E-MRS European Materials Research Society

Keynote session Smart Nano-Materials, Systems Multifunctionality Strategy from Nature

Monday May 29 9:00

Keynote Introduction Founder of the E-MRS, General Secretary of the E-MRS Professor Dr. Paul Siffert

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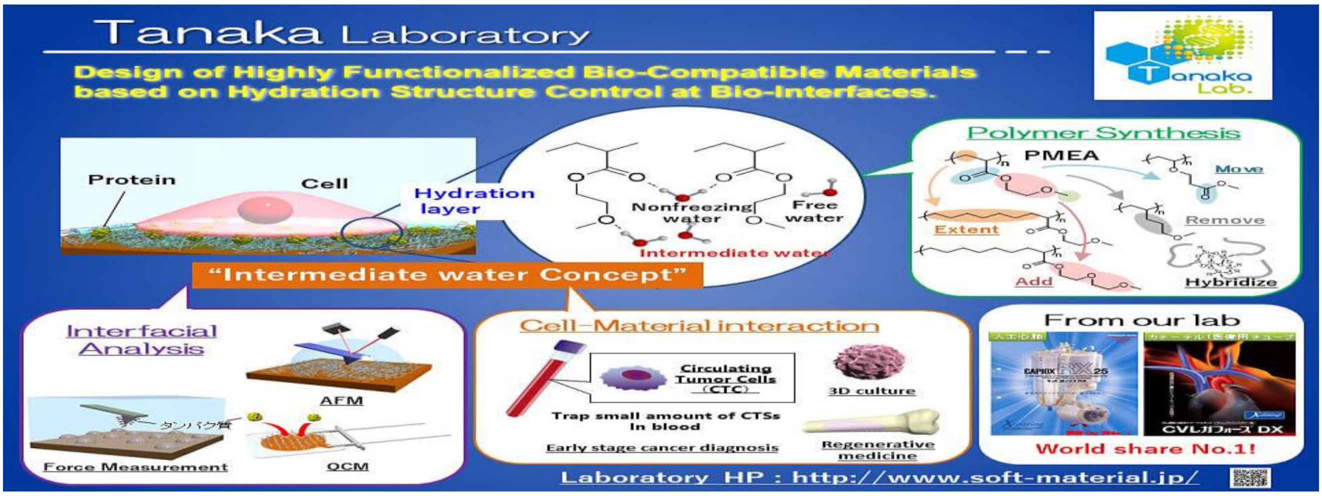
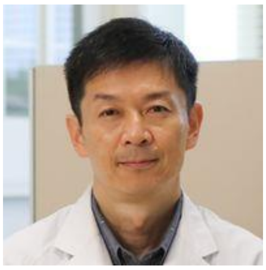
09:10 ***HONORARY LECTURE Nobel Laureate in Chemistry 2022***

Professor. Dr. Morten Peter Meldal

Creating Functional Molecules with Click Chemistry and Bioorthogonal Chemistry . Carolyn R. Bertozzi, Morten Meldal, K. Barry Sharpless are awarded the Nobel Prize in Chemistry 2022 "for developing click chemistry and bio-orthogonal chemistry. www.nobelprize.org/prizes/chemistry/2022 meldal@chem.ku.dk



10:30 Tutorial Lecture Design and Synthesis of Functional Biomaterials -Intermediate Water Concept for Medical Devices



Prof. Dr.Masaru Tanaka,
Kyushu University, Tanaka-Lab, Japan
https://hyoka.ofc.kyushu-u.ac.jp/search/details/K005747/english.html
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Masaru TANAKA is a professor at Kyushu University. He worked for TERUMO Co. (Leading Medical Devices Company) and designed novel biocompatible polymers and commercialized as medical devices such as catheters, and artificial lung and heart (Global market share No.1). In 2000 he moved to Hokkaido University and in 2007 he moved to Tohoku University. Stents covered with the self-organized porous 3D films are commercially available in the world clinical market (over 250 original patents). In 2009 he was awarded a full professorship at Yamagata University. He became a leader of Funding Program for Next Generation World-Leading Researchers (NEXT Program, Japan). Since 2015, he has been at Kyushu University as a full Professor. Thus far, he has published over 200 papers in peer reviewed journals (H-index 56) and has received the Award for the Japanese Society for Biomaterials 2021 for his intermediate water concept for biomaterials discovery.

The E-MRS Member Activity: Invited and Keynote Presentations at Symposia Bioinspired and Biointegrated Materials as New Frontiers Nanomaterials" 2011(II the Edition) and 2014 (with Colleagues) and 2016, 2017, 2018 (with PhD Student), 2023 (II-XI th Editions).
The E-MRS Invited Scientific Supervisor for this symposium Keynote Session "Young Investigator Forum " at Symposia 2017 and 2023 and Scientific Organizer of this Symposium 2023 -XI th Edition

Design and Synthesis of Functional Biomaterials-Intermediate Water Concept for Medical Devices

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Water molecules play a crucial role in bio-interfacial interactions, including protein adsorption/desorption and cell adhesion behavior. To understand the role of water in the interaction of proteins and cells at biological interfaces, it is important to compare the states of hydration water with various physicochemical properties of hydrated biomaterials. Here, we present the fundamental concepts for determining the interactions of proteins and cells with hydrated materials along with selected examples corresponding to our recent studies, for example, poly(2-methoxyethyl acrylate) (PMEA), PMEA derivatives, zwitterionic polymers, poly(ethylene glycol), and poly(2-oxazoline)s, and other biomaterials including biomolecules/polymers (DNA, RNA, proteins, and polysaccharides). The states of water were analyzed by differential scanning calorimetry, in situ attenuated total reflection infrared spectroscopy, and surface force measurements. We found that intermediate water which is loosely bound to a biomaterial, is a useful indicator of the biocompatibility of material surfaces. This finding on intermediate water provides novel insights and helps develop novel experimental models for understanding protein adsorption in a wide range of materials, such as those used in biomedical applications. https://www.chem.kyushu-u.ac.jp/~cstm/en/laboratory/laboratory_318.php

16:30 Keynote Lecturer Recent Applications of Electrochemical Nucleic Acid Biosensors based on Carbon Nanomaterials

Prof. Dr. Arzum ERDEM GURSAN

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Arzum Erdem Gursan received Bachelor in Pharmacy from Ege University, Izmir, Turkey in 1993. She received the master degree in 1996 and PhD degree in 2000 in Department of Analytical Chemistry at the same university in Izmir. She worked as an Assistant Professor from 2000 to 2003 and as an Associated Professor from 2003 to 2009 at the Analytical Chemistry Department of the Faculty of Pharmacy in Ege University. She has been working at the same department as a Full Professor since 2009. Prof. Arzum Erdem Gursan was awarded by the Turkish Academy of Sciences (TÜBA) as the one of highly skilled young twenty Turkish scientists elected in 2001, and she also received *"TÜBİTAK-Juniour Science Award"* in 2006 and *"TÜBİTAK-Science Award"* in 2015 given by The Scientific and Technological Research Council of Turkey (TÜBİTAK). She was elected as the *associate member* of TÜBA in 2007 and elected as the *principal member* of TÜBA in 2016. Arzum Erdem Gursan was elected as the **Special Committee member of Association of Academies and Societies of Sciences in Asia (AASSA)- Women In Science and Engineering (WISE)** for the period of 2017-2019 and 2019-2021. She was elected as a **fellow of Royal Society of Chemistry (FRSC)** in December, 2017

Prof. Arzum Erdem Gursan has authored or co-authored more than 150 papers in refereed journals and conference proceedings, she has given more than 30 invited talks in international meetings and conferences, is the co-author of 10 book chapters and review papers. She has received more than 6400 citations (h-index= 42 in the WoS records on August 2021).

Prof. Dr. Arzum Erdem who is the principal investigator at the research team @nanoBioSensLab (Ege University, Izmir, Turkey), has initiated many national and international collaborative research on development and applications of electrochemical (bio)sensors based on drugs, nucleic acids, enzymes, proteins, toxins etc. since 2006. The research @ nanoBioSens lab is centred on the development of novel transducers and chemical and biological recognition systems by using different nanomaterials (graphenes, magnetic nanoparticles, carbon nanotubes, gold and silver nanoparticles, dendrimers, nanowires, nanorods etc.) designed for electrochemical sensing of nucleic acid (DNA, miRNA) hybridization, and also the specific interactions between drug and DNA, or protein and DNA, aptamer-protein and also the development of integrated analytical systems for environmental monitoring, food safety, industry and biomedical monitoring.

ARZUM ERDEM, HUSEYIN SENTURK, ESMA YILDIZ, MELTEM MARAL, "Amperometric immunosensor developed for sensitive detection of SARS-CoV-2 spike S1 protein in combined with portable device" TALANTA, 2022, 144, 123422. https://doi.org/10.1016/j.talanta.2022.123422

The activity in E-MRS: Prof. Dr. Arzum Erdem was the one of organizers in EMRS spring 2004 meeting; "Symposium J: Synthesis, Characterisation and Advanced Applications of Amorphous Carbon Films". She has been the E-MRS Member 2009-2018 with a special invited presentation in the symposium: "Bioinspired and Biointegrated Materials as New Frontiers Nanomaterials I (2009) –VIII (2018)" as well as the session of graduate students' invited presentations for the E-MRS Hq Grad Student Award in 2013. She has been working as the Symposium Principal Organizer invited by the symposium SciComm Board in 2013, 2018 and Keynote Presenter at The Symposium V - XI th Edition.

Recent Applications of Electrochemical Nucleic Acid Biosensors based on Carbon Nanomaterials

Arzum ERDEM GURSAN

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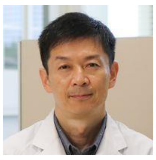
Biosensors provide a sensitive and selective detection of nucleic acids, pathogens, proteins, etc. Advanced biosensors based on nanomaterials could be significantly applied to the areas of genomics, biomedical diagnostics, proteomics and drug discovery due to the advantages of different nanomaterials having unique electronic, optical, mechanical, and catalytic properties. Carbon based nanomaterials such as, carbon nanotubes, carbon nanofibers etc. have numerous applications in tissue engineering, drug delivery, cancer therapy and diagnosis including biosensors.
Electrochemical biosensors present a great promise for sensitive and selective detection of nucleic acids towards to the clinical, environmental, or forensic investigations. Recent developments of electrochemical nucleic acid biosensors based on carbon nanomaterials have been presented herein, and discussed with their further applications.

Acknowledgements
Arzum Erdem express her gratitude to the Turkish Academy of Sciences (TÜBA) as the Principal member for its partial support.

The E-MRS Invited Scientific Organizer of Plenary Session

Prof. Dr. Kadriye Arzum ERDEM GURSAN Ege University Izmir, TURKEY
arzume@hotmail.com; arzum.erdem@ege.edu.tr

The E-MRS Invited Scientific Organizer of Plenary Session



Prof. Dr. Masaru Tanaka, Kyushu University, Japan
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Monday May 29 17:30 02839 Keynote Lecturer

Peter Scharff,
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Peter Scharff graduated at TU Clausthal as a chemist. He holds a PhD (1987) and his habilitation followed in 1991 in the field of inorganic chemistry. He worked as a visiting professor at University of Torun, Poland and was appointed associate professor. In 1999 he went as a C4-Professor to TU Ilmenau in the subject of physics. In the time from 2000 till 2004 he was head of the department of chemistry in TU Ilmenau and was selected as rector of this university in 2004. In this position, he is until now.
Professor Peter Scharff selected for high functions in scientific committees and associations. For about ten years he is chairman of the local chapter Erfurt Ilmenau of the German Chemical Society. Further honorable calls followed with the election as president of the European Carbon Association as well as the senator of the academy of charitable sciences to Erfurt. For his work in the field of graphite and fullerene chemistry, Peter Scharff was honored in 1998 by the Sigri Great Lakes Carbon AG with the "SGL-CARBON-Award". https://www.sglgroup.com/ and https://idw-online.de/de/news?print=1&id=5716
Research activity: Professor Sharff is the author and co-author of more than 250 scientific publications (citations – 3500, h-index 36). He is presented 200 reports at International Conferences and Congresses, specially at The E-MRS Spring Meetings at Focused Sessions on Nanocarbons and Carbon based Biomaterials (31).
The activity in E-MRS: Professor Peter Scharff is The E-MRS Member during 2003-2004 and 2009 -2017 has working as Principal Organizer for The Symposia 2003-2004 on Nanocarbons Materials and is Founder for The EMRS Symposia 'Bioinspired and Biointegrated Materials as New Frontiers Nanomaterials: I 2009 with his active Organizer working during next Symposia II – XI th Editions.

Carbon materials chemistry and processing for multi-functionality: from graphite to fullerenes-tubes-graphene

Prof. Dr. Peter Scharff

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Graphite is composed of layers of linked carbon hexagons. Between the layers, base metals such as potassium and the like, but also metal compounds can be incorporated, forming new substances (GIV). In hightemperature electrolyses any GIV formed may destroy the carbon electrodes. In other processes, such as the production of graphite foils, a versatile material with outstanding chemical and physical properties, make GIV the crucial intermediate. The electrochemical behavior of GIV opened up the possibility of constructing new highperformance lithium-GIV battery systems. New carbon compounds are found and their reaction behaviour characterized . In addition to graphite and diamond, the group of fullerenes is the third carbon form, which has been experimentally accessible by graphite evaporation in the carbon arc. In the case of graphite evaporation, in addition to the fullerenes, similarly constructed carbon tubes. Buckminsterfullerene is soluble in organic solvents and gives a brownish product in the solid state. Fullerenes with many inorganic and organic substances react to form derivatives that have interesting physical properties and potential applications in the field of superconductivity and nonlinear optics. Fullerene research is an area of research in chemistry, materials science, physics and medicine. . Considering of CNTs, our research is focused on the study of CNT synthesis and growth mechanisms upon thermal chemical vapour deposition, and their electrochemical properties. The functionalization of CNTs, through a chemical attachment of either molecules or functional groups to their sidewalls, is an effective way to improve their solubility and to enhance their physical properties that make them of potentially useful for technological applications ranging from nanoelectronics, sensors and electrochemical devices to composite materials. Graphene is the carbon fourth form: the 2D material graphene, made of carbon atoms arranged in a honeycomb lattice, has its peculiar mechanical, electronic, optical, and transport properties. Many of these features result solely from the symmetry properties of the honeycomb lattice. The chemical modification can be achieved via either covalent or noncovalent interactions. Covalent modifications often destroy some of the graphene conjugation system, resulting in compromising some of its properties.

Monday May 29 14:00 00246 Keynote Presenter

Prof. Gianni Ciofani PhD
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Gianni Ciofani (born in La Spezia, Italy, on August 14th, 1982) is Senior Researcher Tenured at the Istituto Italiano di Tecnologia (Italian Institute of Technology, IIT), where he is Principal Investigator of the Smart Bio-Interfaces Research Line and Coordinator of the Center for Materials Interfaces (Pontedera, Italy).
He received his Master Degree in Biomedical Engineering (with honors) from the University of Pisa, Italy, in July 2006, and, in the same year, his Diploma in Engineering (with honors) from the Scuola Superiore Sant'Anna (Sant'Anna School of Advanced Studies, SSSA) of Pisa, Italy. In January 2010, he obtained his Ph.D. in Innovative Technologies (with honors) from SSSA. He joined IIT as Post-Doctoral Fellow from January 2010 to August 2013, and then as Researcher from September 2013 to October 2015. From October 2015 to October 2019 he was Associate Professor at the Polytechnic University of Torino (Torino, Italy), maintaining at the same time his research activity in IIT, where he is Senior Research Tenured since November 2019. In 2021, he was appointed Coordinator of the Center for Materials Interfaces; in the same year, he has been Visiting Professor at Waseda University, Tokyo (Japan).
His main research interests concern smart nanomaterials for nanomedicine, complex in vitro models, and biology in altered gravity conditions. He is coordinator or unit leader of several projects (about 5 MEur granted); in particular, he was awarded a European Research Council (ERC) Starting Grant and two ERC Proof-of-Concept Grant in 2016, 2018, and 2022, respectively. Thanks to grants from the Italian Space Agency (ASI) and the European Space Agency (ESA), he had the opportunity to carry out experiments onboard the International Space Station (ISS) in 2017 and 2019. In 2018, his real-scale model of the blood-brain barrier was highlighted in the Annual Report on the ERC Activities and Achievements.
Gianni Ciofani is author of more than 160 papers on international journals (Scopus H-index 42, excluding self-citations), 3 edited books, and 16 book chapters, and delivered about 60 invited talks/lectures in international contexts. He serves as Reviewer for many funding agencies (including ERC, Swiss National Science Foundation, French National Research Agency, National Science Center of Poland), for about 200 international journals, and as Editorial Board Member of Bioactive Materials, International Journal of Nanomedicine, Journal of Physics: Materials, Nanomedicine UK, Nano Trends, and Scientific Reports; he is Specialty Chief Editor (Nanobiotechnology) for Frontiers in Bioengineering and Biotechnology.
Gianni Ciofani is co-founder (2022) and Scientific Advisor of "Kidaria Bioscience SRL", an IIT spin-off company dedicated to the preparation and characterization of cosmetic and nutraceutical products based on natural-derived active ingredients. He is also co-founder (2021) and member of the executive committee of "ERC in Italy APS", a non-profit association of ERC awardees born to promote fundamental and frontier research in Italy.
The E-MRS Member, the E-MRS Invited Presenter at The Symposium O "Bioinspired and Biointergrated Matherials as New Frontiers Nanomaterials (10 th Edition)" at The E-MRS Spring Virtual Conference 2021 and Keynote Presenter, The E-MRS Invited CHAIR, Leader of Discussions at KEYNOTE Session next Symposium I (11 th Edition) of The E-MRS Spring Meeting 2023, Strasbourg , France

Biomimetic anioxidant nanomaterials in biomedicine

Gianni Ciofani 1
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Administration of redox-active nanoparticles is becoming a popular strategy to improve the biological effects of traditional molecular antioxidants [1]. Here, we will summarize properties, mechanisms of action, and activity of nanomaterials that show an intrinsic redox activity, in particular focusing our attention on cerium oxide nanoparticles as inorganic nanomaterial, and on polydopamine nanoparticles as organic nanomaterial.

Cerium oxide nanoparticles (nanoceria) mimic both superoxide dismutase and catalase activities, and many studies demonstrated their strong biological antioxidant properties, reducing both basal and stress-induced reactive oxygen species (ROS), and acting as pro-survival agents. Based on these excellent features, cerium oxide nanoparticles have become a promising pharmacological tool for the treatment of many diseases associated with oxidative stress, and our group extensively studied effects of nanoceria on many cellular models, including their protective actions on muscle cells exposed to microgravity conditions onboard of the International Space Station [2].

Despite their intriguing ROS scavenger properties, cerium oxide nanoparticles are an inorganic and non-biodegradable material, and this is motivation of concerns for their future application in the clinical practice.

In this scenario, we have to consider, as a valid alternative, polydopamine, a polymer deriving from the self-polymerization of the biomolecule dopamine. Polydopamine nanoparticles (PDNPs) have been increasingly attracting the attention of the research community due to their excellent ability to encapsulate drugs, to convert near-infrared (NIR) radiation into heat, and to act as antioxidant agents [3]. We propose PDNPs as smart nanomaterials for ROS scavenging and as nanotransducers for cellular stimulation. We demonstrated the efficiency of this nanoplatform in protecting neuronal-like cells from oxidative stress and in promoting, when irradiated with near-infrared light, neuronal activation upon a localized increment of temperature [4]. Their suitability as therapeutic agent in neurodegenerative diseases has been moreover provided, and corroborated by an extensive proteomic analysis on cell derived from patients affected by Autosomal recessive spastic ataxia of Charlevoix-Saguenay [5].

In this talk, we will summarize our most recent results about biomedical application of PDNPs, with particular attention to their properties as “nanozymes” applied to the treatment of central nervous system disorders.

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[2] Genchi G.G., […], Ciofani G. ACS Appl. Mater. Interfaces 13: 40200-40213, 2021.
[3] Carmignani A., […], Ciofani G. ACS App. Nano Mater. 5: 1702-1713, 2022.
[4] Battaglini M., […], Ciofani G. ACS Appl. Mater. Interfaces 12: 35782-35798, 2020.
[5] Battaglini M., […], Ciofani G. Biomater. Sci. 10: 3770-3792, 2022.

Monday May 29 11:00 02501 Keynote Presenters

Emmanuel Stratakis Prof. Dr.

Research Director of the Ultrafast Laser Micro- and Nano- Processing Lab, Institute of Electronic Structure and Laser (IESL), University of Crete, Heraklion 714 09, Greece Head of the Ultrafast Laser Micro- and Nano-Processing Lab. National Representative to the Program Committee of EU on Nanosciences, Nanotechnology and Advanced Materials Member of the Scientific Committee of COST Director of the European Nanoscience Facility of FORTH, part of the NFFA-Europe P.O. Box 1527, Heraklion 711 10, Greece

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Dr. Emmanuel Stratakis research interests are in the fields of ultrafast laser interactions with materials for (a) biomimetic micro- and nano- structuring (b) nanomaterials synthesis, modification and functionalization for organic electronics and (c) biomaterials processing for tissue engineering. He has delivered more than 60 invited and keynote lectures and has been organizer and chair in major international scientific conferences. He has over 230 publications including 7 cover pages, in refereed scientific journals and he has received ~ 9000 total citations (h-index 52). Dr. Stratakis is the Greece representative for the Horizon 2020 committee configurations on: Nanotechnologies, Advanced materials, Biotechnology, Advanced Manufacturing and Processing. In the Ultrafast Laser Micro- and Nano- processing group (ULMNP) of IESL, research is focused on the development of novel ultrafast pulsed laser processing schemes for controlled structuring at micro- and nano- scales of a variety of materials, including biopolymers. By applying ultrafast UV and IR laser pulses novel surface structures with sub-micron sized features are produced while the physical properties of semiconductor, dielectric and metallic surfaces are significantly modified. Developed methods include laser micro/nano surface structuring performed in different media, laser-induced forward transfer deposition and combination of those. Further control over the surface topology is achieved by proper functionalization of the 3D structures obtained with well-defined nanostructures. In particular, the artificial surfaces developed by processing under gaseous environments exhibit controlled dual-scale roughness, that mimics the hierarchical morphology of natural surfaces with exciting properties (i.e. the Lotus leaf), comprising micro-conical structures decorated with nanometre sized protrusions. The biomimetic morphology attained gives rise to notable multifunctional properties when combined with methods of tailoring the surface chemistry. Research shows that appropriate combination of topography and chemistry can lead to artificial surfaces that are: (a) of extremely low surface energy, thus water repellent and self-cleaned (b) smart, i.e show the ability to change their surface properties in response to different external stimuli and (c) functional in the sense that exhibit remarkable physical properties compared to the bulk. The ability to tailor the morphology and chemistry is an important advantage for the use of such structures as models to study the dependence of growth, division and differentiation of cells on the surface energy of the culture substrate and as scaffolds for tissue regeneration. At the same time, ULMNP focuses on the ultrafast laser syntheses of various types of nanomaterials including nanolayers. In particular, laser processing in liquid media results in the formation of self-organized surface nanostructures and colloids of surfactant-free nanoparticles used for photovoltaic applications. Additionally, the exploitation of ultrafast laser processing schemes for the synthesis and functionalization of graphene derivatives and other 2D materials for organic electronic applications is investigated. Editor of the 'Materials Today Bio' journal. Guest Editor of Special Issue 'Biomimetic and Functional Materials', International Journal of Molecular Sciences.

The Nano-Bio Conference activity: 2018 Heraklion, Crete, Principal Organizer 1st International conference on Nanotechnologies and Bionanoscience. Invited Presenter for The E-MRS Symposia "Bioinspired and Biointegrated Materialas as New Frontiers Nanomaterials I and II th Editions and Co- Organizer next Symposia III-IV and Principal Organizer for VI th Edition, Co-Organizer for Symposia IX, XI th editions.

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Dr. Anthi Ranella is an Assistant Researcher at IESL-FORTH and leads the Tissue Engineering – Regenerative Medicine and Immuno-engineering Lab (TERMIM Lab). She received her received PhD in 2005 from the Department of Biology of University of Crete.
Her fields of interests comprise mainly the study of the basic biological and biophysical processes at the molecular and cellular level, the understanding of the physicochemical mechanisms that take place at the interface between cells and biomaterials in micro / nano scale and the examination of the potential medical and/or clinical applications of optimized artificial tissue scaffolds.
In the interdisciplinary area of her interest three post-doctoral research scientists, three PhD, two MSc and two undergraduate students, originated from different scientific fields, are employed. Her research activities have led to the granting of two patents, she has published 39 peer reviewed papers with more than 1200 citations (Scopus h index: 18), 4 chapters in international scientific books, while she serves as a reviewer in many peer-review journals.

DR. PAPADIMITRIOU LINA L.
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Post Doc Papadimitriou is a Post Doctoral Researcher in the IESL, FORTH. She received her PhD in Molecular Biology/Immunology from the University of Crete in 2009. She has worked as a postdoctoral researcher at Biomedical Research Foundation of Academy of Athens (BRFAA), at the Biology Department of the University of Crete and at the Institute of Molecular Biology and Biotechnology (IMBB). Her main research interests focus on the interaction of cells with biomaterials for tissue engineering applications and on the study of the immuno-modulatory potential of biomaterials and scaffolds. Her research interests include the study of biocompatibility and immunocompatibility of potential implantable biomaterials and the investigation of the interaction of cells and scaffolds, in the concept of morphological, physiological and molecular aspects of their interface. She is also interested in the anti-microbial performance of nanotextured multifunctional surfaces for medical applications.

Induction of neuroregeneration and functional neural network development in adECM/rGO scaffolds

L. Pappadimitriou [1], N. Barroca [2], A. García-Lizarribar [3], K. Verstappen [4], E. Stratakis [1], B. Olalde [3], A. Klymov [4], P. Marques [2], A. Ranella [1].
[1]Institute Of Electronic Structure And Laser, Foundation For Research And Technology-Hellas (forth-Iesl) - Heraklion (Greece), [2]Department Of Mechanical Engineering, University Of Aveiro - Aveiro (Portugal), [3]Tecnalia, Basque Research And Technology Alliance (brta), Donostia-San Sebastian - Donostia-San Sebastian (Spain), [4]Radboud University Nijmegen Medical Centre, Department Of Regenerative Biomaterials - Nijmegen (Netherlands).

The spinal cord (SC) exhibits a highly organized and complex histological architecture that is responsible for the 3 most important functions of an organism: sensation, autonomic and motor control. Spinal cord injury (SCI) is considered one of the most challenging injuries, due to the limited ability of the central nervous system (CNS) to repair itself. While clinical management of SCI has improved functional outcomes, the injured nerve cannot regenerate functionally, so the injury repair is incomplete. Neural tissue engineering can help construct 3D microarchitectures necessary to guide cell growth and promote tissue regeneration, but we are still a long way from regenerating functional networks of the CNS.

The excellent biocompatibility and intrinsic properties of the extracellular matrix (ECM) favor its use for the development of implantable scaffolds over synthetic ones. Various methods have been proposed for the isolation and processing of ECM among them decellularized ECM from the liver, kidney, and lung has been used1. In parallel, Graphene-based materials have shown enthralling evidence of their therapeutic potential for pathologies of the CNS, including spinal cord injuries (SCI).

In this work, we explore a strategy based on the use of decellularized extracellular matrix from adipose tissue (adECM) and reduced graphene oxide (rGO) to fabricate 3D scaffolds that can induce the regeneration of functional neural tissue for SCIs.

Specifically, to deliver biologic-electronic signals to the platforms, reduced graphene oxide (rGO) was incorporated, due to the remarkable in vivo results of rGO in SCI. The adECM/rGO scaffolds were synthesized by thermally induced phase separation. Matrix cross-linking was assessed by resorting to EDC-based cross-linking, prior to the incorporation of rGO in order to improve the biological and structural stability of collagenous materials and maintain cell compatibility.

Using the adECM scaffolds with different concentrations of rGO, we investigated the adhesion, proliferation and differentiation of neural stem cells (NSCs) seeded on them as well as the process of neuritogenesis and synaptogenesis on these scaffolds. We also wanted to explain the NSCs' growth and differentiation in relation to the mechanical and physical properties of the scaffolds, investigating mechanotransduction processes. The results of this research showed that:

1. NSCs adhere, spread and proliferate in all compositions. 2. Scaffolds with less rGO facilitate cell attachment, yet the proliferation rate remains the same. 3. Scaffolds with more rGO favor spontaneous neuronal differentiation and do not support spontaneous astrocytic differentiation. Neurospheres are larger and neurons display longer and thicker axons with strong synaptophysin. expression along them. 4. Scaffolds with more rGO also favor retinoic acid-induced neuronal differentiation.

Based on the above, the potential of using adECM/rGO scaffolds in SC regeneration emerges.

Monday May 29 14:30 02293 Invited Presenter

PhD Radosław Mrówczyński
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The Radek Mrówczyński research group was established in 2020 at the Adam Mickiewicz University, Faculty of Chemistry and Centre for Advanced Technologies. We are particularly interested in the synthesis of advanced nanomaterials for combined anti-cancer therapies and their interaction with biological barriers. We have also a strong background in the synthesis and structural studies of biomimetic nanoparticles, layers, membranes and hybrid materials based on polyaminocatechols and their application not only in nanomedicine but in catalysis and tissue engineering.
Dr. Radosław Mrówczyński holds an adjunct position at NanoBioMedical Center at Adam Mickiewicz University in Poznan. He received his B.Sc. and M.Sci in Chemical Biology at Adam Mickiewicz University Poznan, Poland in 2008 and 2010, respectively. In 2014 he obtained Ph.D. at Humboldt University Berlin under supervision of Professor Jürgen Liebscher. Afterward, he had short-research stay in Korea and Canada. He also is a laureate of Bekker Program from the National Agency of Academic Exchange. In the frame of this project, he worked in the Catalan Institute of Nanoscience and Nanotechnology (ICN2) in Barcelona with Dr. Daniel Ruiz Molina. His research areas are multimodal nanoparticles based on polydopamine and related materials for combined chemo- and photothermal and chemo- and gene therapy aiming at liver and brain cancers. He also studies the chemistry of catechol-based materials both in macro and nanoscale. His awards include START scholarship granted by Foundation for Polish Science and Scholarship for Outstanding Young Scientist granted by the Minister of Higher Education
The E-MRS Member, The E-MRS Invited Presenter at The Symposium "Bioinspired and Biointegrated Materials as New Frontiers Nanomaterials" of The E-MRS Fall Meeting 2018, Warsaw, Poland and
The E-MRS Invited Presenter Reports with Colleagues NanoBioMedical Centre AMU at Poznan and as Supervisor PhD student - at next Symposium of The E-MRS Fall Meeting 2018, Warsaw, Poland
The E-MRS Invited Presenter at this Symposium I (11 th Edition), The E-MRS Spring Meeting 2023, Strasbourg , France

Co-delivery of chemotherapeutics by polydopamine based nanomaterials

R. Mrówczyński 1, M. Szukowska 1, S. Ostrowska 1, Y. Kim 2, D. Wawrzyniak 3.
1Faculty Of Chemistry, Adam Mickiewicz University - Poznań (Poland), 2Department Of Applied Chemistry, Konkuk University - Chungju (Korea, republic of), 3Department Of Molecular Neurooncology, Institute Of Bioorganic Chemistry, Polish Academy Of Sciences, - Poznań (Poland).

Polydopamine is a nature-inspired coating material that has been widely exploited in the synthesis of advanced materials for catalysis, photocatalysis, energy storage and nanomedicine. [1-3] Because of structural similarities to naturally occurring melanins polydopamine is considered synthetic eumelanin while its adhesive properties are often compared to those observed for mussels.[4] The easy functionalization and proven biocompatibility render polydopamine an ideal material for the preparation of nanoscale carriers for oncological purposes [5,6]
Here we will present the synthesis of mesoporous polydopamine nanoparticles capable of bearing different chemotherapeutic drugs and exhibiting high photothermal properties in the II biological window which makes them a potential candidate for application in combined chemo-photothermal therapy of hepatocellular carcinoma. In the second part of the lecture we will present potential application of polydopamine coated silica nanoparticles and nanoscale coordination polymers in co-delivery of different hydrophobic drug and their application in triple-punch therapy of hepatocellular carcinoma. The drugs release from the carriers will be discussed in detail as well as

their photothermal properties in biological windows. The research was financed by The National Science Centre, Poland under project number UMO-2018/31/B/ST8/02460.

Refernces

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[2]Y.Kim et al. "Efficient photocatalytic production of hydrogen by exploiting the polydopamine-semiconductor interface" J.Catal. B 2021, 281, 119423
[3]R. Mrówczyński, B.F. Grześkowiak "Biomimetic Catechol-Based Nanomaterials for Combined Anticancer Therapies" in Nanoengineering of Biomaterials: Biomedical Applications, II, 145-180,WILEY-VCH GmbH
[4]Y. Liu et al. "Polydopamine and Its Derivative Materials: Synthesis and Promising Applications in Energy, Environmental, and Biomedical Fields" Chem. Rev. 2014, 114, 9, 5057–5115
[5]R.Mrówczyński "Polydopamine-Based Multifunctional (Nano)materials for Cancer Therapy" ACS Appl. Mater. Interfaces 2018, 10, 9, 7541–7561
[6]Bartosz F. Grześkowiak et al. „Polyamidoamine Dendrimers Decorated Multifunctional Polydopamine Nanoparticles for Targeted Chemo- and Photothermal Therapy of Liver Cancer Model" Int. J. Mol. Sci. 2021, 22(2), 738

Monday May 29 14:45 01782 Invited Presenters

Dr. Bartlomiej Graczykowski
Assistant Professor
Principal Investigator -
Foundation for Polish Science (FNP) First Team Project
Faculty of Physics Adam Mickiewicz University AMU
Poznan, Poland
Email: bartlomiej.graczykowski@amu.edu.pl
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Dr. Bartlomiej Graczykowski obtained his Ph.D. in Physics in 2012 (AMU, Poznan, Poland).
He was appointed as a postdoctoral researcher at ICN2
Barcelona in Spain (2013–2016) and MPIP Mainz in Germany (A. von Humboldt Foundation fellowship, 2016–2017). Currently, he is an assistant professor at the Faculty of Physics of Adam Mickiewicz University in Poznan, Poland, and a guest researcher at the Max Planck Institute for Polymer Research in Mainz, Germany.
Research Interests:
Phononic Crystals, Brillouin Light Scattering, Raman Spectroscopy, Nanoscale Thermal Transport, Finite Element Method

Postdoctoral Researcher

Dr. Thomas Vasileiadis
Faculty of Physics Adam Mickiewicz University AMU
Poznan, Poland

Email: thomas.vasileiadis@amu.edu.pl

Dr. Thomas Vasileiadis obtained his diploma in Physics from the University of Patras (Greece) in 2011 with a specialization:
"Theoretical and Computational Physics, Astronomy and Astrophysics".

After graduation, he worked for three years as a research assistant at the Institute of Chemical Engineering at High Temperatures, part of the Foundation of Research and Technology Hellas (ICEHT-FORTH). In 2014, he obtained his Master's degree in Materials Science. From 2014 to 2019 and he worked at the Fritz Haber Institute of the Max Planck Society in Berlin (Germany). There, he studied electron-phonon coupling with Femtosecond Electron Diffraction. In 2019 he defended his Ph.D. thesis entitled: "Ultrafast Energy Flow and Structural Changes in Nanoscale Heterostructures". In 2019 he joined the group of B. Graczykowski as a postdoctoral scientist at the Adam Mickiewicz University in Poznan (Poland), and as a guest scientist at the Max Planck Institute for Polymer Research in Mainz (Germany). Since November 2020 he is appointed as a Marie Skłodowska-Curie postdoctoral fellow at the Faculty of Physics of Adam Mickiewicz University.

Fast Light-Driven Motion of Polydopamine Nanomembranes

T. Vasileiadis 1, T. Marchesi D'alvise 2, M. Pochylski 1, M. Warzajtis 1, A. Krysztofik 1, S. Harvey 2, C. Synatschke 2, J. Gapinski 1, G. Fytas 2, T. Weil 2, B. Graczykowski 1.

1Adam Mickiewicz University In Poznan - Poznan (Poland), 2Max Planck Institute For Polymer Research - Mainz (Germany).

Polydopamine (PDA) is a mussel-inspired multifunctional polymer with a broad range of applications for biomedical and environmental purposes, (photo-)catalysis, sensing, photonics, and optoelectronics. Recently, we have employed a combination of contactless optical techniques to show that pure PDA nanomembranes can also exhibit fast light-driven motion [1]. Light-induced heating of PDA leads to the desorption of water molecules and contraction of membranes in less than 140 μs. Switching off the light leads to a spontaneous expansion in less than 20 ms due to heat dissipation and water adsorption. The same type of motion, which resembles pseudo-Negative Thermal Expansion (NTE), can be driven by changes of temperature, moisture, and pressure, albeit in a non-local and slower manner. This behavior is attributed to the lamellar-like structure of PDA [2] and the weakening of intermolecular interactions upon water adsorption. Our findings demonstrate that PDA nanomaterials can be harnessed as robust building blocks for soft, micro-, and nanoscale photoactuators, nanorobots, and artificial muscles.

[1] T. Vasileiadis, et al. Fast Light-Driven Motion of Polydopamine Nanomembranes. Nano Letters, 2022, 22(2), pp. 578–585.

[2] T. Marchesi D'Alvise, et al. Ultrathin Polydopamine Films with Phospholipid Nanodiscs Containing a Glycophorin A Domain. Advanced Functional Materials, 2020, 30(21), 2000378.

This work was supported by Polish National Science Centre (UMO-2021/41/B/ST5/03038).

Monday May 29 15:00 1253 Invited Presenter

Dr.AL KATTAN Ahmed
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Aix-Marseille University
Cnrs, Lp3 Umr 7341,
ampus De Luminy, Case 917,
13288, Marseille Cedex 9,
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Associate Professor Aix-Marseille University Oct. 2012 г. - present. Marseille, France
Development of nanobioengineered particles by ultrashort Laser process in nanomedicine fieldDevelopment of nanobioengineered particles by ultrashort Laser process in nanomedicine field
Postdoctoral Internship
EmpaEmpa Aug 2011 - Sep 2012, Switzerland Zürich,
Environmental Impact of Nanoengineered Materials
"Release of TiO2 nanoparticles from outside paints and their environmental fate"Environmental Impact of Nanoengineered Materials "Release of TiO2 nanoparticles from outside paints and their environmental fate"
Assistant ProfessorAssistant Professor
INP Toulouse - Institut National Polytechnique de Toulouse. Dec. 2010 г. - July 2011 - Toulouse , France
ENSIACET-INP Toulouse
Ph.D in Materials Science and Engineering, Nanomedicine 2007 - 2010
Activities and Communities: Leader of Ph.D students at CIRIMAT Institute - Member of the advisory board
Synthesis and characterization of nano-sized colloids based on biomimetic calcium-phosphate apatites - Application to intracellular imaging and drug delivery for cancer diagnosis or therapeutics
Ahmed Al-Kattan is Assoc. Prof. at LP3 laboratory (UMR 7341,CNRS-Aix-Marseille University). His research is dealing with the design of novel biocompatible/biodegradable nanoparticles fabricated by ultrafast laser process and soft chemistry for advanced theranostic modalities, and the development of innovative functional biomimetic scaffold platforms for tissue engineering applications.

Development of functional Si nanoparticles elaborated by laser method in liquid medium for non-invasive TPE-PDT biomedical applications

A. Al-Kattan [1], L. M.a. Ali [2], M. Daurat [3], D. Durand [2], M. Gary-Bobo [2].

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Nanoengineered particles based on silicon and their derivative formulations have gained significant interest. Indeed, besides their intrinsic biocompatibility and biodegradability, silicon nanoparticles (NPs) exhibit distinctive physiological activities such as bone mineralization and transduction mechanism [1]. Moreover, they also offer the possibility of advanced theranostic modalities, such as photoluminescence-based imaging, photodynamic and hyperthermia therapies [2]. However, the most NPs based on silicon, exploited are synthesized through chemical routes (e.g., sol-gel condensation/polymerization of organosilane precursor) leading to the formation of mesoporous-silica NPs with the necessity to employ several stages of switching solvents and purification steps before usein biological medium. Based on the laser-matter interaction in liquid ambiance with a solid target, the pulsed laser ablation method appears relevant approach to develop innovative nanoparticles for healthcare and wellbeing challenges. In fact, this method can lead naturally to the formation of functional engineered nanoparticles with adjustable physicochemical properties exempt of any contaminants compared to analogue nanoparticle formulations made from conventional synthesis methods [3]. In this work, fallowing the ablation and the fragmentation methods by laser approach, we have thus demonstrated the possibility to elaborate ultraclean and monodispersed stable colloidal silicon nanoparticles with unique physicochemical properties for biomedical applications [4]. For instance, structural analysis revealed the spherical shape of the NPs with a narrow size distribution centered at the mean size diameter of 62 nm ± 0.42 nm, while the negative surface charge of −40 ± 0.3 mV ensured a great stability without sedimentation over a long period of time. In vitro biological assessment performed on several cell lines such as breast and liver, including healthy cells revealed their low cytotoxicity without any light stimulus and their therapeutic potential under TPE-PDT mode at 900 nm with a promising cell death of 45% in case of MCF-7 breast cancer cells, as a consequence of intracellular reactive oxygen species release [4]. Their luminescence emission inside the cells was clearly observed at UV-Vis region. Compared to analogue Si NPs fabricated by chemical methods, which are often linked to additional modules with photochemical and photobiological properties to boost photodynamic effect, laser-synthesized Si NPs exhibit promising non-invasive therapeutic properties for the nanomedicine field.

[1] Carlisle et al, Tissue Int. 1981, 33, 27-34.
[2] Gu et al, Nat. Commun. 2013, 4, 2326.
[3] Al-Kattan et al, Nanomaterials, 2021, 11,712.
[4] Al-Kattan et al, Nanomaterials, 2020, 10, 1462.

Monday May 29 13:45 02678 Invited Presenter

PhD GRUMEZESCU Valentina
National Institute For Lasers,
Plasma And Radiation Physics INFLPR
Magurele (Romania),
E-mail: valentina.grumezescu@inflpr.ro
https://inflpr.ro/en/node/5156

Dr. Grumezescu is an impressive young post-doc researcher, who is always in search for novel studies and approaches in her work. Although her main research activity is based on the engineering and chemistry of nanostructured materials, her skills have also improved significantly during the last years in the fields of biology, and laser processing. These interconnected acquired skills have therefore allowed her to develop cutting-edge research in the field of bioactive nanomaterials and laser-processed surfaces. Her valuable research is supported both by an impressive number of publications (+70 research papers and 13 book chapters focused on novel and multifunctional nanostructured materials with applications in various medical fields), and a H-index of 20.

The E-MRS Member, Invited Presenter at Young Investigator Forum Symposia Bioinspired and Biointergated Materials as New Frontiers Nanomaterials during 2018, 2019, 2021 years and Invited Presenter at Keynote Session Smart Materials, Systems Multifunctionality Strategy Fron Nature at this Symposium 2023- 11th Edition.

Composite coatings for osteoblast growth attachment obtained by pulsed deposition techniques

I. Bioinspired and biointegrated materials as new frontiers nanomaterials (11th edition)

V. Grumezescu 1, O. Gherasim 1, S.A. Irimiciuc 1, A.M. Grumezescu 2, B.S. Vasile 2, B. Gălățeanu 3, A. Hudiță 3.

1National Institute For Lasers, Plasma And Radiation Physics - Magurele (Romania), 2Politehnica University Of Bucharest - Bucharest (Romania), 3University Of Bucharest - Bucharest (Romania).

We report on composite coatings based on hydroxyapatite, polysaccharide, and growth factor synthesized by pulsed physical deposition techniques. In this study, the hybrid systems were transferred onto Ti implants to obtain thin coatings with anti-adherence effects to guide and enhance bone regeneration. The physical-chemical properties of the prepared samples were characterized by

High Resolution Transmission Electron Microscopy, Scanning Electron Microscopy, and Infrared Microscopy.

To endorse cell attachment and growth without toxic effects and to promote pre-osteoblast differentiation towards the osteogenic lineage, in vitro tests on MC3T3-E1 cell line were carried out. The obtained results showed that the biocompatibility of the coated metallic implants was significantly enhanced. This was highlighted by the superior potential towards cell adhesion, sustaining cell viability and proliferation, corroborated with a low cytotoxicity as compared with uncoated samples.

The improved properties shown by the coated Ti implants (i.e., lack of toxicity, promotion of cell adhesion and proliferation, sustaining the differentiation of pre-osteoblasts towards mature bone cells) should advance them as suitable candidates for bone tissue engineering applications.

E-MRS European Materials Research Society 40th Anniversary

Keynote session Living Systems/ Materials and Biomimetics Multifunctionality from Nature

Wednesday May 31 10:30 – 18:00

The E-MRS Invited Chair, Leader of Discussions of Keynote session Living Systems/ Materials and Biomimetics Multifunctionality from Nature Prof. Dr. Bo ZHU Shanghai University, China email: bozhu@shu.edu.cn

The E-MRS Invited Chair, Leader of Discussions of Keynote session Living Systems/ Materials and Biomimetics Multifunctionality from Nature Dr.CHUKOVA Oksana, Deutsches Elektronen-Synchrotron - Hamburg, Germany, https://www.researchgate.net/profile/Oksana-Chukova

The E-MRS Invited Chair, Leader of Discussions of Keynote session Living Systems/ Materials and Biomimetics Multifunctionality from Nature Dr. Olivier Felix, Institut Charles Sadron France, email: olivier.felix@ics-cnrs.unistra.fr

The E-MRS Invited Chair, Leader of Discussions of Keynote session Living Systems/ Materials and Biomimetics Multifunctionality from Nature Prof. Dr. Insung S. Choi, Center for Cell-Encapsulation Research, KAIST, Korea, email: ischoi@kaist.ac.kr

Wednesday May 31 16:30 01580 Keynote Presenter

Prof. Dr. Bo ZHU
Shanghai Distinguished Experts,
Organic Bioelectronic Materials Laboratory
College of Materials Science and Engineering,
Shanghai University,
99, Shangda Road, BaoShan, Shanghai, 200444, China
E-mail: bozhu@shu.edu.cn

Prof. Dr. Bo Zhu received his Ph.D. from Tokyo Institute of Technology in 2004. He continued his research as a postdoctoral researcher from 2004 to 2006, and as a JSPS Postdoctoral Fellow from 2006 to 2008 at Tokyo Institute of Technology. He moved to RIKEN since 2008, and received a SPDR Fellowship to start his independent research from 2010, and became a research scientist in 2013. Since late 2013, he joined Donghua University as a full professor. From 2017, he moved to Shanghai University, to found Organic Bioelectronic Materials Lab. He works on bioinspired conducting polymers, and their applications in bioelectronic devices. He has co-authored 1 book, more than 70 papers and obtained more than 10 patents. Has been promoted as Deputy Dean of School of Materials Science and Technology since 2018. He works on the functional conducting polymers, electro-responsive polymers, flexible bioelectronics, wearable and wireless sensors. He has given more than 20 invited talks in international conferences, coauthored 2 book chapters, more than 80 peer reviewed papers
The activity in the E-MRS: Professor Dr. Bo Zhu is The E-MRS Member 2013-2019 with a special invited Presentations/Lectures and with a special invited presentations his Grad Students/Postdoctoral researchers for The Symposia "Bioinspired and Biointegrated Materials as New Frontiers Nanomaterials III-IX". Professor Dr. Bo Zhu has success working, as The Symposia Sci Comm Member, Organizer/Chair for a special ONE Day SESSION with invited Professors/Dr Lecturers and Presenters from China (2017, E-MRS Spring Meeting Strasbourg).

Prof.Bo Zhu -Keynote Presenter at Keynote Session Living Materials/Systems and Biomimetics Multifunctionality from Nature and Invited Chair, Leader of discussions at this session the Symposium 2023 - 11th Edition.

Biomimicking Organic Electronic Materials Toward Bioelectronic Devices Intrinsically Resisting Nonspecific Interactions

I. Bioinspired and biointegrated materials as new frontiers nanomaterials (11th edition)

B. Zhu 1 .
1 Shanghai University - Shanghai (China)

Bioelectronic devices, integrating (bio)materials and circuits, emerge as a new biomedical tool for life science studies and novel therapy methods due to their potential to spatially and electrically interface with biological tissues. However, it is highly challenging to establish intimate and long-term electrocoupling between the devices and biological matter. Extensive efforts are carried out to fabricate electronic devices of high density, conformable deformation, and biocompatibility to address the combined challenge of spatially resolved monitoring and stable integration with biological matter. However, few concerns were focused on the critical role of the surface-presented nonspecific interaction, which mainly arises from hydrophobic and electrostatic interactions. These electronic devices generally work in complex biological fluids, where biomolecules and cells would nonspecifically adsorb on devices. The nonspecific protein/cell interaction has been verified as one of the primary factors to impede electrical signal transfer, distort or even fake sensing signals,
and trigger inflammation. To improve the biocompatibility of thin film bioelectronic

devices, we synthesized a series of zwitterionic conducting PEDOTs featuring static, dynamic, or 3D selective cell interaction. These conducting polymers have demonstrated an intimate, stable, and efficient electrical electrocoupling with targeted cells by integrating nonspecific-binding resistance, specific interaction, and low impedance. Moreover, we also developed biomimicking hermetic encapsulation materials, compatible with photolithography microfabrication, to make the whole device surface intrinsically resistant against nonspecific-interaction in bio-fluids. Finally, we create a universal fabrication platform with high yield and uniformity to prepare biomimicking bioelectronic devices with intrinsical resistance to nonspecific protein interaction, excellent mechanical compliance, and a high-density array. This fabrication platform was based on the photolithography fabrication of zwitterion-revised conducting electrodes and hermetic encapsulation systems without compromising their electrical properties and low permeability. We further utilized this platform to show that a selective interaction with targeted cells could be constructed on the electrode surface, enabling a selective and efficient electrocoupling with cells/tissues both in vivo and in vitro. We envision our process offering a general platform for fabricating biocompatible and conformable electronic devices toward accurate sensing performance and long-term stable integration with cells/tissues.

Wednesday May 31 10:30 00357 Keynote Presenters

Prof. Dr. Anne Staubitz
Universität Bremen | Uni Bremen ·
Institute for Organic and Analytical Chemistry
Bremen
eMail: staubitz@uni-bremen.de

The overarching topic of our research is the synthesis of new functional polymers and also low molecular weight compounds which are able to convert forms of energy into one another:
Current fields of interest are:
Molecular and polymeric switches
Organotin heterocycles and polymers and their optoelectronic properties
Aromatic heterocycles in which CC bonds are replaced by BN bonds
New synthetic methods for the synthesis of semiconducting polymers
Chemoselective Cross-Coupling Reactions
The challenges we address are therefore primarily of a synthetic nature, where development of synthetic methodology for unusual heterocycles is a main focus. We combine this with research of the properties of such materials with the aim of controlling such properties by carefully designed syntheses.
In the area of molecular switches, we are interested in developing efficient ways of functionalising switchable molecules. Although halogenated azobenzenes typically serve as the electrophilic component in a cross-coupling reaction, it can be advantageous to be able to use them as a nucleophilic cross-coupling partner as well. For this purpose, we developed a palladium catalysed stannylation protocol, which converts iodinated azobenzenes into the corresponding stannanes in high yields. These can then be subjected to Stille cross-coupling conditions, where the products are obtained in excellent yields.

Prof. Dr. Stanislav N Gorb,
Kiel University Zoological Institute
Functional Morphology
and Biomechanics, Kiel, Germany
Email: https://www.sgorb.zoologie.uni-kiel.de/?page_id=658

Our research includes approaches of several disciplines: zoology, botany, structural biology, biomechanics, physics, and materials science. Using a wide variety of methods, the group studies mechanical systems and materials, which appeared in biological evolution. The research is mainly focused on biological surfaces specialised for enhancement or reduction of frictional or/and adhesive forces. Such surfaces are composed of highly-specialised materials and bear surface structures optimised for a particular function. Some of these systems employ secretory substances, modulating forces in the contact area.

Prof. Dr. Stanislav Gorb is a Professor and Director at the Zoological Institute of Kiel University, Germany. He received his Ph.D. degree in zoology and entomology at the Schmalhausen Institute of Zoology of the Ukrainian Academy of Sciences in Kyiv (Ukraine). Prof. Dr. Gorb was a postdoctoral researcher at the University of Vienna (Austria), a research assistant at the University of Jena, a group leader at the Max Planck Institutes for Developmental Biology in Tübingen and for Metals Research in Stuttgart (Germany). His research focuses on the morphology, structure, biomechanics, physiology, and evolution of surface-related functional systems in animals and plants, as well as the development of biologically inspired technological surfaces and systems. He received the Schlossmann Award in Biology and Materials Science in 1995, the International Forum Design Gold Award in 2011 and Materialica "Best of" Award in 2011. In 1998, he was the BioFuture Competition winner for the work he conducted on biological attachment devices as possible sources for biomimetics. Prof. Dr. Gorb is a Corresponding member of the Academy of the Science and Literature Mainz, Germany (since 2010), and a Member of the National Academy of Sciences Leopoldina, Germany (since 2011). He has authored several books, more than 500 papers in peer-reviewed journals, and four patents.

Biomimetic photoswitchable dry adhesives

A. Staubitz [1], S. Schultzke [1], E. Kizilkan [2], J. Strüben [2], L. Heepe [2], S. Gorb [2].

[1]University Of Bremen - Bremen (Germany), [2]University Of Kiel - Bremen (Germany).

Light switchable liquid crystalline elastomers (lsLCEs) are capable of showing a photomechanical effect: they bend reversibly when exposed to light of the correct wavelength. This feature has been combined with a dry adhesive structure that can be found in beetles, allowing adhesion and peel-off solely controlled by light.

Although the early specimens required UV-light to switch, the latest generation of lsLCEs can now operate with visible light, which is a major advantage in a biological context.

References:

E. Kizilkan, J. Strueben, A. Staubitz*, S. N. Gorb*, Bioinspired photocontrollable microstructured transport device. Sci Robot 2, aak9454 (2017).
E. Kizilkan, J. Strueben, X. Jin, C. F. Schaber, R. Adelung*, A. Staubitz*, S. N. Gorb*, Influence of the porosity on the photoresponse of a liquid crystal elastomer. R. Soc. Open Sci. 3, 150700/150701 (2016).
Keywords: dry adhesive, biomimetic, liquid crystalline elastomer, photomechanical effect.

Wednesday May 31 11:00 00195 Invited Presenter

Dr. Nguyêt-Thanh HA DUONG
The Interfaces, Traitements, Organisation et Dynamique des Systèmes (ITODYS) UMR 7086, Paris Diderot University

http://www.itodys.univ-paris-diderot.fr

Ha Duong Thanh currently works at the Interfaces, Traitements, Organisation et Dynamique des Systèmes (ITODYS) UMR 7086, Paris Diderot University, Department 2.
L'ITODYS est un laboratoire pluridisciplinaire qui explore différents aspects de la chimie et de la chimie-physique des molécules, des nanomatériaux, des nanostructures et des surfaces.
Nanoélectrochimie, plasmonique moléculaire, biocapteurs électrochimiques, surfaces fonctionnalisées, électronique organique, nanomatériaux et matériaux hybrides, assemblages supramoléculaires, modélisation.
Her current project is 'nano-bio-hybrid materials based on plant virus. Study of the mechanisms of protein-protein interactions and the complexation of metals by proteins or small molecules, specialist in fast kinetic techniques

Functionnalized plant virus-based nanomaterials: From synthesis to applications

I. Bioinspired and biointegrated materials as new frontiers nanomaterials (11th edition)

N.T. Ha Duong [1], S. Darwish [1], H.A. Nguyen [2], C. Da Silva Moreira [1], S. Ammar [1].

[1]Itodys Laboratory - Paris (France), [2]Phenikaa University - Hanoi (Viet nam).

The ability to construct three dimensional architectures via nanoscale engineering is important for emerging applications of nanotechnology in sensors, catalysis, controlled drug delivery, microelectronics, and medical diagnostics. Because of their well-defined and highly organized symmetric structures, high robustness over wide ranges of temperature, pH, buffer, and in the presence of organic solvents, viral capsid proteins then provide a 3D scaffold for the precise placement of plasmon or magnetic materials yielding hierarchical hybrid materials. In this study, we use several plant viruses with different shapes and morphologies: Turnip yellow mosaic virus (TYMV), Rice yellow mottle virus (RYMV), Tobacco mosaic virus (TMV). To obtain assemblies of nanoparticles onto capsids at room temperature, we used two different synthesis: grafting pre-formed nanoparticles or biomineralization.

In the first part of this work, I will present the synthesis and characterization of new nano-bio-hybrid materials, which are soluble and stable in solution. Gold nanoparticles (AuNP) of different sizes (5, 10 and 20 nm) were grafted on icosahedral capsid, according to two strategies. After purification, the resulting nano-biohybrids were characterized by different technics (DLS, TEM, XPS...). Similarly, we grafted onto the virus capsid iron oxide nanoparticles (IONP) synthetized by the polyol process, and then characterized the objects, specifically their magnetic properties.

In the second part, gold biomineralization experiments on TMV will be described. The size, morphology, monodispersity of AuNP and gold assembly on virus were studied according to the experimental conditions (concentrations of reactant, number of cycle, nature of reductant…) and in situ TEM observations directly in liquid media were also performed to unravel the nucleation and growth mechanisms.

Finally, I will show some applications of these new nano-biohybrid materials in the field of sensors and therapy.

Wednesday May 31 11:15 02080 Invited Presenter

Roig Serra Anna
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Nanoparticles and Nanocomposite
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https://scholar.google.com/citations?user=csvi_P4AAAAJ&hl=ca
https://www.researchgate.net/profile/Anna_Roig

I graduated in Physics and received a PhD in Materials Science at the UAB. I completed my education at the KTH in Stockholm and at Northeastern University in Boston. In 2005, I spent over two years as a Seconded National Expert in Brussels at the Research Directorate. At present, I am a Research Professor at the ICMAB where I lead the Nanoparticles and Nanocomposites Group.

I am interested in issues related to gender equality and education of science at all levels. Other interests are geo-politics, literature and travelling. I have lived and worked for extended periods of time in Sweden, USA, UK, Poland and Belgium

I am a materials scientist working in the preparation, characterization and new uses of functional nanomaterials. My scientific activities revolve around the rational design and synthesis of inorganic and hybrid nanoparticles and bio-based nanocomposites and the study of their structural-functional properties, including the better understanding of nano/bio/interactions. My driving force is to prove the validation of nanomaterials in applications related to Nanomedicine

Exploring opportunities for biosynthesized nanocellulose in ophthalmology

A. Roig 1, I. Anton-Sales 1, J. D'antin 2, T. Meslier 1, V. Charoenrook 2, L. Koivusalo 3, H. Skottman 3, A. Laromaine 1, R. Michael 2.
1Insitute Of Materials Science Of Barcelona (icmab-Csic) - Bellaterra (Spain), 2Centro De Oftalmología Barraquer - Barcelona (Spain), 3Faculty Of Medicine And Health Technology, Tampere University - Tampere (Finland).

Bacterial nanocellulose (BC) is a microbial biosynthesized natural polymer formed by intertwined non-soluble cellulose nanofibers and interconnected porosity. The resulting pellicle is a low-solid-content hydrogel with a high morphological resemblance to collagen. In contrast to collagen, BC is animal-free and temperature stable; moreover, it exhibits additional features sought after for biomaterials such as being endotoxin-free, easy to cryo-preserve, high-liquid holding capacity, and high tensile strength and flexibility [1]. Medical applications of BC mainly consist of patch-like formats for wound healing, drug delivery, or regeneration of soft tissue defects. Our goal is to

develop versatile and portable BC cell supports and BC patches to study their regenerative potential in ophthalmology which is still an unexplored field.
The Komagataeibacter xylinus strain cultured in Hestrin-Schramm medium was used to grow BC pellicles which were exhaustively cleaned and sterilized. To explore BC as a cell culture substrate and transplantation tool, BC was either used as-produced, functionalized with inorganic nanoparticles, or plasma-treated to enhance cell adhesion.
I will present some examples of BC as a cell culture platform [2], with more detail on the case of limbal stem cells [3]. The use of BC patches to treat ocular surface disorders and protect corneal wounds will also be proposed [4]. Our results validate BC as an excellent cell-supporting substrate while BC hydrogels meet the basic requirements of mechanical resistance to suture, conformability to the eye's dome shape, ex-vivo stability, and ease of manipulation to be used as eye patches. Those findings endorse the use of BC as a new ocular bandage material and as a cell transplantation vehicle with corneal regenerative potential.
ACKNOWLEDGEMENTS: Spanish Science & Innovation Ministry (PID2021-122645OB-100, RTI2018-096273-B-I00, CEX2019-000917-S). Generalitat de Catalunya (2021 PROD 00204, 2021SGR0046), CSIC-Susplast and CSIC Nanomedicine HUB (202180E048), EPNOE Association, AERoGELS COST Action.
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Wednesday May 31 11:30 02833 Keynote Lecturer

Prof. Dr. **Insung S. Choi**
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Dr. **Insung S. Choi** is Professor of Chemistry and of Bio and Brain Engineering at KAIST, Korea, and the Director of the Center for Cell-Encapsulation Research (Creative Research Initiative; 2012-). He obtained his
BS and MS degrees in Chemistry at Seoul National University in 1991 and 1993, and did his PhD degree in Chemistry at Harvard University in 2000 under the supervision of George M. Whitesides. After postdoctoral work with Robert Langer at the Department of Chemical Engineering of MIT, he joined the faculty at KAIST in 2002. He was awarded KCS-Wily Young Chemist Award (2003), Thieme Journal Award (2003), Presidential Young Scientist Award (2004; KAST), and JANG SEHEE Research Achievement Award (2013; KCS). His research interests include biomimetic chemistry, cell-material

interfaces, and biosurface organic chemistry. He has published over 240 peer-reviewed papers (>10000 citations, h-index = 48). He is the editorial board member of Chemistry-An Asian Journal (Wiley-VCH), ChemNanoMat (Wiley-VCH), Scientific Reports (NPG), and Polymers (MDPI), and the editorial advisory board member of Advanced Healthcare Materials (Wiley-VCH).

The E-MRS Member, INVITED Presenter the Symposium Bioinspired and Biointegrated Materials as New Frontiers Nanomaterials
at The E-MRS Fall Meetings 2014, 2016, 2018, 2019 Warsaw, Poland. Supervisor PhD Student Grantee The E-MRS Young Researcher AWARD at 2019.
KEYNOTE Presenter at The Symposia The E-MRS Spring Meetings 2017, 2021, 2023 Strasbourg, France.
The E-MRS INVITED Organizer (main) this Symposium at 2021 and Member the Symposium'Scientific Committee during 2016-2023 for the Symposia VI-XIth Editions
Professor Insung S. Choi MEMBER The E-MRS -Korea MRS Committee

Catalytic Bioempowerment of Individual Cells in Single-Cell Nanoencapsulation

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Single-cell nanoencapsulation (SCNE), generating cell-in-shell nanobiohybrid structures in a cytocompatible manner, has emerged as a powerful chemical tool for endowing individual living cells with extrinsic and exogenous functions that are not innate to the cells. Beyond cytoprotection against external harmful stressors, SCNE can also create catalytically empowered cells by embedding enzymes or their catalytic equivalents within artificial nanoshells, as demonstrated by the enzyme-embedded, supramolecular metal-organic complex of ferric ions and trimesic acid.

Wednesday May 31 14:00 02147 Keynote Presenter

Dr.Sc.CHUKOVA Oksana
MSCA Felloweship
Deutsches Elektronen-Synchrotron (desy)-
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Optoelectronics. Optoelectronics is the study and application of electronic devices that source, detect and control light, usually considered a sub-field of photonics. In this context, light often includes invisible forms of radiation such as gamma rays, X-rays, ultraviolet and infrared, in addition to visible light. Optoelectronic devices are electrical-to-optical or optical-to-electrical transducers, or instruments that use such devices in their operation.
Materials. Explore the latest questions and answers in Materials, and find Materials experts.
Optics and Photonics. Optics and Photonics are a specialized field of physics and engineering involved in studying the behavior and properties of light and the technology of analyzing, generating, transmitting, and manipulating ELECTROMAGNETIC RADIATION in the visible, infrared, and ultraviolet range.
Optics. Explore the latest questions and answers in Optics, and find Optics experts.
Thin Films and Nanotechnology. Thin Films and Nanotechnology is a group to exchange views on the HOT topic of Nanotechnology.
Material Characterization. Explore the latest questions and answers in Material Characterization, and find Material Characterization experts.

Nanomaterials. Explore the latest questions and answers in Nanomaterials, and find Nanomaterials experts.
X-ray Diffraction. The scattering of x-rays by matter, especially crystals, with accompanying variation in intensity due to interference effects. Analysis of the crystal structure of materials is performed by passing x-rays through them and registering the diffraction image of the rays (CRYSTALLOGRAPHY, X-RAY). (From McGraw-Hill Dictionary of Scientific and Technical Terms, 4th ed).
Heat Treatment. Heat treating is a group of industrial and metalworking processes used to alter the physical, and sometimes chemical, properties of a material. The most common application is metallurgical. Heat treatments are also used in the manufacture of many other materials, such as glass. Heat treatment involves the use of heating or chilling, normally to extreme temperatures, to achieve a desired result such as hardening or softening of a material. Heat treatment techniques include annealing, case hardening, precipitation strengthening, tempering and quenching.
Data Analysis. Analysis of data is a process of inspecting, cleaning, transforming, and modeling data with the goal of highlighting useful information, suggesting conclusions, and supporting decision making. Data analysis has multiple facets and approaches, encompassing diverse techniques under a variety of names, in different business, science, and social science domains.
Oksana Chukova from Kiev National Taras Shevchenko University, who joined DESY last year, received a special Marie Skłodowska-Curie scholarship.
Oksana Chukova works with luminescent materials developed for application in light emitting devices, luminescent probes and sensors and particularly luminescent covering layers of solar cells. Her research concentrates on the effects on structure, morphology and optical properties induced by heterovalent substitutions in oxide nanoparticles and composites to improve the luminescent efficiency of these materials.

Green synthesis and characterzation of luminescent ZnO@polymer core-shell nanoparticles with natural biopolymer coatings

I. Bioinspired and biointegrated materials as new frontiers nanomaterials (11th edition)

O. Chukova 1, I. Fesych 2, S.A. Nedilko 2, S.G. Nedilko 2, T. Voitenko 2.

1Fs-Petra-S, Deutsches Elektronen-Synchrotron (desy) - Hamburg (Germany), 2Taras Shevchenko National University Of Kyiv - Kyiv (Ukraine).

The most of luminescent materials currently applied in modern devices contain rare earth (RE) activators. But, applications of the RE elements have grown dramatically in diversity and importance over the past four decades. Since that, the search for the RE-free materials for various applications is a very actual task. On the other hand, the use of natural biocompatible components for the synthesis of nanomaterials is also an important point for the expected cost reduction and environmental effect.
With the noted goals, we study in the present work a green chemical approach to the method manufacturing ZnO core-shell nanoparticles with natural biopolymer molecules. ZnO nanoparticles are widely used in various fields of science and technologies. But, ZnO own photoluminescence (PL) is mainly located in the UV range that makes it unsuitable for lightening applications. Adding of various functional components is needed to obtain defect-induced visible light PL from materials based on the ZnO matrix. The main novelty of this approach, which gives it an ecological direction, is that in order to create in the crystal structure of the surface of simple oxides centers that give luminescence in the visible range, we propose to use natural biopolymers, in particular, polypeptides (gelatin, etc.) and polysaccharides (agar, starch, etc.). These compounds are biocompatible and the developed phosphors will not pollute the environment. Also it is possible to obtain some of the proposed biofunctionalizes from natural organic objects.
The nanoparticles for investigation were synthesized by low-temperature chemical homogenization methods (sol-gel technology and co-precipitation of components), which promotes the rational use

of natural resources (lower temperature of synthesis is possible) and ecological purity of the synthesis process due to the use of organic molecules as precipitators, stabilizers, complexing / gelling agents. The synthesized ZnO@biopolymer core-shell nanoparticles have been analyzed by XRD, FTIR, SEM and DTA/TG methods. PL emission of the investigated samples is observed in the wide spectral range from 350 to 800 nm. The PL spectra are complex and consist of two types of spectral details. There are narrow band in the 350 – 420 nm range and wide band in the 430 – 800 nm range. The relative intensities of these bands depend on types and concentration of polymers. The narrow UV band corresponds to the well-known ZnO exciton emission. The wideband visible emission is complex and consists of several wide and overlapping bands. Its intensity strongly depends on a type of polymer. The observed luminescence bands can be explained by electron transitions in defects induced by polymer molecules in the ZnO crystal lattice, such as H+ impurities, interstitial oxygen, zinc and oxygen vacancies, etc. The possibility of creation of Eco-friendly and cheap commercial phosphors based on simple oxides functionalized by natural biopolymers is discussed

Wednesday May 31 13:00 02149 Keynote Presenter

Dr. Olivier Felix
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Multimaterials and anisotropic materials

Inspired by nature and based on our longstanding expertise in Layer-by-Layer (LbL) assembled films and our recent breakthrough in creating films with large area in-plane anisotropies, we focus on multi-nano-materials and anisotropic materials. We prepare, study and optimize different multicomposite architectures with respect to their composition, their nanoscale architecture (in-plane and out-of-plane spacing, orientation, etc...) and their anisotropic materials properties. In particular, we focus on optical or electronic properties of metallic (Au, Ag) or semi-conducting (ZnO, TiO2) nano-objects and mechanical properties of nanocelluloses and mineral platelets. For all these hybrid systems, we investigate the tight relationship between the architecture of the assembly (in particular the in-plane anisotropy of 1D-nano-objects induced by grazing incidence spraying) and the resulting properties. The stepwise build-up of complex structures (e.g. chiral thin films made of non-chiral 1D-nano-objects) obtained by the combination of various bottom-approaches allows to characterize the properties as we go from the nano to the mesoscale and to some extend to the macroscopic scale. https://www.ics-cnrs.unistra.fr/equipe-pecmat-recherche.html

Hierarchical bio-inspired nanocomposite materials with anisotropic properties

O. Felix.
Cnrs-Institut Charles Sadron - Strasbourg (France).

Nature has developed through evolution nanocomposite materials with complex structures including the helical architecture found for exemple in plant cell walls and the Arthropod exoskeleton. Such materials often possess remarkable optical and/or mechanical properties by simply assembling hard and soft elements. These oustanding properties have attracted a wealth of research to understand their structure-properties relations at all length scales and to design novel materials with superior performance. However, while nature masters the organization of anisotropic nano-objects like nanocelluloses into complex superstructures, the development of synthetic nanocomposite materials with complex and precisely controlled architectures (e.g. helical) has proven to be difficult due to the lack of suitable approaches for their preparation with a nanoscal precision.

Recently, we have introduced a method called "Grazing Incidence Spraying"[1] for the in-plane alignment of anisotropic nanoparticles (cellulose nanofibrils, metallic nanowires and nanorods, …) on large areas. Its combination with the Layer-by-Layer assembly[2] approach permits to extend it toward the preparation of complex (e.g. helical) multilayer films in which the composition and orientation can be controlled independently in each layer. The talk will illustrate some of our recent results on the design of complex bio-inspired nanostructured materials combining hard anisotropic elements like nanocelluloses with soft polymer building blocks. The preparation of such thin films will be presented and their optical and mechanical properties will be discussed as function of the film composition and geometry,[3-5] with a special emphasis on helical superstructures, which display chiroptical activit

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Wednesday May 31 13:30 00716 Invited Presenter

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Polymer Chemist, Smart Materials group Polymer Chemist, Smart Materials group
Istituto Italiano di Tecnologia, Apr. 2019 – present, Genoa Region, Italy.
Industrial PHD Student May 2015. - Nov. 2018 - Netherlands
Horizon 20202 Maria Skłodowska-Curie industrial PhD studies at the University of Parma, Italy and SABIC, Geleen, the Netherlands including 2 months secondments at Eindhoven

Technical University, the Netherlands, University of Cambridge, England and SABIC research centre in Bangalore, India.

Patents:
-A process for the preparation of a graft copolymer comprising a polyolefin main chain and one or a multiple polymer side chains and the products obtained therefrom US20170320989A1
-Gas barrier film EU 16POLY0166
-Process for the preparation of a block copolymer comprising a first polyolefin block and a second polymer block and the products obtained therefrom Block and the Products Obtained Therefrom US20170349710A1

Works:
-Biodegradable and Biobased Mulch Films: Highly Stretchable PLA Composites with Different Industrial Vegetable Waste
-Effect of Green Plasticizer on the Performance of Microcrystalline Cellulose/Polylactic Acid Biocomposites
-Plant-based biocomposite films as potential antibacterial patches for skin wound healing
-Porous pH natural indicators for acidic and basic vapor sensing
-Super Tough Polylactic Acid Plasticized with Epoxidized Soybean Oil Methyl Ester for Flexible Food Packaging
-Wearable and self-healable textile-based strain sensors to monitor human muscular activities
-Biobased, Biodegradable, Self-Healing Boronic Ester Vitrimers from Epoxidized Soybean Oil Acrylate
-Polyethylene vitrimers via silyl ether exchange reaction
-Polyolefin copolymer PE-HEMA with increased metal adhesion properties
-Physically cross-linked polyethylene: Via reactive extrusion
-Strain-reporting pyrene-grafted polyethylene
-Toward polyethylene-polyester block and graft copolymers with tunable polarity
-Towards sugar-derived polyamides as environmentally friendly materials

Biobased vitrimers - novel dynamic materials from vegetable oils and their applications

A. Zych [1], D. Sangaletti [1], G. Spallanzani [1], J. Tellers [2], L. Bertolacci [1], L. Ceseracciu [1], A. Athanassiou [1].

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The global production of thermosets has been increasing in recent years, causing rapid consumption of fossil-based feedstocks and contributing to the plastic waste accumulation in the environment, especially because they cannot be easily reprocessed or recycled at the end of their lifetime. To overcome those issues, dynamic crosslinks capable of exchange reactions can be introduced, enabling network rearrangements, malleability, and reprocessability.1 Those dynamic thermosets form a new class of materials, called vitrimers, since they flow like a vitreous silica (quartz glass) following the Arrhenius law.2 At service temperatures they behave like permanently crosslinked polymers but at elevated temperatures the exchange reactions speed up making flow possible while maintaining constant number of chemical bonds and crosslinks. Thanks to that, vitrimers can be repaired, reshaped and reprocessed decreasing significantly the cost and environmental impact. Facile way to produce biobased vitrimers from vegetable oils and a diboronic ester dithiol vitrimer crosslinker will be presented.3 The synthesis of the cross-linker and the production process of the vitrimers has been done following green chemistry principles. The developed vitrimer materials can be reprocessed multiple times like a thermoplastic, without compromising its mechanical properties.

Moreover they can be conveniently recycled by reversible hydrolysis in 90% ethanol and subsequent solvent evaporation, regenerating the original vitrimer. In case of an accidental release into the environment, the materials are able to biodegrade, solving the problem of waste accumulation. Properties of the final materials can be tuned from soft and flexible to rigid and hard by varying the vegetable oil type and crosslink density. The use of those materials in self-healing coatings, strain sensors and carbon fiber composites will be demonstrated.

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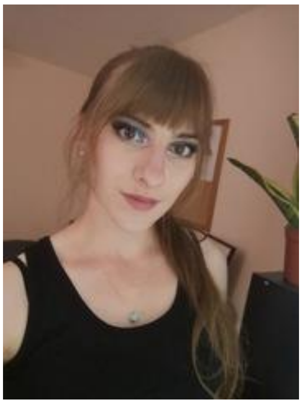
Wednesday May 31 14:45 02394 Invited Presenter



Dr. Kimberley Callaghan

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Dr Kimberley Callaghan has a Ph.D. from the University of Cambridge, United Kingdom (2021). Working with Vale Sir Prof. Christopher Dobson and Prof. Tuomas Knowles, she investigated the Thermodynamic Stability of Amyloid Fibrils. This research followed a biophysical chemistry career path from Kimberley's honours between the Walter Eliza Hall Institute and the University of Melbourne (2016). During this project, Kimberley worked with A/Prof. Ethan Goddard-Borger and A/Prof. Jeff Babon to study the C-Mannosylation of Tryptophan. Kimberley then returned to Australia and joined the Department of Chemical Engineering, University of Melbourne (2022) as a Research Associate in Synthetic DNA, to engineer a method for chemically joining DNA strands and investigate applications of this technology.
Her prestigious and diverse research background and expertise has enabled her to tackle multidisciplinary research challenges across science and engineering. Kimberley collaborates across projects within chemical engineering, nanotechnology and biochemistry, working to bring together researchers from a range of backgrounds and skills for a truly interdisciplinary approach.

A Simple(r) Approach to Making DNA

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Deoxyribonucleic acid (DNA) is best known for its role as an information storage molecule within the cell. However, applications of DNA extend far beyond the central dogma, including in gene therapy, as a tool compound for microscopy and as a drug delivery route.

Despite, these powerful applications, techniques for DNA production remain limited. An emerging technique, non-enzymatic chemical ligation, offers a promising method to make DNA without enzymes or protecting groups [1]. Non-enzymatic chemical ligation uses entropic templating to gain specificity rather than the traditional route of enthalpic activation and protecting groups[2]. This synthetic route offers an alternate method to generate DNA and could provide access to hybrid materials which cannot be readily produced with traditional enzymatic pathways[3].
Currently, while non-enzymatic ligation is an effective route for extension of RNA systems, DNA systems have not been successfully extended using this approach. This failure in DNA based non-enzymatic ligation reactions is attributed to an extremely slow reaction rate, rendering equilibrium steps too inefficient[4].
In this talk I will outline our recent innovations in understanding and overcoming this kinetic limitation, by using the 2-amino-imidazole activation of nucleotide monomers[5]. Optimisation of the ligation reaction will be discussed, including an investigation into the structural differences between DNA and RNA and the ramifications of these on ligation efficiency. We propose a mechanism by which DNA can be activated for non-enzymatic ligation, demonstrating that non-enzymatic chemical ligation can be a promising pathway for future DNA production.

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Wednesday May 31 17:00 01226 Invited Presenter

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Dr. Zhi Geng received his Ph.D from Technical Institute of Physics and Chemistry, CAS in 2016. He continued his research as a postdoctoral researcher from 2016 to 2018 in Donghua University. Since 2019, he joined Shanghai University as a lecturer. He works on nano conducting polymers, biological and chemical sensor, corrosion protection and marine antifouling coatings. He has got the funding from NSFC and “China Postdoctoral Science Foundation”. He has published 20 papers including “Journal of Chemistry A”, ”Nanoscale”, “ACS Applied Materials & Interfaces” and “Advanced Material Interfaces”.

The E-MRS Member, Invited presenter at Young Investigator Forum the Symposia Bioinspired and Biointegrated Materials as New Frontiers Nanomaterials during 2017, 2018,2019 and Invited Presenter at this Symposium Keynote Session Smart Materials, Systems Multifunctionality Strategy From Nature at 2021 and 2023 years - Symposia 10th and 11th Editions.

Facile but Tunable Electroassembly of Tubular Functionalized nano PEDOTs toward Bioelectronics

Z. Geng.

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Poly(3,4-ethylenedioxythiophene) (PEDOT) was considered as the star material for fabricating bioelectronic devices [1-4] due to their excellent electrical conductivity and electrochemical stability [5,6]. Nano-assembling of functionalized PEDOTs with a high aspect ratio has been considered an effective method for the performance reinforcement of bioelectronic devices. Templating is an efficient method to form functionalized PEDOT thin films with a high aspect ratio. Meanwhile, on-demand regulation of the morphology parameters can be realized by using customized templates. However, the high cost of the templates and complex procedure makes it difficult to integrate the template-base assembling approaches into wafer-scale and on-chip device fabrication processes. Herein, we proposed a facile but controllable approach for in situ electrochemical assembling of functionalized PEDOT nanotube thin films with tunable size and shape. Phase-separate water was introduced into the dichloromethane electrochemical solution to orient the assembling direction of the monomers. Well-shaped tubular nanostructures can be formed on various kinds of functionalized PEDOT nanotube thin films. We further study the affection of the phase-separated water on the condensed structure of the PEDOT thin films and explore the formation process of the tubular nanostructure. On the basis of the assembling mechanism, we can realize on-demand regulation of the morphology parameters (including diameter, length, and density) by merely changing the electrochemical polymerization conditions. The achieved functionalized PEDOT nanotube thin films showed enhanced electric and biological properties compared with flat thin films. The proposed approach combines the benefits of templating and template-free assembling, which can realize the on-demand nano assembling of functionalized PEDOTs with a cost-effective and on-chip device fabrication process.

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The Symposium I Scientific Committee BOARD with Working Team Symposium I Organizers

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