TECHTERA (French Textile « pôle de compétitivité ») since 2021. During the last 20 years, he was strongly involved in many European and French collaborative programmes related to textiles and composites (including KU Leuven, Ecole Centrale de Nantes, etc). He participates in a scientific network lead by Professor Steve Tsai from Stanford University working on new approaches to composite design.



Social & Networking Events



Belgian Beer Reception

Wednesday 11th September - 17:20 onwards

To welcome all our delegates to Belgium, we will offer you the pinnacle of the country: a Belgian beer reception. From sour ales to IPAs, stouts and trappists, we have lined up a wide range of styles you can sample in a TexComp-branded glass. This glass is small (10 cl), so you can taste a broad variety of the (sometimes very strong) beers. You will receive this glass during registration.



Emeritus Ceremony

Thursday 12th September - 17:00-19:40 - OGrote Aula

The TexComp conference also serves as an opportunity to celebrate the retirement of Prof. Stepan Lomov. He has been a very active member of the textile composite community and has attended nearly all TexComp conferences in the past. This ceremony will include talks by his colleagues and collaborators to honour his contributions to the field. All delegates are welcome to attend this ceremony in the Grote Aula, including the reception afterwards.



Conference Dinner

Thursday 12th September – 20.00 onwards – **Q** De Hoorn

After the ceremony and reception, we will move to the conference dinner at De Hoorn. Up until the late 1980s, this building was used to brew Stella Artois. This site was completely renovated in 2012. In addition to a restaurant and bar, it also features meeting rooms, co-working space, and lofts with a unique view on Leuven. De Hoorn will offer us a three-course menu of Belgian specialties, next to the original copper beer kettles.

Awards - Best Poster & Best Student Presentation

Friday 13th September - 12:30-13:30 - OGrote Aula

We will hand out two awards. One for the **Best Oral Presentation** and another for the **Best Poster Presentation**. All eligible presenters will be automatically considered for these awards.

The best poster presenter will receive an award worth 300€. The evaluation criteria are:

- The quality of the visual representation on the poster
- The quality of the abstract
- The novelty of the content
- The questions and answers during the poster session

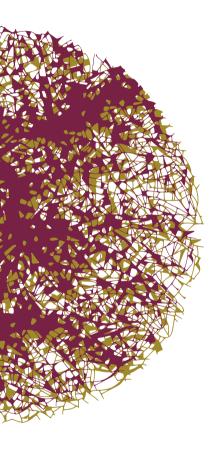
The best oral student presenter will receive an award worth 300€.

The evaluation criteria are:

- The quality of the oral delivery
- The quality of the abstract
- The novelty of the content
- The questions and answers with the audience

Both awards will be presented during the farewell ceremony.





Detailed Schedule

08:30-09:00 Registrations and Welcome

09:00-09:40 Plenary talk by Yi Wan: Recent works on CFRTP-SMC:

Complex internal morphology and mechanical property variations

Grote Aula

09:40-10:00 Parallel Session 1

• Grote Aula Yarn and fibre scale modelling

Chairs: Louise Brown, Stephen R. Hallett

G. Auteri, J. Neggers, D. Durville

Université Paris-Saclay

FIBER SCALE MODELLING OF TEXTILE/ELASTOMER COMPOSITES

Simulating the manufacturing of textile cords is essential to reproduce their architecture. To highlight the filament- scale mechanisms in the composite under various loads, both an adhesive layer and filaments-matrix interactions are modelled.

Chairs: Christophe Binetruy, Nahiene Hamila

S. Chen, A. Thompson, T. Dodwell, S. Hallett, J. Belnoue

University of Bristol, University of Exeter and digiLab, National Composites Centre

DATA-LIGHT OPTIMISATION OF HIGH-DIMENSIONAL COMPOSITES FORMING PROCESSES

A Gaussian process surrogate framework is built to optimise the forming process of dry fabric. Active learning and dimension reduction are applied to emulate the problem featuring complex parameter space and a computationally costly small dataset.

Room 01.03 Fatigue of textile composites

Chairs: Stepan Lomov, Valter Carvelli

C. Stewart, B. El-Said, G. Allegri, S. Hallett

University of Bristol

EXPERIMENTAL INVESTIGATION ON THE EFFECT OF BARELY VISIBLE IMPACT DAMAGE ON THE FATIGUE BEHAVIOR OF 3D WOVEN COMPOSITES

Due to improved damage tolerance, 3D woven composites are used in impact applications, where barely visible impact damage (BVID) can be detrimental when followed by fatigue. This work assesses the effect of BVID on the fatigue behavior of these composites.

10:00-10:20 Parallel Session 1

• Grote Aula Yarn and fibre scale modelling

Chairs: Louise Brown, Stephen R. Hallett

L. P. Brown, G. Spackman, M. Matveev

University of Nottingham

AUTOMATIC GENERATION OF PREDICTIVE MODELS FOR OPTIMISATION OF 3D PROFILED COMPOSITE STRUCTURES

Automation of modelling of profiled composite structures to enable use in optimisation algorithms is described, e.g. bifurcation of flat woven models, prismatic domains to enable meshing of the composite area. Initial optimisation results are shown.

Q Room 00.14

Emerging composite processes

Chairs: Christophe Binetruy, Nahiene Hamila

D. Droste, A. Dimassi

Faserinstitut Bremen e.V.

HOW ARTIFICIAL INTELLIGENCE CAN IMPROVE LIQUID COMPOSITE MOULDING PROCESSES?

The application of artificial intelligence (AI) can be used to support the design and process control of liquid composite moulding (LCM) processes. In this work, the use of AI in the design phase is considered in order to make the process more efficient.

Room 01.03

Fatigue of textile composites

Chairs: Stepan Lomov, Valter Carvelli

S. Watanabe, K. Obunai, K. Okubo

Doshisha University

IMPROVEMENT OF STATIC STRENGTH AND FATIGUE DURABILITY OF BOLTED JOIINT OF WOVEN CARBON FIBER REINFORCED COMPOSITE PLATE BY INSERTING MAT OF PVA NANOFIBERS

The modification by inserting mat of PVA nanofibers was effective to improve fatigue durability as well as static strength when the woven carbon fiber reinforced composite plate was connected by conventional steel bolt.

10:20-10:40 Parallel Session 1

Grote Aula Yarn and fibre scale modelling

Chairs: Louise Brown, Stephen R. Hallett

R. Guo, M. Alves, M. Mehdikhani, C. Breite, Y.Swolfs

KU Leuven, Move,ai

ENHANCING SIMULATIONS THROUGH DEEP LEARNING- GENERATED MICROSTRUCTURES IN COMPOSITES

By incorporating realistic microstructures generated through deep learning, we aim to enhance the numerical prediction of composites mechanical properties.

Q Room 00.14

Emerging composite processes

Chairs: Christophe Binetruy, Nahiene Hamila

H. Jamet, G. Helbert, N. Hamila, F. Bouillon

FNIB. Safran Ceramics

PROCEDURE FOR GENERATING A NETWORK OF ENTAGNLED FIBERS FOR FINITE ELEMENTS SIMULATIONS: APPLICATION TO THE CASE OF NEEDLING

A method was developed to generate averagely unidirectional but not straight networks. Generated networks were geometrically characterized and needling finite element simulations were carried out to underline the influence of the geometry.

Room 01.03

Fatigue of textile composites

Chairs: Stepan Lomov, Valter Carvelli

L.L. Warnet, S. Benou, R. D. R. Sithohang, R. Akkerman

University of Twente

ON THE DAMAGE DEVELOPMENT OF WOVEN FABRIC REINFORCED. THERMOPLASTIC COMPOSITE FLEXURES SUBJECTED TO LARGE **DEFORMATIONS**

This paper reports on an extensive qualitative and quantitative damage development study on thin woven fabric reinforced composite curved beam subjected to large deformations. The data obtained is useful to design fatigue resistant flexures.

11:10-11:30 Parallel Session 2

Grote Aula Yarn and fibre scale modelling

Chairs: Louise Brown, Stephen R. Hallett

S. Hügle, A. J. Thompson, M. Pei, S. R. Hallett, P. Middendorf

University of Stuttgart, University of Bristol

MODELING OF A REALISTIC FIBER BUNDLE ARCHITECTURE IN THE ROBOTIC CORELESS FILAMENT WINDING PROCESS

A prediction of a realistic fiber-bundle architecture in coreless filament winding process using a multi-filament- approach in the SimTex finite element solver (developed at Bristol Composites Institute, for textile modelling) is presented.

Q Room 00.14

Emerging composite processes

Chairs: Christophe Binetruy, Nahiene Hamila

O. H. Margoto, M. A. Batouei, Y. Abdin, A. S. Milani

The University of British Columbia

TOWARDS ENHANCING FORMABILITY OF NATURAL FIBER REINFORCEMENTS USING DATA-DRIVEN APPROACHES

This study aims to enhance the understanding and mitigation of forming-induced defects in flax fabric composite reinforcements through mechanical characterization and data-driven modeling, further promoting the industrial applications of sustainable biocomposites.

Room 01.03

Fatigue of textile composites

Chairs: Stepan Lomov, Valter Carvelli

V. Carvelli, T. Fujii, K. Okubo

Politecnico di Milano, Doshisha University

PERCOLATION OF FATIGUE DAMAGE IN PLAIN-WEAVE TEXTILE REINFORCED COMPOSITES

A thermography based method to detect the evolution of the fatigue damage in plain-weave carbon fiber/epoxy composites is detailed. Percolation theory has also been applied to show the properties and evolution of the clusters of damaged unit cells.

11:30-11:50 Parallel Session 2

• Grote Aula Yarn and fibre scale modelling

Chairs: Louise Brown, Stephen R. Hallett

S. Shukla, D. Singh, A. Rawal, K. Koul, I. Szenti, Y. Wen, A. Kukovecz, R. Jervis, P. Shearing

Indian Institute of Technology Delhi, Elofic Industries, Limited, University of Szeged, University College London

QUANTIFICATION OF STRUCTURAL HETEROGENEITIES IN RECYCLED CARBON FIBRE NONWOVEN REINFORCEMENTS

Structural anisotropy of recycled carbon fibre nonwovens has been quantified using the first principles of stereology to improve their implementation as reinforcements in carbon fibre-reinforced polymer composites.

Q Room 00.14

Emerging composite processes

Chairs: Christophe Binetruy, Nahiene Hamila

C. O. Ndukwe, S. Allaoui, J. Paux, W. Zouari, M. Assarar

University of Reims Champagne-Ardenne

EXPERIMENTAL ANALYSIS OF THE GEOMETRY OF BUCKLE DEFECTS IN WOVEN FABRICS

A woven fabric was subjected to mechanical loads using a specific laboratory bench. The amplitude of out-of-plane buckles and the proportional shear angles, alongside buckled yarn geometrical properties, were assessed using 2D scan and 3D tomography.

Room 01.03

Fatigue of textile composites

Chairs: Stepan Lomov, Valter Carvelli

F. Lamon, L. Maragoni, P. A. Carraro, M. Quaresimin

University of Padova

UNDERSTANDING THE INFLUENCE OF THE MESOSTRUCTURE ON THE FATIGUE DAMAGE EVOLUTION IN WOVEN COMPOSITES

In this work the influence of the mesostructure on the fatigue behaviour of woven composites is analyzed, proving a strong effect on the stress distribution and consequently on the damage evolution under cyclic loading.

11:50-12:10 Parallel Session 2

• Grote Aula Yarn and fibre scale modelling

Chairs: Louise Brown, Stephen R. Hallett

T. G. Lang, M. M. Badrul Hasan, A. Abdkader, C. Cherif, T. Gereke

Dresden University of Technology

STOCHASTIC MODELING AND SIMULATION OF THE DEFORMATION PROCESS OF WOVEN TEXTILES MADE FROM RECYCLED CARBON FIBRE

An approach for the stochastic modeling of textiles made from recycled carbon fiber hybrid yarns for the analysis of its deformability is presented.

Room 00.14 Emerging composite processes

Chairs: Christophe Binetruy, Nahiene Hamila

S. Nishimura, D. Tanabe, T. Eguchi, K. Nishiyabu, T. Kurashiki

Osaka University, Kobe City College of Technology, Kindai University

PROCESS CONTROL IN ULTRASONIC WELDING OF CF/PP LAMINATES AND **PULTRUDED ROD**

In this study, the manufacturing method of rib structure for CF/PP laminates using ultrasonic welding with UD-CF/PP pultruded rod was investigated. From the experimental results, the intersection welding quality affects the whole rib stiffened structure.

Room 01.03

Fatigue of textile composites

Chairs: Stepan Lomov, Valter Carvelli

L. M. Martulli, A. Panerai, M. Carboni, A. Bernasconi

Politecnico di Milano

EFFECT OF THE MORPHOLOGY OF TEXTILE SUBSTRATES ON FATIGUE CRACK MONITORING WITH OPTICAL FIBRE SENSORS

We compare the measured strain profiles using optical fibres on unidirectional laminates, crimped fabrics and woven composites. We show how their morphology affects the optical fibres readings, but does not hamper an effective crack monitoring.

12:10-12:30 Parallel Session 2

Grote Aula Yarn and fibre scale modelling

Chairs: Louise Brown, Stephen R. Hallett

Y. Lee, T. Chatziathanasiou, S. AhmadvashAghbash, B. Fazlali, M. Mehdikhani, C. Breite, Y. Swolfs, M. N. Mavrogordato, S. M. Spearing, I. Sinclair

University of Southampton, KU Leuven

ENHANCING FIBRE DIRECTION STRAIN ANALYSIS THROUGH DIGITAL VOLUME CORRELATION WITH IN-SITU HOLOTOMOGRAPHY

A detailed understanding of stress redistribution from a broken fibre to surrounding intact fibres in carbon fibre composites has been achieved through Digital Volume Correlation combined with in- situ X-ray holotomography, with imaging at 150nm.

Room 00.14

Emerging composite processes

Chairs: Christophe Binetruy, Nahiene Hamila

B. Schäfer, D. Dörr, R. Zheng, N. Naouar, L. Kärger

Karlsruhe Institute of Technology, Simutence GmbH, INSA Lyon

HYPERELASTIC MEMBRANE APPROACH FOR MACROSCOPIC FORMING SIMULATIONS OF UNIDIRECTIONAL NON-CRIMP FABRICS (UD-NCF)

A hyperelastic membrane model is proposed for unidirectional non-crimp fabrics based on superimposed shear, transverse tension and compression perpendicular to the rovings. The model accurately predicts the forming behavior for different geometries.

Room 01.03

Fatigue of textile composites

Chairs: Stepan Lomov, Valter Carvelli

A. Panerai, B. Oneda, A. Bernasconi, M. Carboni

Politecnico di Milano

MONITORING MODE II FATIGUE DEBONDING IN ADHESIVELY BONDED UNIDIRECTIONAL CFRP-CFRP JOINTS

We investigate various techniques for monitoring mode II fatigue crack growth on adhesively bonded composite joints. Compliance monitoring and visual testing underestimate crack length, while optical fibres and ultrasonic testing are more effective.

12:30-12:50 Parallel Session 2

• Grote Aula Yarn and fibre scale modelling

Chairs: Louise Brown, Stephen R. Hallett

A. Marduel, A. Shanwan, G. Hivet, A. Buisson

University of Orléans, Safran Landing Systems

ANALYTICAL AND EXPERIMENTAL APPROACH TO STUDY THE FIBERS TRANSFER AND BREAKAGE DURING THE NEEDLING PROCESS OF FIBROUS **STRUCTURES**

This study presents a mechanical model to understand the load, transfer, and breakage of filaments during the needling process. It enables predicting filament breakage parameters and calculating the number of fibers transferred in certain preforms.

Q Room 00.14

Emerging composite processes

Chairs: Christophe Binetruy, Nahiene Hamila

A. Şik, M. Mehdikhani, J. Soete, S. V. Lomov, H. Tanabi, B. Sabuncuoglu

Hacettepe University, KU Leuven, University of Turkish Aeronautical Association

DAMAGE BEHAVIOR INVESTIGATION OF 3D PRINTED SHORT FIBER-REINFORCED COMPOSITES WITH IN-SITU X-RAY COMPUTED TOMOGRAPHY

Microstructure and damage behavior of 3D printed short fiber composites are influenced by printing parameters. This study uses FDM-printed samples to study damage evolution with various tests, enhancing understanding in this field.

12:50-13:50 Lunch Break

13:50-14:10 Parallel Session 3

Grote Aula Yarn and fibre scale modelling

Chairs: Mahoor Mehdikhani, Louise Brown

M. Pei, J. P.-H. Belnoue, S. R. Hallett

University of Bristol

BESPOKE SOFTWARE FOR SIMULATING TEXTILE PREFORM GEOMETRY

SimTex is a bespoke Finite Element solver created to provide fast and accurate varn architecture geometries for woven composite reinforcements. Recent extensions include capabilities for forming and braiding simulations.

Room 00.14

Emerging composite processes

Chairs: Elena Syerko, Nahiene Hamila

J. Buitrago-Osorio, J. Bardon, S. Bulou, R. Quintana, T. Gaulain, G. Mertz, D. Ruch, C. F. Rojas

Luxembourg Institute of Science & Technology, University of Luxembourg, KU

ENHANCING TOUGHNESS OF CARBON FIBRE REINFORCED EPOXY COMPOSITES WITH INTERMITTENT MICRO-PLASMA TREATMENT ON SINGLE **FIBRES**

This study proposes the use of micro-plasma surface deposition and activation to create alternate sections around carbon fibres and along the fibre length of high and low adhesion with a epoxy resin matrix, promoting intermittent sections of high and low shear strength during the process of debonding.

Q Room 01.03

Braided composites

Chairs: Remko Akkerman, Yordan Kyosev

F. Prodanovič, Y. Kyosev

Technical University of Liberec, Technical University of Dresden, TexMind UG

SIMULATION OF THE OVERBRAIDING PROCESS OF MULTI-RING BRAIDING MACHINES WITH ROTATING HORN GEARS AND PROGRAMMABLE SWITCHES

Multi-Ring braiding machines with computer controlled switches have significantly larger fleixibility than normal ovebraiding machines and can produce complex profiles. This work presents FEM Simulation which uses discrete carreir motion simulation and coupled FEM yarn interaction simulation as integrated overbraiding simulation.

14:10-14:30 Parallel Session 3

• Grote Aula Yarn and fibre scale modelling

Chairs: Mahoor Mehdikhani, Louise Brown

E. Polyzos, L. Pvl

Vrije Universiteit Brussel

SHORT FIBER AND FIBER SEGMENT LENGTHS AS BETA DISTRIBUTED **VARIABLES**

This article presents a proof for using fiber and fiber segment lengths as beta distributed variables. Two examples are provided: a) using simulation results, and b) using experimental results for short fibers and fiber segments.

Room 00.14

Emerging composite processes

Chairs: Elena Syerko, Nahiene Hamila

J. Take, P. Middendorf

University of Stuttgart

STUDIES OF UV LED-CURED GFK COMPOSITES WITH THE RTM PROCESS

UV curing of FRP has proven to be a high energy- and time- efficient production process, with material properties comparable to those achieved with epoxy resins. For a variety of parameters, a holistic material characterization was carried out and evaluated.

Room 01.03

Braided composites

Chairs: Remko Akkerman, Yordan Kyosev

L. Tochon, P.-R. Jr. Doffonsou Jr., L. L. Lebel

Polytechnique Montreal

MODELLING THE BRAID DEFORMATIONS DURING THERMOPLASTIC COMPOSITE BRAID-TRUSION OF SQUARE TUBING

Braid modelling is used to predict braid deformation during the pultrusion of braided preforms. The modelling is applied for the design of a braid-truded rectangular tube of glass fiber reinforced polyethylene terephthalate composite.

14:30-14:50 Parallel Session 3

• Grote Aula Yarn and fibre scale modelling

Chairs: Mahoor Mehdikhani, Louise Brown

H. Feng, S. P. Subramaniyan, H. Tewani, P. Prabhakar

University of Wisconsin - Madison

A PHYSICS-CONSTRAINED DEEP LEARNING FRAMEWORK FOR PREDICTING WEAVE ARCHITECTURE AND MECHANICAL PROPERTIES OF COMPOSITES

We present a novel Physics-Constrained Neural Network to predict the mechanical properties like the modulus of woven composites and the inverse problem of predicting weave architectures (pattern/material sequence) for a design/target modulus value.

Room 00.14 Emerging composite processes

Chairs: Elena Sverko. Nahiene Hamila

T. Vosmer, S. Backes, P. Huber, T. Gries

RWTH Aachen University

DEVELOPMENT OF A CFRP SANDWICH CORE FOR AVIATION APPLICATION

The safe and weight-efficient storage of liquid hydrogen is a key technology for the aviation of the future. Tank structures with tessellated sandwich cores made of FRP for protection and insulation with low weight are being researched.

Room 01.03

Braided composites

Chairs: Remko Akkerman, Yordan Kyosev

A. Nakai, K. Aoike, R. Oishi

Gifu University

DEVELOPMENT OF BRAID-REINFORCED THERMOPLASTIC RESIN PIPE WITH FIBER OR RESIN HYBRID STRUCTURE

In this research, a fiber hybrid or a resin hybrid braided CFRTP pipe using two types of resin or fiber was molded, and aimed to develop mechanical properties that cannot be seen with a single material alone.

14:50-15:10 Parallel Session 3

Grote Aula Yarn and fibre scale modelling

Chairs: Mahoor Mehdikhani, Louise Brown

B. Kolcavová Sirková

University of Liberec

IDENTIFICATION OF STRUCTURE OF INTERLACING CELLS IN 2D/3D WOVEN **FABRICS**

Interlacing of threads in the woven fabric is one of the basic construction parameters of 2D/3D fabric. By defining the basic building cells of the interlacing, we define the behavior of the 2D/3D fabric in relation to its properties.

Q Room 00.14

Emerging composite processes

Chairs: Elena Syerko, Nahiene Hamila

A. Spickenheuer, F. Lentz, P. Scheer, J. Andrä, A. A. Abdalla, T. Lisboa, L. Bittrich Leibniz-Intitut für Polymerforschung Dresden e. V.

DESIGNING 3D-TRUSS-LIKE STRUCTURES BASED ON PLAIN TAILORED FIBER PLACEMENT PREFORMS

Recent advances in Tailored Fiber Placement (TFP) technology enable the production of non-unwindable 3D truss-like structures, demonstrating the potential for weight reduction despite the identified challenges in numerical modelling and mold design.

Room 01.03

Braided composites

Chairs: Remko Akkerman, Yordan Kyosev

Y. Wang, A. J. Thompson, M. Pei, S. Hügle, R. Czichos, H. Ahlborn, P. Middendorf, J. P.-H. Belnoue, S. R. Hallett

University of Bristol, University of Stuttgart, National Composites Centre

FAST SIMULATION OF BRAIDING FOR PARAMETRIC STUDY

SimTex is a bespoke Finite Element solver created to provide fast and accurate modelling of textile composites. Its development for braiding simulations and validation against real manufacturing cases are presented.

15:10-15:30 Parallel Session 3

• Grote Aula Yarn and fibre scale modelling

Chairs: Mahoor Mehdikhani, Louise Brown

F. Prodanovič, Y. Kyosev

Technical University of Liberec, TU Dresden

INFLUENCE OF THE FRICTION IN THE TENSILE TEST SIMULATION OF WARP KNITTED STRUCTURES

Warp knitted strucures can be used for medical and technical application. Their behaviour depents on the varn friction and the benidng rigidity. This work presents FEM analysis of the influence of different friction coeffcients and bending rigidity over the tensile behaviour of the fabrics.

15:30-16:00 Coffee Break

16:00-16:20 Parallel Session 4

Grote Aula Yarn and fibre scale modelling

Chairs: Jonathan Belnoue, Stephen R. Hallett

J. Simon, N. Hamila, S. Comas-Cardona, C. Binétruy

ENI Brest, Nantes Université

FINITE ELEMENT MODELLING OF SLIPPAGE IN WOVEN FABRICS USING AN ARBITRARY LAGRANGIAN EULERIAN DESCRIPTION

This work presents an efficient numerical strategy based on a yarn-scale woven fabric finite element modelling approach using the Arbitrary Lagrangian Eulerian framework to capture significant slippage during forming.

Q Room 00.14

Single fibre properties and nano-reinforcements

Chairs: Christian Breite, Sina AhmadvashAghbash

S. Garcia Mayo, H. Rahier, D. Seveno

KU Leuven, Vrije Universiteit Brussel

THE INFLUENCE OF BASALT FIBER COMPOSITION ON WEIBULL DISTRIBUTIONS

Analyzing basalt fiber composition's impact on Weibull distribution. Our work studies how the mineral and chemical composition of basalt fibers affect tensile strength and Weibull distribution.

Room 01.03

Braided composites

Chairs: Remko Akkerman, Axel Spickenheuer

R. Akkerman, A. Ngoc Vu, L. Warnet, M. de Rooij, W. Grouve

University of Twente

YARN INTERACTIONS IN OVERBRAIDING SIMULATIONS

Overbraiding simulations can aid the design of braid reinforced composites. Neglecting yarn interaction enables quick simulations, but accurate braid angle predictions require accurate characterization and modelling of yarn-to-yarn friction.

16:20-16:40 Parallel Session 4

• Grote Aula Yarn and fibre scale modelling

Chairs: Jonathan Belnoue, Stephen R. Hallett

M. Song, B. El Said, A. J. Thompson, S. R. Hallett

University of Bristol

MATERIAL CHARACTERISATION AND MODELLING OF PRE- SHEARED 2D **WOVEN CFRP**

Pre-sheared 2D woven composite coupons were subject to tensile testing in multiple in-plane directions. Test results are compared with the homogenized material properties obtained from RVE FE models using realistic sheared textile geometry.

Q Room 00.14

Single fibre properties and nano-reinforcements

Chairs: Christian Breite, Sina AhmadvashAghbash

E. Van Vlierberghe, C. Breite, Y. Swolfs

KU Leuven

CHARACTERIZATION OF CARBON AND GLASS FIBERS THROUGH AUTOMATED SINGLE FIBER TENSILE TESTING

The longitudinal tensile properties and dimensional variation of carbon and glass fibers were obtained with automated single fiber tensile testing. A large dataset combined with improved compliance correction increased the reliability of the metrics.

Room 01.03 Braided composites

Chairs: Remko Akkerman, Axel Spickenheuer

D. He, P. Potluri, P. J. Withers

University of Manchester

ANALYSIS OF THE PERFORMANCE OF BRAIDED COMPOSITE TUBES BY X-RAY CT IMAGE-BASED VERSUS IDEALIZED TEXTILE MODELLING

An image-based model based on the X-ray CT images, and an idealized textile model are compared against in situ X-ray experiments. The mechanical responses are presented with an eye to optimising braiding textile architectures.

16:40-17:00 Parallel Session 4

Grote Aula Yarn and fibre scale modelling

Chairs: Jonathan Belnoue, Stephen R. Hallett

I. Ud Din. A. Ahmed, K. A. Khan

Khalifa University of Science and Technology

PREDICTING THE FOLDING RESPONSE OF WOVEN COMPOSITE HINGE BASED ON XCT CHARACTERIZATION

XCT characterization is well suited for the elastic properties characterization required for the finite element modeling of deployable folding structures which are commonly ultra thin in nature. Finite element modeling (FEM) was done for the determina on of the moment curvature response of composite hinge using the homogenization of elastic properties based on XCT.

Q Room 00.14

Single fibre properties and nano-reinforcements

Chairs: Christian Breite, Sina AhmadvashAghbash

H. A. Butt. D. V. Krasnikov, V. A. Kondrashov, B. V. Voloskov, S. D. Konev, A. I. Vershinina, S. D. Shandakov, Z. Wang, A. M. Korsunsky, I. V. Sergeichev, A. G. Nasibulin

Skolkovo Institute of Science and Technology, Kemerovo State University, Jiangsu University, Trinity College

MULTIFUNCTIONAL NANOCOMPOSITE ASSESSMENT USING CARBON NANOTUBE FIBER SENSORS

Here, a novel material-based monitoring method is reported. Carbon nanotube fibers are shown to be specialized embedded sensors for monitoring additive carbon nanotubes and their network changes during nanocomposite manufacturing and application.

Q Room 01.03

Braided composites

Chairs: Remko Akkerman, Axel Spickenheuer

F. Jung, T. Gries

RWTH Aachen

ADVANCEMENTS IN ALL-OXIDE CMCS: MULTISCALE MODELLING OF 3D CONTINUOUS FIBRE REINFORCED CERAMICS

To enable the efficient use of novel pressure slip casted ceramic composites, containing 3D braided fibre reinforcements, the development of corresponding a multi-scale structural dynamic model is presented.

17:00-17:20 Parallel Session 4

• Grote Aula Yarn and fibre scale modelling

Chairs: Jonathan Belnoue, Stephen R. Hallett

P. Wadekar, V. Perumal, G. Dion, A. Kontsos, D. Breen

Drexel University, Rowan University

AN OPTIMIZED YARN-LEVEL GEOMETRIC MODEL FOR FINITE ELEMENT ANALYSIS OF WEFT-KNITTED FABRICS

We present a yarn-level geometric model of weft-knitted fabrics, consisting of Knit and Purl stitches, that can be used in Finite Element Analysis simulations. Producing models of varns in a knitted swatch is framed as an optimization problem.

Q Room 00.14

Single fibre properties and nano-reinforcements

Chairs: Christian Breite, Sina AhmadvashAghbash

R. Windey, J. Soete, M. Cardous, R. Baeten, S. AhmadvashAghbash, Y. Swolfs, D. Seveno, H. Pfeiffer, F. Desplentere, M. Wevers

KU Leuven

CHALLENGES AND OPTIMISATION OF NANOPARTICLE DISPERSION AND INTEGRATION IN FIBROUS COMPOSITES FOR ENERGY AND SHIELDING **APPLICATIONS**

Integrating nanoparticles into fibrous composites receives growing interest. A good dispersion is pivotal, yet challenging for achieving advanced functionalities. This study offers an ultrasonication framework for enhanced dispersion.

Room 01.03 Braided composites

Chairs: Remko Akkerman, Axel Spickenheuer

T. Luplow, S. Heimbs, P. Horst

Institut für Flugzeugbau und Leichtbau, Technische Universität Braunschweig

EXPERIMENTAL INVESTIGATION OF THICKNESS EFFECTS IN BIAXIALLY BRAIDED COMPOSITES UNDER FATIGUE LOADING AND CONSIDERATION OF **SELF-HEATING**

This study investigates the size effect in biaxially braided composites under fatigue loading. To eliminate the impact of self- heating, thermodynamic equivalent load frequencies are calculated, allowing for a better assessment of size effects.

12 September Thursday

09:00-09:40

Plenary talk by **Elena Syerko**: Numerical framework and key parameters of modeling of Liquid Composite Molding of textile composites: from micro-scale to macro-scale

Grote Aula

09:40-10:00 Parallel Session 1

• Grote Aula Yarn and fibre scale modelling/Manufacturing of textile preforms

Chairs: Yordan Kvosev, Mikhail Matveev

S. Yan, Y. Li, W. Zhang

Beihang University

CHARACTERIZATION OF PRESSURE-DEPENDENT NONLINEAR BENDING BEHAVIOR OF YARNS AND ITS APPLICATION IN MODELING THE COMPRESSION OF 2D WOVEN FABRICS

A new formulation for the virtual fiber element has been developed with a physicsbased definition of bending properties.

Room 00.14 X-ray computed tomography

Chairs: Yi Wan, Christian Breite

T. Chatziathanasiou, Y. Lee, C. Breite, M. Mehdikhani, Y. Swolfs

KU Leuven, University of Southampton

SYNCHROTRON NANOTOMOGRAPHY FOR IN-SITU DAMAGE MONITORING OF COMPOSITES

In this study, we demonstrate the potential of synchrotron nanotomography, operated at 150 nm pixel size, for investigating the in-situ damage behaviour of carbon and glass fibre-reinforced composites.

Room 01.03

3D textile architecture

Chairs: François Boussu, François Charleux

Z. Wei, Xiaogang

The University of Manchester

EXPERIMENTAL INVESTIGATION ON 3D WOVEN COMPOSITE TJOINTS WITH CROSSING WARP ARCHITECTURES FOR RESISTING DELAMINATION

The study engineered various 3D woven structures in composite Tjoints, finding that crossing warps significantly improve tensile mechanical properties and delamination resistance, with external warp configurations being particularly effective.

12 September Thursday

10:00-10:20 Parallel Session 1

• Grote Aula Yarn and fibre scale modelling/Manufacturing of textile preforms

Chairs: Yordan Kvosev, Mikhail Matveev

Z. El-Alami, A. Hivet, G. Hivet

Université Orléans, Université Tours, INSA-CVL

MODELLING AND SIMULATING MESOSCOPIC DEFECTS IN RTM-FORMED WOVEN COMPOSITES REINFORCEMENTS

Resin Transfer Molding (RTM) excels in shaping woven composites, but some defects like buckles may arise. This study aims to understand and mitigate the appearance of these defects through a Finite Element modelling and optimized simulation.

Room 00.14 X-ray computed tomography

Chairs: Yi Wan, Christian Breite

S.F. Gavot, J. Soete, J. Vanhulst, C. Bailly, P. Gérard, T. Pardoen

UCLouvain, KU Leuven, Arkema, WEL Research Institute

IN-SITU CONTINUOUS XCT IMAGING OF VOID FORMATION IN PMMA-BASED COMPOSITES PRODUCED BY LIQUID MOULDING

Void formation in fibre-reinforced polymer composites processed by liquid injection moulding is monitored in-situ using continuous acquisition 4D-XCT. Key causes for void formation are flow-related air entrapment, and chemical and thermal shrinkage.

O Room 01.03

3D textile architecture

Chairs: François Boussu, François Charleux

F. Xu

Donghua University

HIGH-PERFORMANCE AND MULTIFUNCTIONAL 3D WOVEN COMPOSITE **STRUCTURES**

Smart or functional composites with hybrid structures are developed based on multifunctional structures of 3D weaving composites, such as 3D textile-based antennas, E-heating composites, and electromagnetic metamaterial composites.

12 September Thursday

10:20-10:40 Parallel Session 1

Grote Aula Yarn and fibre scale modelling/Manufacturing of textile preforms

Chairs: Yordan Kvosev, Mikhail Matveev

M. Woestmann, A. Miene, P. Schiebel, E. de Menezes, L. Bittrich, L. Echer, A. Spickenheuer

Faserinstitut Bremen e. V., Leibniz-Intitut für Polymerforschung Dresden e. V., SENAI Institute of Innovation in Polymer Engineering

MINIMIZING THE EFFECTS OF PRODUCTION PARAMETERS IN THE TAILORED FIBER PLACEMENT PROCESS THROUGH IMAGE ANALYSIS

Image analysis methods are being used in the Tailored Fiber Placement (TFP) process to determine deviations in the roving placement by drawing conclusions on the influences of certain process parameters in order to optimize the preform quality.

Room 00.14

X-ray computed tomography

Chairs: Yi Wan, Christian Breite

S. E. Madi, Y. Wan, K. Madi, J. Soete, Y. Swolfs

KU Leuven. The University of Tokyo, 3Dmagination Ltd.

MECHANICAL CHARACTERISATION OF CARBON FIBREREINFORCED SHEET MOULDING COMPOUNDS VIA X-RAY INSITU BIAXIAL TESTING OF COMPOSITE MATERIALS

Growing interest in CFRTP-SMC prompts in-situ XCT/DVC for mechanical analysis. Traditional simulations struggle, KU Leuven introduces a lab-scale XCT biaxial rig to aid biaxial loading studies.

Room 01.03

3D textile architecture

Chairs: François Boussu, François Charleux

J. Walther, M. Decrette, M. Tourlonias, M. Bueno, F. Charleux

Université de Haute Alsace, SAFRAN group

WEAVING PROCESS-BASED DESIGNATION FOR WEAVING PATTERNS

3D woven fabrics can involve high warp yarns densities. Binding warp yarns may have to interact with many neighboring yarns during shedding. A weave pattern process approach is considered to discriminate critical configurations for weaving damages.

11:10-11:30 Parallel Session 2

Grote Aula Manufacturing of textile preforms

Chairs: Edward Archer, Luise Kärger

M. Y. Matveev, L. P. Brown

University of Nottingham

TAILORED WOVEN PREFORMS FOR NEAR-NET SHAPE FORMING

Tailored woven textiles, consisting of more than one weave style, is used to create preforms that can be formed into near-net products thus resulting in less waste. Experimental and numerical results are presented.

Room 00.14 Special technical textile products

Chairs: Marcin Barburski, Christoph Greb

A. N. Kulkarni, A. Pupurs

Riga Technical University

CARBON/STAINLESS STEEL HYBRID FABRICS FOR COMPOSITE-METAL JOINT **APPLICATIONS**

Various configurations of knitted and woven carbon/stainless steel hybrid composites were manufactured, and their mechanical properties were studied under quasi-static tensile loading.

Q Room 01.03

3D textile architecture

Chairs: François Boussu, François Charleux

S. E. Mermouli, P. del Sorbo, D. Durville

Université Paris-Saclay, Safran Tech

SIMULATION OF FRICTIONAL CONTACT INTERACTIONS WITHIN A JACQUARD HARNESS FOR 3D INTERLOCK WEAVING

Frictional contact interactions between warp yarns and heddles within a Jacquard harness for 3D interlock weaving are simulated using a finite element code to evaluate efforts in the heddles and to predict the occurrence of blockages that may be responsible for damage or weaving faults.

11:30-11:50 Parallel Session 2

• Grote Aula Manufacturing of textile preforms

Chairs: Edward Archer, Luise Kärger

C. McGarrigle, A. O'Boyle, J. Quinn, E. Archer

Ulster University

THE INFLUENCE OF TUFTING PATTERNS ON THE MECHANICAL PROPERTIES OF COMPOSITES

40 tex Kevlar® was tufted into 6 layers of 375 gsm carbon fibre with a spacing of 5mm between tuft. Linear, offset and spiral patterns were trialled.

Room 00.14 Special technical textile products

Chairs: Marcin Barburski, Christoph Greb

C. Uthemann, R. Emmerich, P. Huber

RWTH Aachen University

TENSILE PROPERTIES OF COMPOSITES REINFORCED WITH NON-CRIMP FABRICS AND WOVEN FABRICS MADE FROM RECYCLED CARBON FIBRE YARNS

The processing of recycled Carbon Fibres (rCF) to textile semifinished products is of increasing interest. In this study, woven fabrics and non-crimp fabrics are produced using wrap-spun yarns from rCF and PA6-fibres and the composites' tensile properties are investigated.

Room 01.03 3D textile architecture

Chairs: François Boussu, François Charleux

H. El Herichi, A. Mendoza, Y. Wielhorski, S. Roux, H. Talbot

Safran Group, Université Paris-Saclay

MODAL ANALYSIS FOR YARN DETECTION ON 3D WOVEN COMPOSITES

Manual annotations of yarn centerlines on a large textile preform are analyzed with PCA. The modal decomposition of the yarn crosssections allows creating a cross-correlation heatmap for an optimal path algorithm to reconstruct the yarn centerlines.

11:50-12:10 Parallel Session 2

Grote Aula Manufacturing of textile preforms

Chairs: Edward Archer, Luise Kärger

D. Nuss, Ch. Cherif

Technical University of Dresden

WEAVING MACHINE DEVELOPMENTS TO PROVISION NEARNET-SHAPE WOVEN FABRICS FOR 3D SHELL-SHAPED FRP COMPONENTS

Complex components demand textile reinforcement structures that meet requirements, necessitating the integration of innovative technologies. This drives the introduction of advanced weaving processes designed to yield 3D near-net-shape fabrics

Room 00.14 Special technical textile products

Chairs: Marcin Barburski, Christoph Greb

P. Khalili, M. Skrifvars

University of Borås

DEVELOPMENT OF COMPOSITES CONTAINING NATURAL FIBERS AND WASTE **TEXTILE FABRIC**

The utilization of natural fibers and end-of-life textiles in composites offers a promising pathway towards sustainable materials development.

Room 01.03

3D textile architecture

Chairs: François Boussu, François Charleux

E. Facon, F. Rault, É. Deletombe, F. Boussu

ONERA, Université De Lille

DEVELOPMENT OF AUXETIC COMPOSITE MATERIALS FOR IMPROVED IMPACT PROPERTIES

Auxetic structures and para-aramid-reinforced composite materials exhibit interesting capabilities for energy absorption during impacts. The aim of this study is to develop auxetic composite materials using woven reinforcement to reach this property.

12:10-12:30 Parallel Session 2

• Grote Aula Manufacturing of textile preforms

Chairs: Edward Archer, Luise Kärger

C. McGarrigle, M. Wegrzyn, E. Harkin-Jones, A. McIlhagger, E. Archer

Ulster University

TAILORED TUFTING YARNS FOR OPEN-HOLE TENSION STRENGTH

Continuous polymer yarns with diameters ranging from 160 μ m to 720 μ m were prepared using a twin-screw extruder and tufted into a composite.

• Room 00.14 Special technical textile products

Chairs: Marcin Barburski, Christoph Greb

M. Barburski, T. Lemmi, N. Kadi

Lodz University of Technology, University of Borås

FIRE-RESISTANT NATURAL FIBER REINFORCED COMPOSITES

The flammability of natural fiber-reinforced composites is a significant concern. In this study, composites were produced from wool and PLA fiber-based nonwoven fabrics. The flammability and mechanical properties of the composites were investigated.

Room 01.03 3D textile architecture

Chairs: François Boussu, François Charleux

J. W. P. Humphries, M. Y. Matveev, L. P. Brown

University of Nottingham

THE EFFECT OF TAPER RATIO ON TAPERED 3D WOVEN COMPOSITES IN CANTILEVER BENDING

A study into the effect of taper ratio on the mechanical response of tapered 3D woven composites in cantilever bending compared to 2D woven tapered composites.

12:30-12:50 Parallel Session 2

Grote Aula Manufacturing of textile preforms

Chairs: Edward Archer, Luise Kärger

A. Ohtani, T. Miyatake

Kyoto institute of technology

EFFECT OF WARP KNITTING CONDITIONS ON THE INTERNAL STRUCTURE AND MECHANICAL PROPERTIES OF NCF REINFORCED COMPOSITES

In this study, FRP laminates were fabricated using NCF with different warp knitting conditions, and the effects of warp knitting conditions on the internal structure and mechanical properties of FRPs made of NCF as reinforcement material were investigated.

Room 01.03 3D textile architecture

Chairs: François Boussu. François Charleux

Z. Hassan, T. Sharif, D. Odivi, RS. Choudhry, U. Diala

University of Derby, University of Doha for Science and Technology

DEVELOPMENT OF FIRST-GENERATION SODIUM ION BASED STRUCTURAL **BATTERY COMPOSITES**

This novel research work demonstrates the development of sodium-ion based structural battery composites by employing the unique configuration of structural electrodes and exhibited their stable multifunctionality under load conditions.

12:50-13:50 Lunch break

13:50-15:10 Mini-oral and poster session (2 minutes each)

Grote Aula

W. Chen:

DEVELOPMENT OF 3D TEXTILE STRUCTURE ELECTRONIC DEVICES BASED ON FLEXIBLE CONDUCTIVE YARNS

T. Eguchi:

DIRECT PREPREG SHEET THERMAL-PULTRUSION FORMING FOR CF/PEEK RODS WITH VARIOUS FIBER ORIENTATION: EFFECT OF SLITTING AND TWISTING

T. Kurashiki:

DEVELOPMENT OF EASY DISMANTLABLE ADHESIVE METHOD WITH MICROWAVE FOR FRP JOINTS

J. Ornstova:

EXPERIMENTAL STUDY OF TWO TYPES OF 24-BOBBINS BRAIDED STRUCTURES

K. Wei:

FABRICATION OF POROUS PVDF NANOFIBER MEMBRANES FOR PASSIVE RADIATION COOLING

A. Nixon:

MACHINE LEARNING DEVELOPMENT FOR PREDICTING BRAIDED FIBRE ANGLES

M. Tadano:

MANUFACTURE OF CF/PEEK ROD GRID-STRUCTURED MEMBERS BY CONTINUOUS THERMO-LATERAL COMPRESSION FORMING

R. Dong:

CHARACTERIZATION AND SIMULATION OF IN-PLANE SHEAR BEHAVIOR OF WOVEN PREPREGS CONSIDERING VISCOELASTICITY

M. Kitamura:

DEVELOPMENT OF IN-SITU MOLDING FOR TEXTILE REINFORCED THERMOPLASTIC RESIN COMPOSITE

K. Noma:

DEVELOPMENT OF MESOSCALE MODEL AND FORMING SIMULATION TECHNOLOGY OF BIAXIAL NON-CRIMP FABRIC

H. Takayashiki:

EFFECT OF STIRRING CULTURE OF ACETIC ACID BACTERIA ON MECHANICAL PROPERTIES AND CRYSTAL STRUCTURE OF BACTERIAL CELLULOSE

D. Tanabe:

HYBRID JOINING FOR CF/PEEK LAMINATES USED WELDING AND CF/PEEK RIVET FASTENING AFTER THERMAL-PIERCING

T. Tsurusaki:

PRESS-PIERCING OF CF/PP PULTRUDED BARS INSERTED DURING INJECTION MOLDING AND DEFORMATION BEHAVIORS OF OVER-MOLDED PARTS

M. Vysanska:

THE THICKNESS OF TEXTILE FABRICS FROM THEIR PACKING DENSITY PROGRESS

H. Zhu:

DESIGN AND PREPARATION OF MULTIFUNCTIONAL CARBON FIBER REINFORCED POLYMER COMPOSITES BASED ON CONDUCTIVE NETWORK CONSTRUCTION

P. Guillon:

ADVANCING STRUCTURAL APPLICATIONS OF BIOCOMPOSITES: THE BIOSTRUCT PROJECT

C. Leclaire:

ADVANCING SUSTAINABLE PRACTICES IN THE COMPOSITE INDUSTRY: MULTI-LEVEL CIRCULAR PROCESS CHAIN FOR CARBON AND GLASS FIBRE COMPOSITES (MC4)

15:10-15:40 Coffee Break

15:40-16:00 Parallel Session 3

• Grote Aula Thermoplastic textile composites

Chairs: Remco Akkerman, Laurent Warnet

S. Kawaharada, T. Tanaka, M. Sasada

Doshisha University

STUDY ON THE EFFECT OF FIBER SHAPE ON MECHANICAL PROPERTIES OF CARBON/ARAMID FIBER REINFORCED THERMOPLASTIC COMPOSITES

This study aimed to determine the optimal fiber length in composites with a hybrid structure of rigid carbon and flexible aramid fibers, focusing on the effect of fiber shape on mechanical properties in terms of microscopic structure.

Q Room 00.14

Special technical textile products

Chairs: Marcin Barburski, Asami Nakai

D. Ranz, R. Miralbes, J. Abad, C. Pina, M. Barburski

Zaragoza University, Lodz University of Technology

TOWARDS MORE SUSTAINABLE SPORT GOODS: THE CASE OF PADDLE **RACKETS**

In this work, a new paddle racket proposal made with flax fiber reinforcements has been analyzed in terms of performance, i.e. stiffness and rebound capacity, and its vibration behavior. The analysis of the behavior of paddle rackets is carried out both by experimental tests and numerical methods

Room 01.03

3D textile architecture

Chairs: François Boussu, Prasad Potluri

S. Li, E. Sitnikova

University of Nottingham

CATEGORISATION AND CHARACTERISATION OF TEXTILE COMPOSITES

Categorisation should precede characterisation for materials of micro-structures. Reflectional symmetries have conventionally been employed to identify principal axes, but they are often absent. Can rotational symmetries serve the purpose instead?

16:00-16:20 Parallel Session 3

Grote Aula

Thermoplastic textile composites

Chairs: Remco Akkerman, Laurent Warnet

J. Baur, M. Horvat, S. Carosella, P. Middendorf

University of Stuttgart

STUDIES ON THE ULTRASONIC WELDING OF THERMOPLASTIC NFRPs

The ultrasonic welding of thermoplastic NFRPs provides an efficient approach for joining sustainable lightweight materials. For a variety of welding parameters, the mechanical strength and the surface damage are tested and evaluated.

O Room 00.14

Special technical textile products

Chairs: Marcin Barburski, Asami Nakai

J. Szary, M. Barburski

Lodz University of Technology

THE USE OF THE NEW TEXTILE STRUCTURES FOR COMPOSITE REINFORCEMENT IN THE PRODUCTION OF CUSTOM-MADE ORTHOSES

Research shows practical application in the production of custom-made orthoses using a new composite consisting of a 3D printed core reinforced with UD glass fiber and carbon fiber braid.

Q Room 01.03

3D textile architecture

Chairs: François Boussu, Prasad Potluri

S. V. Lomov, E. Sitnikova, S. Li

KU Leuven, The University of Nottingham

ELASTIC PROPERTIES OF 3D WOVEN COMPOSITES: FINITE ELEMENTS AND MORI-TANAKA HOMOGENISATION

Mori-Tanaka homogenisation is as good as a finite elements model, demonstrated on six variants of carbon and glass fibres / epoxy 3D woven angle interlock composites.

16:20-16:40 Parallel Session 3

Grote Aula

Thermoplastic textile composites

Remco Akkerman, Laurent Warnet

O. Yuksel, E. Ul-Haq, B. Caglar, C. Dransfeld

Delft University of Technology

OPEN RESEARCH FACILITY FOR THERMOPLASTIC TAPE MANUFACTURING: A MODULAR AND VERSATILE TAPE MANUFACTURING LINE

The properties of thermoplastic composites are strongly dependent on the microstructural features of semi-finished products like tapes/ prepregs. A new dedicated research infrastructure links the manufacturing steps of thermoplastic tapes and their final microstructures.

Room 00.14 Special technical textile products

Chairs: Marcin Barburski, Asami Nakai

A. Weatherburn, S. Giani, A. Reinarz, B. Elsaied, C. Montgomery, E. Archer, C. Ralph. S. Szyniszewski

Durham University, University of Bristol, Ulster University

DESIGNING AND OPTIMISING A NOVEL BIOMIMETIC FIBRE-HYBRID 3D WOVEN COMPOSITE

Finite element models of fibre-hybrid 3D woven composites are generated to investigate and optimise the material properties of different designs.

Room 01.03

3D textile architecture

Chairs: François Boussu, Prasad Potluri

E. Sitnikova, S. Li

University of Nottingham

DESIGN METHOD FOR THE 3D WOVEN COMPOSITES BASED ON KEY GEOMETRIC CHARACTERISTICS OF REINFORCEMENT ARCHITECTURE

Design capability for 3D woven composites of layer-to-layer angle interlock internal architecture has been established that allows to vary their architecture is a systematic way to deliver the desired functional performance.

16:40-17:00 Parallel Session 3

Grote Aula

Thermoplastic textile composites

Remco Akkerman, Laurent Warnet

Y. Kondo, T. Tanaka, M. Sasada

Doshisha University

STUDY ON MANUFACTURING METHOD AND PROPERTY IMPROVEMENT OF CONTINUOUS CARBON FIBER REINFORCED FILAMENT FOR 3D PRINTER

We investigated the effect of fiber spreading. The use of curved rollers improved the void area. In the case of using curved rollers, it was found that the fibers can be dispersed at low tension without the need to apply backward tension.

Q Room 00.14

Special technical textile products

Chairs: Marcin Barburski, Asami Nakai

D. Yang, X. Chen

University of Manchester

ENGINEERING AND PERFORMANCE OF SEGMENTED HIERARCHICAL 3D WOVEN STRUCTURE FOR ANTERIOR CRUCIATE LIGAMENT REPLACEMENT

This study proposes an innovative structural design for artificial ligaments, which not only enhances mechanical properties but also facilitates the osseointegration and ligamentisation processes, thereby promoting cellular and tissue ingrowth.

Room 01.03

3D textile architecture

Chairs: François Boussu, Prasad Potluri

Z.-P. Wang, D. William Rosen

Institute of High Performance Computing, Singapore Institute of Manufacturing **Technology**

A GENERALIZED BACKGROUND VECTOR METHOD FOR DESIGNING 3D NON-PERIODIC WOVEN ARCHITECTURES

This study enhances the Background Vector Method (BVM) for automating the design process of tailoring 3D non-periodic woven composite preforms, incorporating features such as channels and tapering elements.

17:00-19:40

Ceremony and reception for emeritaat Stepan Lomov • Grote Aula



09:00-09:40 Plenary talk by Philippe Sanial:

Textiles for composites: sustainability challenges and opportunities **Q** Grote Aula

09:40-10:00 Parallel Session 1

Grote Aula Manufacturing of textile preforms

Chairs: Edward Archer, Luise Kärger

S. Umeda, T. Motochika, A. Nakai

Nagoya University, Gifu University

EFFECT OF MORPHOLOGY OF FIBROUS INTERMEDIATE MATERIAL ON FIBER ORIENTATION AND MECHANICAL PROPERTIES OF COMPOSITES

Thermal shrinkage of resin fiber impaired the dimensional accuracy of Commingled varn-molded CFRTP products and it reduced their mechanical properties. The intermediate material newly developed suppressed thermal shrinkage and improved impregnation.

• Room 00.14 LCA of textile composites

Chairs: Ignaas Verpoest, Yentl Swolfs

I. Verpoest, V. Michaud, J. Takahashi

KU Leuven, Ecole Polytechnique Fédérale de Lausanne, The University of Tokyo

LCA OF CARBON FIBRES: EXPLORING THE REASONS BEHIND THE HUGELY DIVERGING PUBLISHED DATA

Reliable data on LCA of carbon fibres are important, but very different data have been published over the past two decades. We have investigated the reasons behind this discrepancy, and came up with some solutions, enabling the carbon fibre community to construct a harmonised LCA data set.

Room 01.03 3D textile architecture

Chairs: Stepan Lomov, François Charleux

K. Sowrov, P. J. Withers, P. Potluri

University of Manchester

EFFECT OF WEAVE ARCHITECTURES ON THE FLEXURAL PROPERTIES OF 3D WOVEN COMPOSITES AND THEIR FAILURE MECHANISMS WITH WARP AND WEFT DIRECTIONAL Z-BINDERS

The flexural behaviour of warp and weft bound 3D woven composites with various binder weaves was investigated. The least Z-binder interlaced structure showed the highest stiffness and strength among all the weaves. Weft-bound composites demonstrated higher modulus and strength due to the nature of failure.

10:00-10:20 Parallel Session 1

Grote Aula Manufacturing of textile preforms

Chairs: Edward Archer, Luise Kärger

K. Yamada, M. Ohishi, A. Nakai

Gifu University

MOLDING CONDITIONS FOR HIGH SPEED PULTRUSION OF CERTP PIPE REINFORCED WITH BRAIDED STRUCTURES

Development of high speed pultrusion for CFRTP pipe with braided fabrics was conducted. The problem of the high speed pultrusion was shrinkage and delamination of the inner layer of the braided fabric, and the improvement of the problem was examined.

O Room 00.14

LCA of textile composites

Chairs: Ignaas Verpoest, Yentl Swolfs

B. Moutik, J. Summerscales, J. Graham-Jones, R. Pemberton

University of Plymouth

OUALITY ASSESSMENT OF LIFE CYCLE INVENTORY DATA FOR FIBRE-REINFORCED POLYMER

Rising concerns about environmental sustainability in the composite industry spur LCA studies, revealing LCI data quality issues. This study aims to improve LCA reliability by assessing the data quality of composite materials.

Room 01.03

3D textile architecture

Chairs: Stepan Lomov, François Charleux

N.V. Timoshchuk, K.D. Kasper

Albany Engineered Composites, Inc.

CREATING REALISTIC MESO-SCALE UNIT CELL MODELS OF 3D WOVEN COMPOSITES FOR PROPERTY PREDICTIONS

A methodology of generating realistic meso-scale finite element 3D woven composite unit cell models by means of tow paths extraction using uCT followed by computing of the in-plane and out-plane mechanical properties is presented.

10:20-10:40 Parallel Session 1

Chairs: Ignaas Verpoest, Yentl Swolfs

K. Angerer, T. von Reden, K. Drechsler

Fraunhofer Institute for Casting, Composite and Processing Technology IGCV

CARBON FIBER PRODUCTION - MARKET OVERVIEW AND ENVIRONMENTAL IMPACTS

The environmental impact of carbon fiber (CF) production is not well understood, with past assessments lacking transparency. Thus, a detailed life cycle assessment using industry-approved data was conducted, including a global scenario representing market averages for CF production.

Room 01.03 3D textile architecture

Chairs: Stepan Lomov, François Charleux

B. Turbot, F. Boussu, F. Rault

Université de Lille

AUXETIC HEXAGONAL COMPOSITE WITH WOVEN REINFORCEMENT AS INNOVATIVE SUBSITUTION OF SILENT BLOCKS IN AUTOMOTIVE

These works focus on studying auxetic composite materials to replace elastomeric silent blocks in automobiles. Their manufacturing involves weaving hollow reinforcements, then shaping them into a reentrant hexagonal geometry.

10:40-11:10 Coffee Break

11:10-11:30 Parallel Session 2

Grote Aula Toughness, defects and mechanical testing

Chairs: Mahoor Mehdikhani, Panayiotis Tsokanas

S. Fliescher, U. Mörschel, M. Khalid

Textechno H. Stein GmbH & Co. KG.

MEASUREMENT OF INTERFACIAL SHEAR STRENGTH BY MEANS OF MICROMECHANICAL SINGLE-FIBRE PULL-OUT TESTS

Micromechanical testing of the interfacial bonding between fibres and matrices has recently been standardized as DIN SPEC 19289. We will discuss the testing technique, review the novel standard, and provide hands-on examples.

Room 00.14 LCA of textile composites

Chairs: Ignaas Verpoest, Yentl Swolfs

H. Taiko

The Japan Carbon fiber Manufacturers Association. Toray Industries Inc.

INTRODUCTION TO JCMA'S CARBON FIBER SUSTAINABILITY VISION 2050

The Japan Carbon Fiber Manufacturers Association released the latest carbon fiber LCI data and a vision summarizing the long-term outlook for how carbon fiber (CF) can contribute to the realization of a sustainable society.

Room 01.03

Miscellaneous

Chairs: Prasad Potluri, Stepan Lomov

Y. Liu, N. Xu, W. Nu D. Zhang, M. Vandaele, F. Desplentere, D. Seveno

Heilongjiang University of Science and Technology, Hohai University, Harbin Institute of Technology, KU Leuven

MULTISCALE WETTABILITY OF TEXTILES

Our understanding of how liquid polymer matrices wet and impregnate textiles is still fragmented. This talk approaches this challenge by considering a hybrid Kevlar/PTFE fabrics and a multiscale wettability framework.

11:30-11:50 Parallel Session 2

Grote Aula Toughness, defects and mechanical testing

Chairs: Mahoor Mehdikhani, Panayiotis Tsokanas

X. Meng, W. Zhang, S. Li, S. Yan

Beihang University, The University of Nottingham

A NEW TESTING METHOD FOR CHARACTERIZING STIFFNESS OF TWILL WOVEN COMPOSITES BASED ON SOLELY DIRECT LOADING CONDITIONS

The study thoroughly discussed the category of twill woven composite and proposed a method for characterizing its stiffness that requires only uniaxial tensile tests.

O Room 00.14

LCA of textile composites

Chairs: Ignaas Verpoest, Yentl Swolfs

J. Meegan, A. Bodin, A. Bauby

Syensgo

ECO ASSESSMENT OF A HOT MELT CARBON FIBER PREPREG. UNCERTAINTY IS THE REFUGE OF HOPE?

Syensqo will overview its Sustainable Portfolio Management process and demonstrate the Product Carbon Footprint (PCF), in kgCO2eq / kg, of a representative hot melt carbon fiber prepreg. The uncertainty in the calculated value caused by the range of available data to choose from, will be highlighted and discussed.

Room 01.03

Miscellaneous

Chairs: Prasad Potluri, Stepan Lomov

S.B. Sapozhnikov, S.V. Lomov

South Ural State University, Central Aerohydrodynamic Institute, KU Leuven

DEGRADATION OF GLASS FIBRE WOVEN LAMINATE AFTER WATER UPTAKE / FREEZE / THAW CYCLING

Woven fiberglass after water uptake (1 wt%)/freezing/thaw loss of up to 50% of stiffness and strength (3-point bending) is caused by severe degradation of epoxy in the weave. The axial instability threshold of a cylindrical shell decreases by 40%.

11:50-12:10 Parallel Session 2

Grote Aula Toughness, defects and mechanical testing

Chairs: Mahoor Mehdikhani, Panayiotis Tsokanas

J. Wang, L. Yao

Harbin Institute of Technology

DAMAGE MECHANISMS IN MODE I QUASI-STATIC DELAMINATION OF 3D PRINTED COMPOSITE LAMINATES

Here, a novel material-based monitoring method is reported. Carbon nanotube fibers are shown to be specialized embedded sensors for monitoring additive carbon nanotubes and their network changes during nanocomposite manufacturing and application.

O Room 00.14

LCA of textile composites

Chairs: Ignaas Verpoest, Yentl Swolfs

M.D. Wakeman, R. Ramezani, V. Michaud

Ecole Polytechnique Fédérale de Lausanne

SCENARIO MODELLING OF THE CARBON FIBER INDUSTRY IN THE **TRANSITION TO NETZERO 2050**

A Monte Carlo simulation has been developed to track mass flows, CO2e, and monetary flows versus time to model decarbonization strategies for the carbon fiber industry in the transition to NetZero 2050. Alternate scenarios are considered for enabling technologies and market growth

Room 01.03

Miscellaneous

Chairs: Prasad Potluri, Stepan Lomov

P. Annamalai, S.V. Lomov, D. May, M. Nikzad, M. Bodaghi

Swinburne University of Technology, KU Leuven, Faserinstitut Bremen, Luxemburg Institute of Science and Technology

DESIGN OF A REFERENCE POROUS MEDIUM FOR CALIBRATING THROUGH-THICKNESS PERMEABILITY SETUPS

Permeability measurement in Liquid Composite Moulding (LCM) has lacked a standard reference medium. This study uses 3D printing to create textile-like structures, incorporating porosity and nesting effects, ensuring accurate benchmarking and calibration.

12:10-12:30 Parallel Session 2

Q Room 00.14 LCA of textile composites

Chairs: Ignaas Verpoest, Yentl Swolfs

B. Pech

Alliance for European Flax-Linen & Hemp

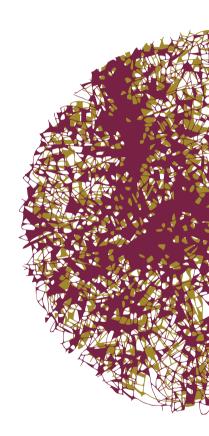
ENVIRONMENTAL TRAJECTORY AND LIFE CYCLE DATA FOR EUROPEAN FLAX-LINEN SECTOR

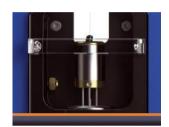
As the reference for technical, scientific, environmental and economic data on Flax, the Alliance for European Flax-Linen and Hemp is committed to co-constructing Life Cycle data which are scientifically robust and representative of our specificities.

12:30-13:30 Closing ceremony and lunch

Grote Aula

Words from Our Sponsors





Fibre-Matrix adhesion

Detailed characterization of the fibre-matrix adhesion for all fibres with thermoset and thermoplastic matrices as well as cement, measured by **FIMATEST**.



Single fibre/filament characterisation

Precise determination of linear density, diameter, tensile strength, elongation at break, breaking stress, modulus, on single fibres/filaments of all kinds by FAVIMAT+.



Roving and yarn characterisation

Linear-density, strength, elongation, stress, modulus, etc. on yarns and rovings of all kinds of fibres including high-tenacity yarns such as Aramid or UHMWE are measured by STATIMAT 4U.

Textechno

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Tel: +49 (0)2161 6599-0 info@textechno.com www.textechno.com





Roving processing properties

Friction properties, spreading behaviour, broken filaments after contact with different surfaces etc. are determined by ROVINGTEST.



Tape performance properties

Friction, width and thickness, fibre orientation, eddy current, heat take-up and protruding filaments measured by TAPETEST.

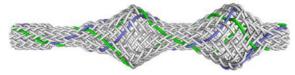


TexMind UG (limited liability) is a software company specialized in the development of software for engineering design, 3-D visualisation and optimisation of textile structures for medical, technical and composites applications.

The software "Braiding Machine Configurator" is specially designed virtual development of braiding machines with fixed and computer controlled switches and their programmes. The selection of the proper carrier arrangement and the states of the switches is a complicated task. With the software, simulation of the carrier motion can be solved iteratively without trials on the machine. The "Configurator" software is acting as a "digital twin" of the machine, it performs collision checks and prepares 3D visualisation of the new braided products. An integrated exporter to various FEM tools allows faster pre-processing of mechanical simulations of the products, as presented in figure.



The software "Braider" creates 3D visualisation of tubular braids over with cylindric or axial-symmetric mandrel. It computes the cover factor, the jamming angles and provides export of the geometry for FEM programmes as LS-Dyna, Abaqus or Ansys for extended computation.



TexMind Warp Knitting Pattern Editor allows visualisation of the complex warp knitting pattern and speeds up significantly the development process. Figure 3 demonstrates the 3D architecture of the yarns in a spacer warp knitted fabrics.

