



EUPOC 2019

Electrospinning and related techniques:
From design to production of advanced
polymer materials and devices

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Booklet of Abstracts

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INDEX

INVITED LECTURES

IL1 P.A. Wieringa	
Design and serendipity: creating fibrous microniches for biological applications	1
IL2 M.L. Focarete	
Functional electrospun polymeric fibers: from nanohybrid to bioactive nanomaterials.....	2
IL3 D. Maniglio	
Multilayer electrospinning approach for vascular applications	3
IL4 L. García-Fernández, J. San Román	
Use of non-conductive templates in the electrospinning process and their applications.....	4
IL5 A. Greiner	
Functional polymer sponges from short electrospun fibers	5
IL6 Y. Xia	
Electrospun nanofibers at work for biomedical research	6
IL7 E. Schoolaert, E. Locufier, L. Daelemans, K. De Clerck	
From sensors to composites: showing the immense versatility of solvent electrospun nanofibres.....	7
IL8 K. Figueroa-Lopez, A. Cherpinski, B. Melendez, M. Pardo-Figuerez, C. Prieto, S. Torres-Giner, J. M. Lagaron	
Biopapers, a novel barrier and active electrospun fiber based materials concept.....	8
IL9 S. Cavaliere, S. Giancola, M. Zaton, M. Dupont, D. Jones, J. Roziere	
Electrospun fibres for proton exchange membrane fuel cell and water electrolysis applications.....	9
IL10 J. Cui, J.-K. Kim	
Surface modification of electrospun porous carbon nanofibers as hosts for stable Li metal anodes.....	10
IL11 A. Camposeo, D. Pisignano, L. Persano	
Electrospinning as additive manufacturing technology for photonics and electronics.....	11
IL12 G. Schlatter, F. Flaig, M. Liang, A. Hébraud	
2D and 3D controlled deposition of electrospun nanofibers: from the mechanisms to the applications	12

ORAL CONTRIBUTIONS

OC1	M. Cirstea The next step: translating electrospinning biomaterials research into a medical device	13
OC2	P. Jain, A. Nishiguchi, S. Singh, M. Moeller Basement membrane mimics of biofunctionalized nanofibers for a bipolar-cultured human primary alveolar-capillary barrier model.....	14
OC3	B. Azimi , M. S. S. Bafoi, M. Latifi, A. Lazzeri, S. Danti ZnO-loaded piezoelectric fiber meshes for tissue engineering applications	15
OC4	M. Simonet , J. Heikoop Electrospinning for regenerative medicine; challenges and solutions to bring products to the market	16
OC5	J. R. Dias , A. F. Alves, N. M.F. Alves Electrospun structures as a key tool to mimic the native skin ECM	17
OC6	I. Bonadies , G. Dal Poggetto, R. Yulina, P. Laurienzo Chitosan based multicomponent nanofibers for drug delivery.....	18
OC7	G. Amokrane , V. Humblot, E. Jubeli, N. Yagoubi, S. Ramtani, V. Migoneey, C. Falentin-Daudré Influence of the covalent grafting of bioactive polymers onto PCL fibre scaffolds: surface characterization, intrinsic properties investigation and <i>in vitro</i> biological response	19
OC8	M. Brunelli , R. M. Rossi, G. Fortunato Enhanced piezo response of PVDFhfp/PDMS core sheath fibres for sensors applications.....	20
OC9	A. Macagnano , J. Avossa, E. Zampetti, R. Paolesse, G. Scarascia Mugnozza, C. Di Natale, F. De Cesare Porphyrin, graphene and polymers: smart combinations for selective nanofibrous chemosensors for gas and VOCs.....	21
OC10	M. Kurečič , S. Hribernik, A. Ojstršek, T. Pivec, M. Božič, K. S. Kleinschek Electrospun composite 3D structures: polysaccharides combined with active substances for versatile applications	22
OC11	G. Lanzara , K. C. Chinnam, A. Casalotti, E. Bemporad Characterization of piezoelectric nanocomposite nanofibers fabricated via far field electrospinning	23
OC12	A. Sensini, C. Gotti , M. L. Focarete, C. Gualandi, A. Kao, G. Tozzi, L. Cristofolini, A. Zucchelli Morphologically bio-inspired hierarchical nylon 6,6 electrospun structures for soft-robotics applications	24
OC13	F. Bossard , H. Mondesert, D. Favier Mechanical behavior of structured electrospun scaffolds dedicated to soft tissue engineering: from experimental characterization to simulation	25
OC14	C. Prieto , J. D. Escobar, M. Pardo-Figuerez, J. Maria Lagarón Microencapsulation of bioactives by an innovative high-throughput technique	

based on electrospraying.....	26
OC15 H.J. Yoo , B. E. Kwak, D. H. Kim Needleless electrospinning for the large production of polymer nanofibers with wing structured spinnerets	27
OC16 C. Ceccone , F. Caldera, F. Trotta, A. Anceschi, P. Bracco, M. Zanetti Electrospun PMDA/cyclodextrin nanosponges as precursor for novel carbon materials	28
OC17 H. Mondésert , F. Bossard, D. Favier Elaboration of honeycomb micropatterned fibrous scaffolds by electrospinning with anisotropic mechanical properties for soft tissue engineering.....	29
OC18 A. Doderò , M. Alloisio, M. Pozzolini, S. Scarfi, S. Vicini, M. Castellano Nanofibrous electrospun sodium alginate membranes loaded with zinc oxide nanoparticles	30
OC19 E. Dzierzkowska , E. Menaszek, M. Nocuń, B. Kolesińska, E. Stodolak-Zych Effect of carbon nanofibers surface modification with biomolecules on structural properties and cellular response.....	31
OC20 G. Fortunato , L. Weidenbacher, A. G. Guex, M. Rottmar, K. Maniura, R. M. Rossi Tailoring nanofiber surface and mechanical properties for cell-laden hybrid membranes mimicking the native blood barrier	32
OC21 M. E. Fragalà , G. Ognibene, G. Cicala Functional applications of hybrid polymeric/inorganic electrospun mats.....	33
OC22 E. Garcia-Verdugo , D. Valverde, R. Porcar, B. Altava, M. I. Burguete, S. V. Luis Hierarchically structured polymeric ionic liquid membranes obtained by electrospinning.....	34
OC23 A. Ivanoska-Dacicj , G. Bogoeva-Gaceva, A. Krumme, C. Scalera, V. Stojkovski, I. Gjorgoski, T. Ristoski, I. Gjurovski Polyurethane/graphene oxide scaffolds for soft tissue engineering application: obtainment, characterization and <i>in vivo</i> behavior assessment.....	35
OC24 P. Kianfar , A. Vitale, S. Dalle Vacche, R. Bongiovanni Preparation of photo-crosslinked chitosan/poly(ethylene oxide) nanofibrous mats	36
OC25 J. Knapczyk-Korczak , D. P. Ura, J.P. Chiverton, U. Stachewicz Controlling wetting and mechanical properties of electrospun polymer fiber composites	37
OC26 B. Akinalan Balik , S. Argin, S. Torres-Giner, J. M. Lagaron Development of electrospun pectin-based films for food packaging applications	38
OC27 M. Pardo-Figuerez , J. Lasprilla-Botero, C. Prieto, S. Torres-Giner, J. M. Lagaron Superhydrophobic coatings based on annealed electrospun fibers and electrosprayed nanostructured particles for easy emptying packaging applications	39
OC28 G. Ognibene , M. E. Fragalà, A. Di Stefano, G. Li Volti, G. Cicala Electrospun nanofibers as cells scaffold with antibacterial properties.....	40

Index

OC29	S. G. King , S. Ravi P. Silva, V. Stolojan Highly conductive aligned carbon nanotube sheets and wires.....	41
OC30	H. Lee, H. Kim, Y. Seo Pure piezoelectricity generation by a flexible nanogenerator based on lead zirconate titanate nanofibers	42
OC31	T. M. Brugo, D. Cocchi, A. Zucchelli , F. Grolli, G. Selleri, M. Speranza, D. Fabiani, E. Maccaferri, L. Mazzocchetti, L. Giorgini, I. Falco, A. Marrani Piezoelectric nanofibrous MAT for self-sensing composite materials	43
OC32	R. Koekoekx , N. K. Zawacka, G. van den Mooter, Z. Hens, C. Clasen Embedding quantum dots in block copolymer particles by electrospraying.....	44
OC33	M. Forouharshad, S. G. King, P. Kunovski, V. Stolojan Electrospun PVDF with enhanced b for energy harvesting textiles.....	45
OC34	U. Stachewicz Surface properties of electrospun polymer fibers controlled with voltage polarities	46
OC35	V. Vassiljeva , E. Tarasova, S. Malmberg, I. Krasnou, M. Viirsalu, A. Krumme Electrospun electrodes for supercapacitors	47
OC36	A. V. Subbotin , V. G. Kulichikhin Electrospinning regimes and orientation of polymer chains	48
OC37	I. Otsuka , C. J. Barrett Electrospinning of a photo-responsive cellulose derivative: towards smart nano/microfibrous materials	49
OC38	C. Bertarelli , R. Castagna, S. Donini, E. Parisini Biohybrid nanofibrous membrane for chemical filtration of nonsteroidal anti-inflammatory drugs.....	50
OC39	E. Maccaferri , L. Mazzocchetti, T. Benelli, A. Zucchelli, L. Giorgini NBR-based electrospun rubbery nanofibers: production and characterization	51
OC40	A. Vitale , M. Quaglio, G. Massaglia, A. Chiodoni, R. Bongiovanni Electrospinning and photo-crosslinking of rubber nanofiber membranes.....	52
OC41	E. Svinterikos, I. Zuburtikudis , M. Al Marzouqi Producing high-added value products from waste and renewable resources through electrospinning: carbon nanofibers from lignin and recycled PET	53
OC42	E. Rezabeigi, N. R. Demarquette Obtention of porous electrospun polymer fibers.....	54
OC43	I. Krucińska, A. Komisarczyk , J. Drobnik, B. Zywicka <i>Application of electrospinning of biodegradable polymers for design of implantable materials</i>	55
OC44	V. G. Kulichikhin , A. V. Subbotin, I.Y. Skvortsov, A. Y. Malkin Electrospinning and mechanotropic spinning: similarities and differences	56
OC45	T. Pivec , M. Kurečić, T. Maver, U. Maver, P. Gasparič, B. Kaker, A. Bratuša, S. Hribernik, K. S. Kleinschek Bio-based mats with included medical plant extracts produced by needle-free electrospinning for wound healing application	57

Index

OC46	N.A. Zavrazhnykh , I.P. Dobrovolskaya, V. E. Yudin Porous matrices based nanofibers of polylactide for vascular surgery	58
OC47	A. Sensini , L. Cristofolini, A. Zucchelli, M. L. Focarete, C. Gualandi, A. De Mori, A. Kao, M. Roldo, G. Blunn, G. Tozzi Hierarchical electrospun bioinspired scaffolds can modify fibroblasts morphology in static and dynamic culture	59
OC48	D. Grande , H. Rodríguez-Tobias, G. Morales Electro-hydrodynamic techniques for fine-tuning antibacterial and UV-shielding properties of electrospun scaffolds based on biodegradable polyesters and ZnO nanoparticles	60
OC49	A. E. Chiriateva , G. V. Vaganov, V. E. Yudin, V. M. Svetlichnyi, L. A. Myagkova, E. M. Ivan'kova, E. N. Popova, V. Y. Elokhovskii Electrospun polyimide nonwoven materials from aqueous solutions of polyamic acid salts	61

POSTER CONTRIBUTIONS

P1	S. Anand , T. Stoppe, S. Danti, L. Moroni, C. Mota Influence of geometry over the vibro-acoustic response of human tympanic membrane.....	62
P2	B. Azimi , C. Ricci, T. Macchi, F. Pratesi, M.-B. Coltelli, S. Danti Electrospun scaffolds based on polyhydroxyalkanoates for skin regeneration.....	63
P3	P. Bruni , F. Maroni, A. Tartaglia, M. Locatelli, F. Croce Study of the kinetic release of an active compound from electrospun polymeric membranes.....	64
P4	A. E. Chiriateva , G. V. Vaganov, V. E. Yudin, V.M. Svetlichnyi, L. A. Myagkova, E. M. Ivan'kova, N. V. Smirnova Development of electrospun polyimide nano- and microfibers for medical application	65
P5	H.-A Christ , H. Menzel Electrospinning of highly modified chitosan – towards selective support matrices for biomolecules.....	66
P6	L. Dabasińskaite , E. Krugly Polycaprolactone scaffold surface modification for cell growth using ozonation	67
P7	O. I. Kalaoglu-Altan, B. Azimi, S. Danti, K. De Clerck Electrospun nanofibers for skin-contact applications.....	68
P8	C. Gualandi, M. L. Focarete , G. Fornaia, M. Raisch, D. Genovese, N. Zaccheroni, S. B. Schmidt, M. Sommer Mechanochromic nanofibers for the development of stress/strain sensors	69
P9	D- Grande , J. R. López Muñoz, G. Morales, F. J. Enríquez-Medrano Electrospun fibers from poly(methyl methacrylate-co-methacrylic acid) loaded with zinc oxide nanoparticles: towards functional devices for anticancer therapy	70
P10	D. Grande , V. Langlois, E. Renard Functional biodegradable electrospun scaffolds meant for tissue engineering: physical vs. chemical functionalization	71
P11	V. Padilla, H. Rodríguez, G. Morales , A. Ledezma, K. Lozano, C. Rodríguez, R. Gilkerson, D. Grande Antibacterial bioactive fibrous mats based on poly(D-L-lactic acid), zinc oxide and hydroxyapatite manufactured by centrifugal spinning (forcespinning®)	72
P12	C. Işık , M- Teke Cellulose acetate/polyvinylpyrrolidone electrospun nanofibers: fabrication and characterization.....	73
P13	E. Mázl Chánová , H. Beneš, J. Svoboda, P. Knotek, Y. Yang Synergic effect of composite polyester nanofibers with carbon-based nanofillers and mechanical stimulation on stem cells' osteo-differentiation.....	74

Index

P14	A. Neira-Carrillo , F. E. Sepükveda, N. Butto, J. L. Arias, M. Yazdani-Pedram Effect of topography and pores of polycaprolactone (PCL) electrospun meshes template on in vitro calcium carbonate (CaCO ₃) crystallization through gas- diffusion technique.....	75
P15	D. Pawcenis , D. Chlebda, R. J. Jędrzejczyk, M. Leśniak. M. Sitarz, J. Łojewska Electrospun nanofibers of modified cellulose with silver nanoparticles.....	76
P16	D. N. Poshina , A. A. Sukhova, Y. A. Skorik Modeling chitosan lactate electrospinning parameters using response surface methodology.....	77
P17	D. N. Poshina , V. A. Petrova, D. D. Chernyakov, A. S. Golovkin, Y. A. Skorik Bilayered electrospun chitosan-hyaluronan material for tissue engineering.....	78
P18	A. Rubin Pedrazzo , C. Cecone, S. Morandi, M. Manzoli, M. Zanetti, P. Bracco Influence of the polymer solution on both morphology and microstructure of nanosized SnO ₂ prepared by electrospinning.....	79
P19	A. C. Trindade , A. P. C. Almeida, J. Oliveira, J. P. Canejo, S. N. Fernandes, J.- O. Fossum, M. H. Godinho Patterned non-woven cellulosic membranes for recovery of oil microdroplets.....	80
P20	S. Vicini , M. Castellano, A. Dodero, V. Caratto, M. Alloisio Alginate with silver nanoparticles electrospun membranes for biomedical applications.....	81
P21	C. Cecone , M. Zanetti. P. Bracco. F. Caldera, F. Trotta Fibrous mats from electrospun PMDA/cyclodextrin polymer as DEET controlled release system	82
Author Index		83
List of Participants		85

A B S T R A C T S

OC9

PORPHYRIN, GRAPHENE AND POLYMERS: SMART COMBINATIONS FOR SELECTIVE NANOFIBROUS CHEMOSENSORS FOR GAS AND VOCS

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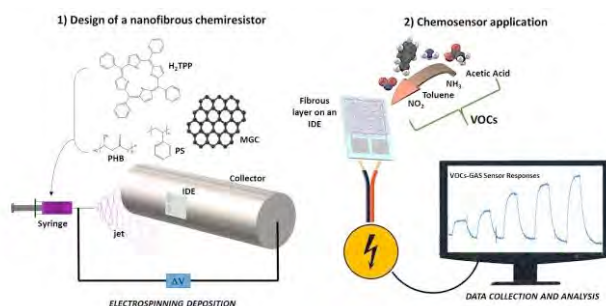
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Abstract

Polymer-carbon nanomaterials composites properties sound so attractive in various areas to have become a great challenge, too, in chemical sensors investigation. Here, a thin nanofibrous layer, composed of two insulating and eco-friendly thermoplastics (polystyrene-PS and polyhydroxybutyrate-PHB), a known percentage of nanofillers of mesoporous graphitized carbon (MGC) and a free-base tetraphenylporphyrin (H₂TPP), has been deposited onto an Interdigitated Micro-Electrode (IDE) by

electrospinning technology and in a single step (**Figure**). The effects of the combination of a porphyrin with the composite system graphene-polymers appeared evident when nanofibrous layers, with- and without porphyrin, were compared about their morphology, electrical and sensing parameters. Both the resulting sensors were conductive at room temperature and could work between 40 and 70-80 °C without any apparent degradation. Therefore porphyrin-



doped fibers appeared smoother and thinner ($d \approx 175$ nm) than porphyrin-free ones ($d \approx 550$ nm). The latter, indeed, looked extremely rough on the surface and decorated with brighter islands. However, both of them were more resistive at lower temperature, but became much more conductive when temperature rose to 60-70 °C. Porphyrin had a key role in adsorption and diffusion of chemicals, depending on its combination inside the composite fiber, since the response rates dramatically increased (toluene, acetic acid) with temperature. Conversely, the porphyrin-free sensor resulted highly sensitive and selective to acetic acid at 40°C but the sensitivity fell down when the sensor operated at 80 °C. On the other hand, the same sensor increased its sensitivity only to NO₂ when worked at 80°C, reporting a ~ 2 ppb limit of detection (LOD), thus confirming that temperature, as well as the free-base porphyrin, were two key players in driving the selectivity of the designed nanocomposite polymeric sensors.

References

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