CURRENT STATUS IN COMPOSITE LAMINATES ENHANCED BY ELECTROSPUN NANOFIBRES

Karen De Clerck[1], Lode Daelemans[1]

[1] *Department of Materials, Textiles and Chemical Engineering (MATCH), Ghent University, BELGIUM*

Abstract

Fibre reinforced polymer composites are the material of choice for designing applications which require a high strength and stiffness at minimal weight such as aerospace structures, wind turbines or ultralight vehicles. However, delamination between the reinforcing plies remains a major problem as it limits further breakthrough of these materials. Recently, interleaving electrospun nanofibres between the reinforcing plies has proven to be a viable interlaminar toughening method which can significantly limit the occurrence of delamination failure in composite materials [1,2]. The interleaved composites can be thought to have three different levels at which the nanofibres affect the properties (Fig 1.). These levels coincide with the hierarchical nature of the laminate itself: (i) the nanotoughened epoxy resin, (ii) the nanotoughened interlayer and (iii) the nanotoughened laminate. The effect of the nanofibres was analysed on each level separately. This multilevel analysis led to a significant advancement of the understanding of these materials in a more structured and general sense, a step that is crucial to be able to design better damage resistant composite structures. Nanofibre interleaved composites with excellent delamination resistance were designed, while obtaining a lot more fundamental knowledge about the prerequisites for effective nanofibre toughening. The improvements were in-line with and often even better than those obtained with traditional toughening methods.

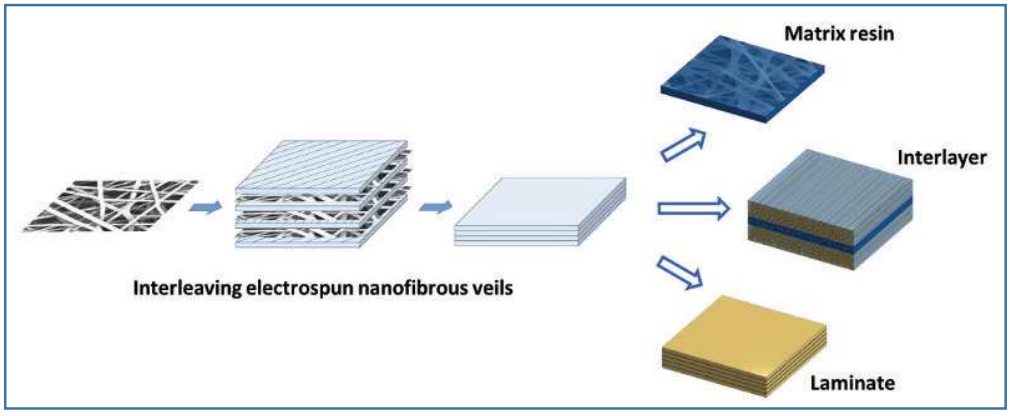


Fig 1. Illustration of the interleaving technique and the multilevel nature of nanofibre interleaved composite laminates.

[1] L. Daelemans, K. De Clerck et al., ACS Appl. Mater. Interfaces 8 (18), 11806-11818 (2016).

[2] L. Daelemans, K. De Clerck et al., Compos. Sci. Technol. 117, 244-256 (2015)

ECOFRIENDLY NANOFIBER MATERIAL AND ITS MASK AGAINST PM 2.5 BASED ON ELECTROSPINNING AND SPECIAL STRUCTURE DESIGN

ASHRAFUL ISLAM[1]*, YANBO LIU[2]

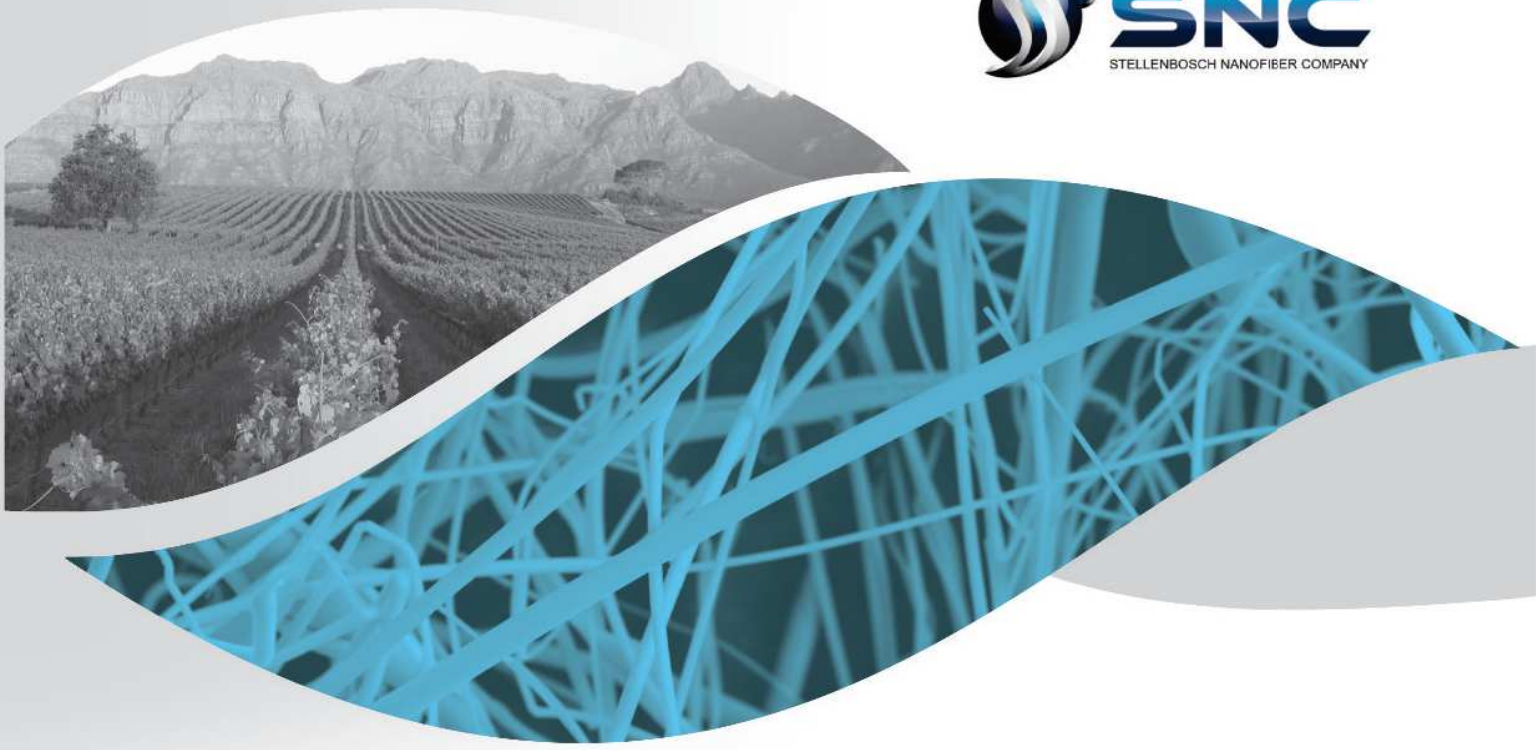
[1] *School of Chemistry and Chemical Engineering, Wuhan Textile University, Wuhan, China*

[2] *School of Textile Science and Engineering, Wuhan Textile University, Wuhan, 430200, China*

**Corresponding author: ashrafulislam73@mails.ucas.ac.cn*

Abstract

This aim of this work was to fabricate an efficient nanofiber based face mask in an ecofriendly way, which able to function well against particulate matter (PM) 2.5. Poly Vinyl Alcohol (PVA-DH: 98% ~ 99%) used as the prime polymer for electrospun nanofiber mat preparation. PAA (MW= 50000) added along with PVA (PVA: PAA, 60:40) to improve the physicochemical property by inducing crosslinkages among the polymer chains of nanofiber mat. Orthogonal experiment design was performed to get the optimal condition for electrospinning. Nanofibers



ELECTROSPIN2018
INTERNATIONAL CONFERENCE

16th to 18th January 2018

Wallenberg Research Centre at Stias

Stellenbosch, South Africa

Hosted by The Stellenbosch Nanofiber Company

PROGRAMME

MONDAY, 15 JANUARY 2018

4:30 PM – 8:00 PM	**WELCOME RECEPTION AND REGISTRATION**

TUESDAY, 16 JANUARY 2018

OPENING REMARKS AND PLENARY SESSION 1

8:50 AM **Welcome and Conference Opening**

9:10 AM **Ultralight polymer sponges from short electrospun fibers (Plenary)**
Andreas Greiner
Universität Bayreuth, Germany

10:00 AM – 10:30 AM	**BREAK**	
	Room 1: Energy, Catalysis, Electronics and Sensors	**Room 2: Medical Applications, Biotechnology and Tissue Engineering**
10:30 AM	**Electrospun nanofibers of organic semiconductors and hybrid materials: novel flexible light sources with enhanced photon emission** (Invited) Andrea Camposeo,[1] Luana Persano,[1] Maria Moffa,[1] Vito Fasano[2] and Dario Pisignano[2] *[1] NEST, Istituto Nanoscienze-CNR, Italy* *[2] Università del Salento, Italy*	**Electrospun cardiovascular devices: scaffolds for blood vessel and heart valve prostheses** (Invited) Deon Bezuidenhout *Strait Access Technologies, South Africa*
10:50 AM	**Electrospun nanofiber membranes for energy, environmental and biomaterial applications** (Invited) Ilias Louis Kyratzis and Yen Bach Truong *CSIRO Manufacturing, Australia*	**Electrospun 3D porous nanofiber scaffolds for tissue engineering** (Invited) Xiumei Mo *Donghua University, China*
11:10 AM	**Air purification by nanostructured electrospun membranes: different strategies for enhancing the performance of nanocomposite photocatalysts** Martina Roso, Carlo Boaretti, Alessandra Lorenzetti and Michele Modesti *University of Padova, Italy*	**Novel poly(ε-caprolactone)/gelatin wound dressings prepared by emulsion electrospinning with controlled release capacity of Ketoprofen anti-inflammatory drug** A.O. Basar,[1] S. Torres-Giner,[2] S. Castro,[3] Turkoglu Sasmazel[1] and Jose M. Lagaron[2] *[1] Atilim University, Turkey* *[2] CSIC, Spain* *[3] Bioinicia S.L., Spain*

11:25 AM	**Conjugates of platinum nanoparticles with gallium tetra – (4-carboxyphenyl) porphyrin and their use in photodynamic antimicrobial chemotherapy when in solution or embedded in electrospun fiber** Muthumuni Managa and Tebello Nyokong *Rhodes University, South Africa*	**Bead-on-string electrospun nanocomposite fibrous system for tissue engineering** Chiara Rinoldi, Ewa Kijeńska, Adrian Chlanda, Emilia Choinska and Wojciech Swieszkowski *Warsaw University of Technology, Poland*
11:40 AM	**MOF-templated synthesis of Co_3O_4 on SnO_2 nanofibers as superior anodes for lithium-ion batteries** Jun Young Cheong, Won Tae Koo, Chanhoon Kim, Ji-Won Jung, Su-Ho Cho and Il-Doo Kim *KAIST, Republic of Korea*	**Improved healing of electrospun tissue engineering scaffolds by increased porosity and drug delivery** Wian van den Bergh, Anel Oosthuysen, Thomas Franz, Peter Zilla and Deon Bezuidenhout *University of Cape Town, South Africa*
11:55 AM	**Laser induced photocatalytic degradation of Orange G using halogenated bodipy dyes embedded in polystyrene nanofibers** Augustus Lebechi, Tebello Nyokong and John Mack *Rhodes University, South Africa*	**Electrospun polyacrylamide hydrogel nanofibers: from nanocarriers to stimuli responsive nanomaterials** Sylwia Pawlowska, P.Nakielski and F. Pierini *Polish Academy of Sciences, Poland*
12:10 PM – 1:40 PM LUNCH		
	Room 1: Energy, Catalysis, Electronics and Sensors	**Room 2: Medical Applications, Biotechnology and Tissue Engineering**
1:40 PM	**Highly aligned printed nanofibers for flexible electronics and neuromorphic artificial synaptic electronics** (Invited) Tae-Woo Lee *Seoul National University, Republic of Korea*	**Tailoring electrospinning techniques for regenerative medicine** (Invited) Marc Simonet *IME Technologies, Netherlands*
2:00 PM	**Design of eco-friendly and sustainable nanofibrous sensors for detecting environmental pollutants** (Invited) Antonella Macagnano,[1] F. De Cesare,[1,2] E. Zampetti,[1] A. Bearzotti,[1] G. Scarascia-Mugnozza[2] and N. Pirrone[1] *[1] IIA-CNR, Italy* *[2] University of Tuscia, Italy*	**Advanced nanostructured fabrics for low burden protection** (Invited) Yen Bach Truong,[1,6] Jacinta Poole,[1,6] Ilias Louis Kyratzis,[1,6] Josh Ince,[1,6] Jurg Schutz,[1,6] Lucy Cotter,[1,6] Yvonne Douglas,[1,6] Shadi Houshyar,[2,6] David Nielsen,[3,6] Liberty Wagner,[4,6] Gareth Beckermann[5,6] and Deepak Ganga[6] *[1] CSIRO-Manufacturing, Australia* *[2] RMIT University, Australia* *[3] Defence Science and Technology Group, Australia* *[4] Bruck Textiles, Australia* *[5] Revolution Fibres, New Zealand* *[6] DMTC Ltd, Australia*

2:20 PM	**Catalyst comprising dual bio-templates assisted WO_3 nanotube toward exceptionally selective and sensitive H_2S sensors** Dong-Ha Kim,[1] Ji-Soo Jang,[1] Won-Tae Koo,[1] Seon-Jin Choi,[2] Hee-Jin Cho,[1] Min-Hyeok Kim,[1] Sang-Joon Kim[1] and Il-Doo Kim[1] *[1] KAIST, Republic of Korea* *[2] Harvard Medical School, USA*	**Nanofibrous scaffolds loaded with neurotrophin for peripheral nerve tissue engineering** Ewa Kijeńska and Wojciech Swieszkowski *University of Technology, Poland*
2:35 PM	**Electrospinning of polythiophene with pendant fullerene nanofibers for single-material organic solar cells** Filippo Pierini,[1] M. Lanzi,[2] P. Nakielski,[1] S. Pawlowska,[1] O. Urbanek[1] and T.A. Kowalewski[1] *[1] Polish Academy of Sciences, Poland* *[2] University of Bologna, Italy*	**Electrospun antimicrobial wound dressings as drug delivery systems-design and development** L. Preem,[1] G.-M. Lanno,[2] M. Putrinš,[2] T. Tenson[2] and K. Kogermann[1] *[1] Institute of Pharmacy, University of Tartu, Estonia* *[2] Institute of Technology, University of Tartu, Estonia*
2:50 PM	**Electrospun PMMA polymer blend nanofibrous membrane: electrospinnability, surface morphology and mechanical response** Jacky Jia Li Lee, Bee Chin Ang, Andri Andriyana, Md Islam Shariful, and M. A. Amalina *University of Malaya, Malaysia*	**Electrospinning of collagen with nanocapsules of PLGA for delivery of paclitaxel in drug-eluting stents** Liliana Maria Agudelo,[1,2] Jesus Antonio Carlos Cornelio,[2] Luis Fernando Rodriguez,[1,2] Isabel Cristina Ortiz,[1] Lina Marcela Hoyos[1,2] and Gabriel Jaime Colmenares[1,2] *[1] Universidad Pontificia Bolivariana, Colombia* *[2] Nanomat S.A.S, Colombia*
3:05 PM	**Laser induced photodegradation of Orange G using phthalocyanine - cobalt ferrite magnetic nanoparticle conjugates electrospun in polystyrene nanofibers** Sivuyisiwe Mapukata and Tebello Nyokong *Rhodes University, South Africa*	**Electrospinning of charged induced fiber scaffolds** Sara Metwally and Urszula Stachewicz *AGH University of Science and Technology, Poland*

3:20 PM – 3:50 PM BREAK		
	Room 1: Energy, Catalysis, Electronics and Sensors	**Room 2: Medical Applications, Biotechnology and Tissue Engineering**
3:50 PM	**Merging light emission and piezoelectric properties in electrospun polymer nanofibers** (Invited) Luana Persano,[1] Andrea Camposeo[1] and Dario Pisignano[1,2] *[1] NEST, Istituto Nanoscienze-CNR, Italy* *[2] Università del Salento, Italy*	**Biodegradable electrospun vascular grafts and their transformation in situ into neo-arteries** (Invited) Yadong Wang *Pittsburg University, USA*
4:10 PM	**Metal and semiconductor nanoparticles and their polymer fibres** (Invited) Makwena Moloto *Vaal University of Technology, South Africa*	**Electrospun nanofibers for advanced wound care** (Invited) Haydn Kriel, Megan Coates and Eugene Smit *The Stellenbosch Nanofiber Company, South Africa*
4:30 PM	**Electrospun polymer fibers for organic field effect transistors: from unipolar to ambipolar devices** Chiara Bertarelli, R. Castagna, B. Saglio, G. Mondini and M. Baroncini *Politecnico di Milano, Italy*	**Structure dependent cell activity on PCL/Gelatin and PCL/Collagen nanofibers electrospun from various solvents** Paweł Sajkiewicz, Judyta Dulnik, Dorota Kołbuk-Konieczny and Piotr Denis *Polish Academy of Sciences, Poland*
4:45 PM	**Morphological advances of thiophene and carbazole derivatives for superhydrophobic and opto-electric application** Khadija Kanwal Khanum and Praveen C. Ramamurthy *Indian Institute of Science, India*	**Characterization and evaluation of TPU-Hyaluronic acid membranes for tissue engineering applications** Magnus Kruse, Manuela Garay, Thomas Gries and Stefan Jockenhoevel *RWTH Aachen University, Germany*
5:00 PM	**Reinforcement of electrospun fibers with 2D MXene fillers** Patrik Sobolčiak,[1] Aisha Tanvir,[1] Anton Popelka,[1] Mohammad K. Hassan,[1] Khaled A. Mahmoud[2,3] and Igor Krupa[1] *[1] Qatar University, Qatar* *[2] Hamad Bin Khalifa University, Qatar* *[3] Port Said University, Egypt*	**Fabrication and characterization of electrospun alginate nanofibers impregnated with silver nanoparticles** Teboho Clement Mokhena[1,2] and A.S. Luyt[3] *[1] CSIR Materials Science and Manufacturing, South Africa* *[2] University of the Free State, South Africa* *[3] Qatar University, Qatar*
5:15 PM		**Electrospun PEO/ZNO nanofibers: characterization and UV-VIS drug delivery studies** Omolola E. Fayemi and Vuyisani M. Rabela *North-West University, South Africa*

WEDNESDAY, 17 JANUARY 2018

PLENARY SESSION 2

9:10 AM **Recent advances in tailored nanofibers for selective sensing and energy storage devices (Plenary)**
Il-Doo Kim
Korea Advanced Institute of Science and Technology (KAIST), Republic of Korea

10:00 AM - 10:30 AM BREAK

	Room 1: Energy, Catalysis, Electronics and Sensors	Room 2: Smart Materials and Novel Properties
10:30 AM	**Light diffusion and amplification in complex networks of electrospun nanofibers** (Invited) Dario Pisignano *University of Pisa, Italy*	**Smart multicomponent fibers** (Invited) Seema Agarwal, Li Liu and Martin Pretscher *Universität Bayreuth, Germany*
10:50 AM	**Constructing soft and solid-state lithium batteries with electrospinning techniques** (Invited) Jianhua Yan, Jianyong Yu, and Bin Ding *Donghua University, China*	**Synthesis of functional oxide nanocomposites via electrospinning** (Invited) Jennifer Andrew *University of Florida, USA*
11:10 AM	**Stretchable organic nanowire transistors** Yeongjun Lee,[1,2] Jin Young Oh,[2] Zhenan Bao[2] and Tae-Woo Lee[3] *[1] POSTECH, Republic of Korea* *[2] Stanford University, USA* *[3] Seoul National University, Republic of Korea*	**Electrospun copolyamide mats reinforced by cellulose nanocrystals** Igor Krupa, Patrik Sobolčiak, Aisha Tanvir and Anton Popelka *Qatar University, Qatar*
11:25 AM	**Influence of ionic liquid on the electrospun mat morphology** Illia Krasnou, Ljudmila Solovjova and Andres Krumme *Tallinn University of Technology, Estonia*	**Mechanical response of randomly oriented nanofibrous membranes: experimental characterization and constitutive modeling** Dannee Wong,[1] Andri Andriyana,[1] Bee Chin Ang[1] and Erwan Verron[2] *[1] University of Malaya, Malaysia* *[2] GeM UMR CNRS 6183, France*
11:40 AM	**All transparent-stretchable electrochromic-supercapacitor wearable patch device** Tae Gwang Yun, Dong-Ha Kim, Jin Gook Bae and Il-Doo Kim *KAIST, Republic of Korea*	**Eco-friendly aqueous electrospinning of polypropylene** Anne Hébraud, Chengzhang Xu and Guy Schlatter *ICPEES, UMR 7515 CNRS-University of Strasbourg, France*
11:55 AM	**Nanostructured carbon fibers as electrode materials for supercapacitors** Bonisiwe Seshabela, Bulelwa Ntsendwana, Sabelo D. Mhlanga and Edward N. Nxumalo *University of South Africa, South Africa*	**Application of melt differential centrifugal spun polypropylene micro-nanofibers as oil sorbent materials** Mahmoud Bubakir[1,2] and Haoyi Li[2] *[1] Aljabal-Algarbi University, Libya* *[2] Beijing University of Chemical Technology, China*

12:10 PM – 1:40 PM LUNCH		
	Room 1: Separation, Filtration and Additive Manufacturing	**Room 2: Smart Materials and Novel Properties**
1:40 PM	**Bio-waste-derived nanofibers formed by solution blowing and electrospinning and their applications as biomedical materials and adsorbents for heavy metals removal from polluted water** (Invited) Alexander Yarin *University of Illinois at Chicago, USA*	**Cellulose nanofibers and aerogels with tunable amphiphilicity and chemical functionalities** (Invited) You-Lo Hsieh *University of California, USA*
2:00 PM	**Polymer nanofibers: design, function and application** (Invited) Zenixole Tshentu *Nelson Mandela University, South Africa*	**Antimicrobial nanofibers – strong and lethal** (Invited) Bert Klumperman *Stellenbosch University, South Africa*
2:20 PM	**Current status in composite laminates enhanced by electrospun nanofibres** Karen De Clerck and Lode Daelemans *Ghent University, Belgium*	**Electrospun polyester mesofibers: a new tool in dispenser technology for broadcasting semiochemicals in plant protection against arthropod pests. The example of cosmopolitan *Lobesia botrana* (*Lep. Tortricidae*) in viticulture** Hans E Hummel[1,2] *[1] Justus-Liebig-University Giessen, Germany* *[2] University of Illinois Urbana-Champaign, USA*
2:35 PM	**Ecofriendly nanofiber material and its mask against PM 2.5 based on electrospinning and special structure design** Ashraful Islam and Yanbo Liu *Wuhan Textile University, China*	**Electrospun fibers in 3D – FIB-SEM tomography** Urszula Stachewicz *AGH University of Science and Technology, Poland*
2:50 PM	**Optimization of rheological solution properties for the development of wet direct-writing electrospinning for tissue engineering purpose** Laura Bourdon, Laura Courty, René Fulchiron, Arnaud Brioude and Vincent Salles *Claude Bernard University Lyon, France*	**The development and optimization of aspalathin-enriched green rooibos loaded polymer nanoparticles by electrospraying** Chantelle Human,[1] Dalene de Beer[1,2] and Elizabeth Joubert[1,2] *[1] Stellenbosch University, South Africa* *[2] Agricultural Research Council, South Africa*
3:05 PM	**Removal of rare earth metal ions by functionalised electrospun polystyrene nanofibers from aqueous solution** Omoniyi Pereao,[1] Chris Bode-Aluko,[1] Katri Laatikainen[2] and Leslie F. Petrik[1] *[1] University of the Western Cape, South Africa* *[2] Lappeenranta University of Technology, Finland*	**Fabrication of polymeric composites nanofiber material using electrospinning technique** Dikeledi More,[1,2] Makwena Moloto[1] and Nosipho Moloto[2] *[1] Vaal University of Technology, South Africa* *[2] Wits University, South Africa*

3:20 PM – 3:50 PM Break		
3:50 PM - 5:30 PM	Poster Session	
5:30 PM – 11:00 PM	Gala Dinner	

THURSDAY, 18 JANUARY 2018

PLENARY SESSION 3

9:10 AM **Stimuli-responsive polymer fibers (Plenary)**
Eyal Zussman
Israel Institute of Technology-Technion, Israel

10:00 AM - 10:30AM BREAK		
	Room 1: Separation, Filtration and Additive Manufacturing	**Room 2: Smart Materials and Novel Properties**
10:30 AM	**Electrospinning as part of additive manufacturing** (Invited) Geoffrey Mitchell *Polytechnic Institute Leiria, Portugal*	**Electrospinning of Nanofibers using Modified Slot Spinnerets** (Invited) Tong Lin, Guilong Yan, Haitao Niu *Institute of Frontier Materials, Deakin University, Australia*
10:50 AM	**Electrospinning activities at the DST/Mintek Nanotechnology Innovation Centre** (Invited) Phillemon Matabola *DST/Mintek NIC, South Africa*	**Has electrospinning come of age? Challenges and opportunities in biomaterials** (Invited) Brendan Robb *Electrospinning Company, UK*
11:10 AM	**New combination of technology: conductive electrospun nanofibers and 3D printed packaging material for freeform flexible Li-Air batteries** Ji-Won Jung, Ki Ro Yoon, Tae Gwang Yun, Chanhoon Kim, Su-Ho Cho, Jun-Young Cheong, Seok Won Songa and Il-Doo Kim *KAIST, Republic of Korea*	**Tannic acid nanofibers from polymer-free solutions** Domitille Mailley,[1] M. Allais,[2,3] P. Hébraud,4 V. Ball,[2,3] F. Meyer,[2,3] A. Hébraud[1] and G. Schlatter[1] *[1] ICPEES-UMR7515, CNRS, University of Strasbourg, France* *[2] INSERM, UMR 1121, France* *[3] Université de Strasbourg, France* *[4] IPCMS, UMR 7504, France*

11:25 AM	**Removal of nickel(II) by 2-(2'-pyridyl) imidazole functionalized polyacrylonitrile nanofiber** Katri Laatikainen,[1] Guillaume Ndayambajeb,[2] Markku Laatikainen,[1] Edith Beukes,[2] Olanrewaju Fatoba,[2] Nico van der Walt,[3] Leslie Petrik[2] and Tuomo Sainio[1] *[1] Lappeenranta University of Technology, Finland* *[2] University of the Western Cape, South Africa* *[3] Cape Peninsula University of Technology, South Africa*	**Real-time random lasing detection during structural transformation in electrospun fibrous structure** SungYeun Yang, Soocheol Kim, Chulmin Joo and WonHyoung Ryu *Yonsei University, Republic of Korea*
11:40 AM	**Electrospun nanofibrous mats modified with cyclodextrin for water treatment** Mandla Brian Chabalala,[1] Stijn WH Van Hulleb,[2] Bheki B Mambaa[1] and Edward N Nxumalo[1] *[1] University of South Africa, South Africa* *[2] Ghent University, Belgium*	
11:55 PM	**Chitosan and chitin based-nanofiber biosorbents for efficient removal of zinc from wastewater** Alicia Botes,[1,2] Albert Johannes Van Reenen,[1] Marietjie Lutz[1] and Sinha Ray Suprakas[2] *[1] Stellenbosch University, South Africa* *[2] CSIR, South Africa*	
12:15 PM	**END OF CONFERENCE**	