Embassy of Italy
Tel Aviv

Israel Vacuum Society

ISRAEL-ITALY WORKSHOP ON
ADVANCED MATERIALS
SYNTHESIS, CHARACTERIZATION, PROPERTIES, AND APPLICATIONS

27 JUNE 2022

THE NANOCENTER, BAR ILAN UNIVERSITY - BUILDING 206

9:00	**Welcome & Workshop Overview** @AUDITORIUM
9:30	**PLENARY TALK** **Prof. Lia Addadi -** Weizman Institute, Officer of "Order of the Star of Italy" ***Biogenic nano-scale mirrors and light scatterers, biogenic advanced functional materials engineered to fulfill optical functions***

9:40	**Prof. Leonardo Ricotti** Scuola Sant'Anna di Pisa ***Nanomaterials and ultrasound stimulation for regenerating human tissues***	9:50	**Prof. Shachar Richter** Tel Aviv University ***Programmable nanostructures using bio-assisted synthesis***
10:00	**Prof. Fabio Biscarini** University of Modena and Reggio Emilia & Istituto Italiano di Tecnologia ***Nanoscale effects in organic transistors for bio- and neuroelectronics***	10:10	**Prof. Boaz Pokroy** Technion Haifa - Institute of Technology ***From biomineralization to advanced functional materials***
10:20	**Prof. Graziella Malandrino** Universita degli Studi di Catania ***Fabrication of advanced materials for energy harvester and energy conversion devices***	10:30	**Prof. David Zitoun** Bar Ilan University ***Metallic nanoparticle synthesis: from atoms to devices***
10:40	**Prof. Candido Fabrizio Pirri** Politecnico di Torino ***Materials and technologies for energy transition***	10:50	**Prof. Lioz Etgar** Hebrew University, Jerusalem ***Excitonic solar cells***

11:00-11:30 COFFEE BREAK (@LOBBY GROUND FLOOR)

11:30	**Prof. Antonio d'Alessandro** Sapienza Università di Roma ***Photonic devices based on liquid crystals and gold nanoparticles***	11:40	**Prof. Mindy Levine** Ariel University ***Bimanes: small fluorophores with expanding sensing applications***
11:50	**Prof. Alberto Vomiero** Ca' Foscari University of Venice ***Composite nanostructures for energy and environment***	12:00	**Prof. Ernesto Joselevich,** Weizmann Institute ***Shaping 1D nanostructures with surfaces***
12:10	**Prof. Andrea Lamberti** Politecnico di Torino ***Advanced nanomaterials for electrochemical energy device***	12:20	**Prof. Igor Rahinov** The Open University of Israel ***Smart synthesis of nanomaterials from the gas phase: insights gained by laser spectroscopy, mass spectrometry and numerical simulations***
12:30	**Prof. Paolo Fornasiero** University of Trieste ***Nanocatalysts for more sustainable chemical processes***	12:40	**Prof. Menny Shalom** Ben Gurion University ***Materials design for photo and electrochemical reactions***

12:50-14:20 LUNCH BREAK (@5TH FLOOR)

14:20 -15:30	FLASH TALKS @AUDITORIUM	**Noa Lachaman-Senesh (TAU), Louisa Meshi (Ben Gurion University), Ilan Shalish (Ben Gurion University), Hanan Teller (Ariel University), Yaron Amouyal (Technion Haifa), Amos Bardea (HIT) Roy Shenhar (Hebrew University)**	**Hannah-Noa Barad (Bar Ilan University), Dan Major (Bar Ilan University), Ariel Ismach (TAU), Lilac Amirav (Technion Haifa), Daniel Sharon (HUJI),**
15:30-16:50	**MIXER & NETWORKING** @5TH FLOOR	**Meeting the Italian guest speakers & setting the ground for future collaboration**	
16:50	**CLOSURE** @AUDITORIUM		

אוניברסיטת בן-גוריון בנגב Ben-Gurion University of the Negev
האוניברסיטה הפתוחה THE OPEN UNIVERSITY OF ISRAEL الجامعة المفتوحة
HIT 50 מכון טכנולוגי חולון Holon Institute of Technology
The Chaoul Center for Nanoscale Systems, Tel Aviv University Center for NanoScience and Nanotechnology
intel
ARIEL UNIVERSITY
מכון ויצמן למדע WEIZMANN INSTITUTE OF SCIENCE
The Alexander Kofkin Faculty of Engineering, Bar-Ilan University

Embassy of Italy
Tel Aviv

IVS
Israel Vacuum Society

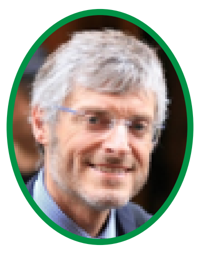
KEEP IN TOUCH...


Prof. Leonardo Ricotti
Scuola Sant'Anna di Pisa
Leonardo.Ricotti@santannapisa.it


Prof. Fabio Biscarini
University of Modena and Reggio Emilia
& Istituto Italiano di Tecnologia
fabio.biscarini@unimore.it


Prof. Graziella Malandrino
Universita degli Studi di Catania
gmalandrino@unict.it


Prof. Candido Fabrizio Pirri
Politecnico di Torino
fabrizio.pirri@polito.it


Prof. Antonio d'Alessandro
Sapienza Università di Roma
antonio.dalessandro@uniroma1.it


Prof. Alberto Vomiero
Ca' Foscari University of Venice
alberto.vomiero@unive.it


Prof. Andrea Lamberti
Politecnico di Torino
andrea.lamberti@polito.it


Prof. Paolo Fornasiero
Università degli studi di Trieste
pfornasiero@units.i


Prof. Lia Addadi
Weizmann Institute
lia.addadi@weizmann.ac.il


Prof. Shachar Richter
Tel Aviv University
srichter@tauex.tau.ac.il


Prof. Boaz Pokroy
Technion Haifa
bpokroy@gmail.com


Prof. David Zitoun
Bar Ilan University
David.Zitoun@biu.ac.il


Prof. Lioz Etgar
Hebrew University, Jerusalem
lioz.etgar@mail.huji.ac.il


Prof. Mindy Levine
Ariel University
mindyl@ariel.ac.il


Prof. Ernesto Joselevich,
Weizmann Institute
ernesto.joselevich@weizmann.ac.il


Prof. Igor Rahinov
The Open University of Israel
rahinov@gmail.com


Prof. Menny Shalom
Ben Gurion University
mennysh@bgu.ac.il

FLASH TALKS

Noa Lachaman-Senesh (TAU), noala@tauex.tau.ac.il
Louisa Meshi (Ben Gurion University), louisa@bgu.ac.il
Ilan Shalish (Ben Gurion University), shalish@bgu.ac.il
Hanan Teller (Ariel University), hanante@ariel.ac.il
Yaron Amouyal (Technion Haifa), amouyal@technion.ac.il
Amos Bardea (HIT), amos.bardea@hit.ac.il
Roy Shenhar (Hebrew University), Roy.shenhar@mail.huji.ac.il

Hannah-Noa Barad (Bar Ilan University), hannah-noa.barad@biu.ac.il
Dan Major (Bar Ilan University), majort@biu.ac.il
Ariel Ismach (TAU), aismach@tauex.tau.ac.il
Lilac Amirav (Technion Haifa), lilac@technion.ac.il
Daniel Sharon (HUJI), daniel.sharon@mail.huji.ac.il

אוניברסיטת בן-גוריון בנגב
Ben-Gurion University of the Negev
האוניברסיטה הפתוחה
THE OPEN UNIVERSITY OF ISRAEL
الجامعة المفتوحة
HIT
מכון טכנולוגי חולון
Holon Institute of Technology
The Chaoul Center for Nanoscale Systems
Tel Aviv University Center for NanoScience and Nanotechnology
intel
ARIEL UNIVERSITY
מכון ויצמן למדע
WEIZMANN INSTITUTE OF SCIENCE
The Alexander Kofkin Faculty of Engineering
Bar-Ilan University

Nanomaterials and ultrasound stimulation for regenerating human tissues

The research efforts of the "Regenerative Technologies" Lab stand at the interface between different disciplines, such as materials science, molecular biology, micro/nanotechnologies, robotics and mechatronics. The aim is to develop technologies for regenerative medicine and artificial and bioartificial organs, to tackle degenerative pathologies and to improve the quality of life of a vast number of people. In particular, the talk will address the use of nanomaterials responsive to external physical stimuli (e.g., ultrasound). This paradigm has been proven to be beneficial in a number of biomedical applications, such as the regeneration of articular cartilage, as well as neural and muscular tissues. These efforts open broad margins for possible future research collaborations: novel nanomaterial types, developed by other groups, could be nicely integrated with the biophysical stimulation technologies and the application scenarios developed by our group, thus tackling new biomedical applications.

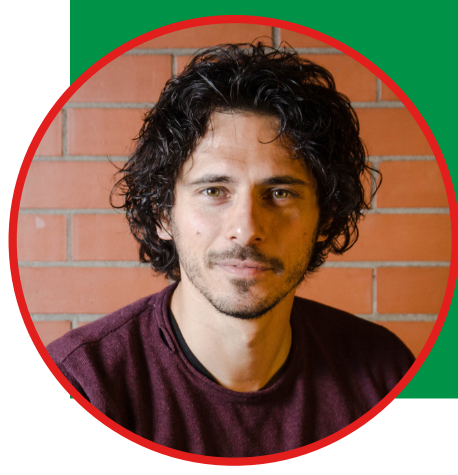
Website:
https://www.santannapisa.it/it/regenerative-technologies-laboratory

Meet the Speakers

Prof. Leonardo Ricotti

Scuola Sant'Anna di Pisa

e - mail:
Leonardo.Ricotti@santannapisa.it



Advanced nanomaterials for electrochemical energy device

Prof. Lamberti coordinates the research line on energy devices in the Materials and Processes for Micro & Nano Technologies Group at the Department of Applied Science and Technology, mainly focused on nanomaterials and electrochemical systems.

In particular third-generation photovoltaics and electrochemical capacitors (also known as supercapacitor) represent the most investigated systems with dedicated nanomaterials designed and engineered to

enhance the performance of such devices. Recently other spin-off lines grew-up about the hybridization of the above mentioned devices and their application in harsh environment, the energy harvesting from salinity gradient and from CO2 capture, and the possibility to recover raw materials from seawater. Possible collaborations are foreseen both on innovative materials preparation and application-driven device customization.

Website:
https://areeweb.polito.it/ricerca/micronanotech/research-activities/energyenviroment

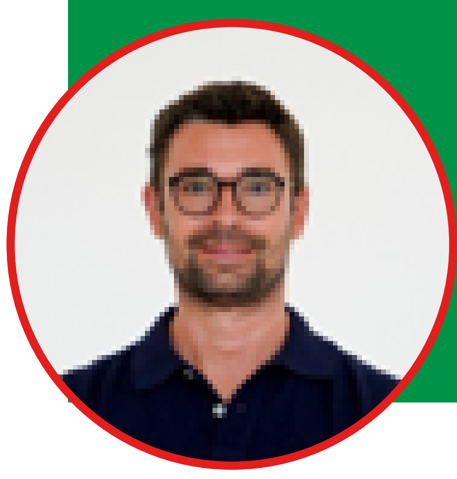
Meet the Speakers

Prof. Andrea Lamberti

Politecnico di Torino PhD
Full Professor of Experimental Physics of Matter

e - mail:
andrea.lamberti@polito.it

Scan to see my website:



Embassy of Italy
Tel Aviv

ISRAEL-ITALY WORKSHOP ON

ADVANCED MATERIALS

SYNTHESIS, CHARACTERIZATION, PROPERTIES, AND APPLICATIONS

IVS
Israel Vacuum Society

Composite nanostructures for energy and environment

Our research investigates composite nanostructures for applications in energy and environmental remediation. Our main expertise is on the synthesis of complex nanostructures and on tailoring the (opto)electronic properties of interfaces, which can boost the functionality of end user devices. Our recent results involve preparation of 1D/2D composites for hydrogen production through water splitting, [1] 1D core-shell array photodetectors, [2] quantum dots and carbon dots for luminescent solar concentrators [3] and hydrogen production [4].

Our main expertise is on the synthesis of nanomaterials and their integration and characterization in specific devices (solar cells, luminescent solar concentrators, solar water desalination, hydrogen production).

We search for active collaboration in the field of high-resolution structural and compositional characterization, including operando techniques using advanced spectroscopies (including synchrotron light).

[1] G. Solomon et al. Advanced Energy Materials 2021, 11 (32), 2101324

[2] P. Ghamgosar et al. Nano Energy 2018, 51, 308-316.

[3] H. Zhao et al Energy & Environmental Science 2021, 14 (1), 396-406

[4] C. Liu et al . Journal of Materials Chemistry A 2021, 9 (9), 5825-5832

Website:
https://www.unive.it/pag/16775

Meet the Speakers

Prof. Alberto Vomiero

Department of Molecular Sciences and Nanosystems

e - mail
alberto.vomiero@unive.it

Metallic Nanoparticle Synthesis: from atoms to devices

My research lab investigates wet chemical synthesis of nanoscale objects and metastable nanostructures, the interfacing in electrochemical devices and the operando measurements of the changes in structural, electronic and magnetic properties related to a chemical or electrochemical activity. I shall present the selectivity achieved through synthesis in constrained environment (single atom in a cavity), specifically the internal void of single wall carbon nanotubes. I am looking for EU partners for two projects (i) HORIZON-CL5-2022-D2-01-02: Interface and electron monitoring for the engineering of new and emerging battery technologies (Batteries Partnership) and (ii) Safe hydrogen injection management at network-wide level: towards European gas sector transition

Website:
www.zitounlab.com

Meet the Speakers

Prof. David Zitoun

Department of Chemistry
Bar Ilan University

Fabrication of advanced materials for energy harvester and energy conversion devices

The research group has know-how and expertise in the metal-organic chemical vapour deposition (MOCVD) and sol-gel processes starting from the synthesis of novel precursors to the fabrication of thin films and nanostructured materials for applications in energy harvesting, energy conversion devices and photovoltaics. In particular, the activity has focused on MOCVD fabrication of nanostructured binary oxides (such as NiO, ZnO, Cu_2O, VO_2, Mn_3O_4, Co_3O_4, Pr_2O_3) and functional perovskite-based films (such as TlBaCaCuO, $CaCu_3Ti_4O_{12}$, $LaCoO_3$, $La_{1-x}Sr_xMnO_3$, $Pr_{1-x}Ca_xMnO_3$). Current research, which will be addressed, includes: a) MOCVD fabrication of multiferroic $BiFeO_3$ and doped $BiFeO_3$ perovskites as energy harvester; b) hybrid multifunctional systems by a combined MOCVD/MLD approach as energy down-conversion systems; c) binary and complex fluorides as host matrices for up- and down-conversion materials. In future collaborations, we look for research groups characterizing the functional properties of materials and realizing devices with our films

Meet the Speakers

Prof. Graziella Malandrino

Dipartimento di Scienze Chimiche,
Università degli Studi di Catania, and INSTM UdR Catania

E-mail: graziella.malandrino@unict.it

Website:
http://www.dsc.unict.it/faculty/graziella.malandrino

Orcid:
http://orcid.org/0000-0001-7483-3070

From Biomineralization to advanced functional materials

My group studies the formation of materials and minerals by various organisms (biomineralization), we identify various biostrategies that the organisms use to form their materials and then translate the ideas to synthetic materials controlling the properties and

structure from the atomic level to the mesoscale. We utilize various state-of-the-art characterization techniques such as synchrotron radiation and aberration corrected TEM.

a. I will show several biostrategies to form tough ceramics in nature despite the fact that the synthesis occurs at room temperature and several examples of bio-inspired materials based on the principals learnt from nature. I will show how we can toughen ceramics by the incorporation of biological molecules and how the same incorporation can tune the optical and magnetic properties of semiconductors and magnetic materials.

b. We are always open to collaborations in all fields of materials science, theory, model and any other complimentary expertise.

Website:

http://pokroylab.net.technion.ac.il

Meet the Speakers

Prof. Boaz Pokroy

Department of Materials Science and Engineering
Technion Israel Institute of Technology

Embassy of Italy
Tel Aviv

ISRAEL-ITALY WORKSHOP ON

ADVANCED MATERIALS

SYNTHESIS, CHARACTERIZATION, PROPERTIES, AND APPLICATIONS

IVS
Israel Vacuum Society

Nanocatalysts for more sustainable chemical processes

My research activity focuses on development of well define heterogeneous catalysts, photocatalysts and electrocatalysts for environmental catalysis and energy related applications.

Topics of interest include

i) air pollution control, with emphasis on catalytic oxidation of methane,

ii) green hydrogen production (water splitting and electrolysis), CO_2 conversion (photocatalysis and electrocatalysis),

iii) N_2 fixation to ammonia (photo and electrocatalysis), and photocatalytic organic synthesis.

Recent major achievements include development of $g\text{-}C_3N_4$ based photocatalysts for more sustainable organic synthesis, materials for photo-reforming of biomasses to H_2 or diesel, and development of materials for extracatalytic synthesis of H_2O_2.

Future research collaborations are needed to improve advanced characterization (e.g. operando, HR-TEM, fast transient spectroscopy) and prototype realization, industrialization, knowledge transfer.

Website:
http://meeresearch.weebly.com/

Meet the Speakers

Prof. Paolo Fornasiero

Department of Chemical and Pharmaceutical Sciences,
University of Trieste
Center for Energy, Environment and Transport Giacomo Ciamician -
University of Trieste,
Consortium INSTM and ICCOM- CNR

e.mail pfornasiero@units.it

Bimanes: Small fluorophores with expanding sensing applications

High quantum yield organic fluorophores, particularly those with small molecular sizes, have significant potential applications in a variety of fields, including in the development of high-performance chemical sensors. One such class of fluorophores, bimanes, has been understudied to date because of historical difficulties in their synthetic accessibility. Recent results from the Grynszpan group have led to the development of robust, high- yielding methods to access a range of bimane derivatives, and in collaboration with the Levine group we reported the use of these bimanes in a range of fluorescent sensing applications. Overall, our demonstrated ability to design bimane structures on demand, synthetically access those structures, and use them as the basis for novel fluorescent sensors (both with and without cyclodextrin complexation), provides a strong foundation for the development of new bi mane derivatives and new and more effective chemical

Meet the Speakers

Prof. Mindy Levine

Department of Chemical Sciences,
Ariel University

Photonic devices based on liquid crystals and gold nanoparticles

I lead research in photonic devices based on liquid crystals integrated with optical waveguides made on several substrate materials e.g. silicon, glass, polymers for optical communications and sensor systems. More recently my group is investigating optofluidic devices using localised surface plasmons in gold nanoparticles and nanorods. Results will be shown on both liquid crystal based optical switches and filters for low power photonic applications in addition to recent modeling of all-optical nanoplasmonic devices for photo-thermal therapy applications. Collaborations are sought for common projects using advanced nanostructured materials for photonic device.

Website:
http://antoniodalessandro.site.uniroma1.it

Meet the Speakers

Prof. Antonio d'Alessandro

Department of Information Engineering, Electronics and Telecommunications, Center of Nanotechnology applied to Engineering, Sapienza University of Rome

Email:
antonio.dalessandro@uniroma1.it

Excitonic Solar Cells

Photovoltaic cells (PVCs) use semiconductors to convert sunlight into electrical current and are regarded as a key technology for a sustainable energy supply. Recent discoveries have revealed a breakthrough in the field using inorganic-organic hybrid layers called perovskites as the light harvester in the solar cell. The inorganic-organic arrangement is self-assembled as alternate layers, being a simple, low cost procedure. These organic-inorganic hybrids promise several benefits not delivered by the separate constituents. Prof. Etgar's research group is focused on the development of innovative perovskite solar cells. Prof. Etgar's group is searching for new excitonic solar cell architectures while designing and controlling the organic-inorganic light harvester structure and properties, in order to improve the photovoltaic parameters.

The current talk will discuss some of our recent results on low dimensional perovskite and fully printable mesoporous indium tin oxide (ITO) perovskite solar cells.

The solar cell structure consists of triple-oxide screen-printed mesoporous layers. In this structure, the perovskite is not forming a separate layer but fills the pores of the triple-oxide structure. The perovskite is utilized as both the light harvester and a hole transporting material. One of the advantageous of this solar cell structure is the transparent contact (mesoporous ITO) which permit the use of this cell structure in bifacial configuration without the need for additional layers or thinner counter electrode. My research group is searching for a collaboration in several areas including:

(i) Advanced photophysical measurements of our unique materials and devices;

(ii) Theoretical calculations for devices and materials properties.

(iii) Advanced characterizations of nanomaterials.

Website:
https://lioz.etgar.huji.ac.il

Meet the Speakers

Prof. Lioz Etgar

The Institute of Chemistry
The center for nanoscience and nanotechnology
Casali Center for Applied Chemistry
The Hebrew University of Jerusalem, Israel

Biogenic nano-scale mirrors and light scatterers, biogenic advanced functional materials engineered to fulfill optical functions

Organisms construct optical devices based on assemblies of organic crystals. The constituent molecules are mostly purines and pteridines. All the crystals have unusually high refractive indexes in the directions along which the light penetrates the crystal. The crystals form mirrors and light scattering layers that function to increase light sensitivity in the eyes of scallops [1], of crustaceans such as shrimps and crayfish [2], of some fish [3], and so far, in one case of terrestrial insects, the jumping bristletails [4]. Scallops contain in their eyes a concave multi-layered mirror perfectly tiled with a mosaic of square guanine crystals, reflecting the light to form images onto the overlying retinas. The crustaceans and the zander fish have in their image-forming eyes crystals surrounding the light receptors. In the crustaceans, the crystals form densely packed assemblies of highly organized spherulites, composed of layers of isoxanthopterin crystals [5]. In the zander fish, the tissue surrounding the light receptors is densely occupied by block-shaped crystals of 7,8-dihydroxanthopterin.

In both the latter cases, the crystals backscatter the direct light missed in the first passage to the light receptors. In the insect, a mirror composed of disordered crystals of xanthine reflects light back onto the scattered retina components, resulting in light sensors that are not image forming. In all these examples, the hierarchical organization is controlled from the crystal structure at the nanoscale to the complex 3D super-structure at the millimeter level. The crystal structure, the size, the crystal morphology and the superstructural arrangement all together determine the optical properties of the material. We have thus a vast choice of molecular components, of structures and superstructures, assembled following precise blueprints to fulfill optical functions. A fascinating heterogeneous source of inspiration for engineering optical materials.

Meet the Speakers

Prof. Lia Addadi

Depts. of Chemical and Structural Biology, Molecular Chemistry and Materials Science
Weizmann Institute of Science
Rehovot, Israel

[1] BA Palmer, GJ Taylor, V Brumfeld, D Gur, M Shemesh, N Elad, A Osherov, D Oron, S Weiner, L Addadi, "The Image Forming Mirror in the Eye of the Scallop", Science 358, 1172–1175 (2017)
[2] BA Palmer, A Hirsch, V Brumfeld, ED Aflalo, I Pinkas, A Sagi, S Rozenne, D Oron, L Leiserowitz, L Kronik, S Weiner and L Addadi, "Isoxanthopterin: An Optically Functional Biogenic Crystal in the Eyes of Decapod Crustaceans", PNAS, 115, 10, 2299–2304 (2018)
[3] G Zhang, A Hirsch, G Shmul, L Avram, N Elad, V Brumfeld, I Pinkas, I Feldman, R Ben Asher, BA Palmer, L Kronik, L Leiserowitz, S Weiner and L Addadi, "Guanine and 7, 8-dihydroxanthopterin reflecting crystals in the zander fish eye: crystal locations, compositions and structures", J Am Chem Soc 141, 50, 19736–19745, (2019)
[4] O Friedman, A Böhm, K Rechav, I Pinkas, V Brumfeld, G Pass, S Weiner, L Addadi, "Structural Organization of Xanthine Crystals in the Median Ocellus of the Ancestral Insect Lepismachilis rozsypali (Hexapoda: Archaeognatha)", submitted for publication (2021)
[5] BA Palmer, VJ Yallapragada, N Schiffmann, E Merary-Wormser, N Elad, ED Aflalo, A Sagi, S Weiner, L Addadi, D Oron, "Highly Reflective Biogenic Materials from Core-Shell, Birefringent Nanospheres", Nature Nanotechnology 15 , 138–144 (2020)

Website: http://www.weizmann.ac.il/CSB/Addadi/

Programmable nanostructures using Bio-assisted synthesis

The bio and molecular electronics group focuses on developing new materials, mainly from components originating from renewable resources. We research and develop all aspects of the new materials, such as modification of the raw materials on the molecular level, development of new synthesis routes, processing methodologies, and applications

In this talk, I will present some recent findings on the development of methodologies to control the structure of nanoparticles using green synthesis. These are used for various applications such as photothermal materials, smart-wound dressing, photocatalysis, and more.

We are looking for a collaboration to explore the issues addressed, focusing on the environmental and green aspects of the methodologies addressed.

Meet the Speakers

Prof. Shachar Richter

Department of Materials Science and Engineering
Faculty of Engineering & University Center for Nano Science and Nanotechnology
Tel Aviv University

Nanoscale effects in organic transistors for bio- and neuroelectronics

Our current research interest is organic electronics for biosensing and neuroelectronics. We devise ultra-sensitive label-free biosensors in Modena, and the next generation neural implants for electrical and chemical recording and stimulation aimed to human patients in Ferrara.

In my presentation, I will report unpublished results of iterated wetting/dewetting transitions during the growth of a molecular semiconductor (pentacene) thin films by high vacuum sublimation. This phenomenon yields large oscillations of transistor properties on nm thickness scales, hinting to an alternative view on the mechanisms of operations in organic transistors in aqueous electrolytes.

We are interested in establishing collaborations on the study of fundamental aspects at the basis of organic transistors in aqueous electrolytes, the coupling between biorecognition and the active channel, and active materials with ion-pi interactions

Website:
https://www.iit.it/it/component/people/fabio-biscarini
http://www.leo.unimore.it

Meet the Speakers

Prof. Fabio Biscarini

Center for Translational Neurophysiology of Speech and Cognition-Istituto Italiano di Tecnologia
Life Sciences Deptartment Università di Modena e Reggio Emilia

Email:
fabio.biscarini@unimore.it

Materials design for photo and electrochemical reactions

One of the promising technologies for future alternative energy sources is the direct conversion of sunlight into chemical or electrical energy using photocatalysis or photoelectrochemical cells (PEC). The greatest challenge in these fields is to develop new types of advanced materials with the desired electrical and optical properties that will replace the conventional raw materials that are currently used. Although, in the last years, significant progress has been made, it is still an essential task to find efficient and low-cost materials as photoactive materials and cocatalysts. In this talk, I will present our research on developing new materials and concepts for clean fuel production (e.g., hydrogen and carbon-based fuels) using photocatalysis, photoelectrochemical cells (PEC), and electrocatalysis. I will discuss new methods to synthesize metal-free 2D materials and earth-abundant metal-containing materials with well-defined structures and properties for their utilization in energy-related applications such as photoand electrocatalysis.

Meet the Speakers

Prof. Menny Shalom

Department of Chemistry, Ben Gurion University of the Negev

Email: mennysh@bgu.ac.il

Shaping 1D Nanostructures with Surfaces

The large-scale assembly of 1D nanostructures, such as nanotubes, nanowires, nanoribbons and nanowalls, with controlled orientation on surfaces remains one challenge toward their integration into practical devices. During the last decade, we have reported the growth of perfectly aligned nanotubes, nanowires and nanowalls of various semiconductor materials with controlled crystallographic orientations on different substrates. The growth directions and crystallographic orientation of the nanowires are controlled by their epitaxial relationship with the substrate, as well as by a graphoepitaxial effect that guides their growth along surface steps and grooves. We demonstrated the massively parallel self-integration of nanowires into circuits via guided growth and the production of optoelectronic nanosystems, including photodetectors, photodiodes and photovoltaic cells. This talk will present a quick overview on these and other activities in our research group, and suggest possible directions of collaboration.

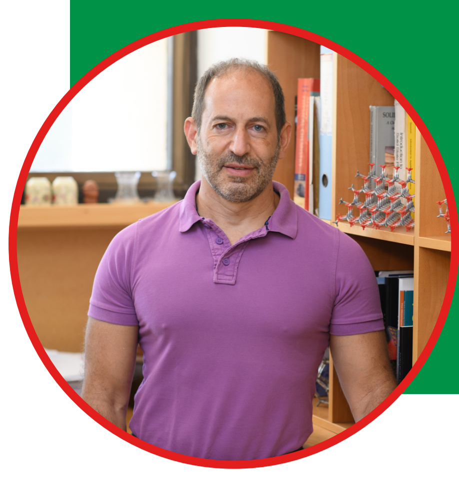
Website: http://www.weizmann.ac.il/materials/ernesto

Meet the Speakers

Prof. Ernesto Joselevich

Department of Molecular Chemistry and Materials Science
Weizmann Institute of Science

Email: ernesto.joselevich@weizmann.ac.il,



Smart synthesis of nanomaterials from the gas phase: insights gained by laser spectroscopy, mass spectrometry and numerical simulations

Combustion synthesis is a viable route for scaled-up and continuous production of inorganic-oxide-based nanomaterials used for energy storage, catalysis, sensor design, medicine and many other areas. It is becoming increasingly clear that empirical advances reached in combustion synthesis of nanomaterials, employing trial and error, should evolve into predictive, model-based synthesis protocols, relying on a detailed understanding of the underlying chemical kinetics and the interplay between chemical reactions and fluid dynamics To fully master a scaled-up combustion synthesis of nanoparticles towards a wide library of materials with tailored functionalities, detailed understanding of underlying kinetic mechanism is required. In this respect, flame synthesis of iron oxide nanoparticles is a model case, being one of the better understood systems and guiding the way how other material synthesis systems could be advanced.

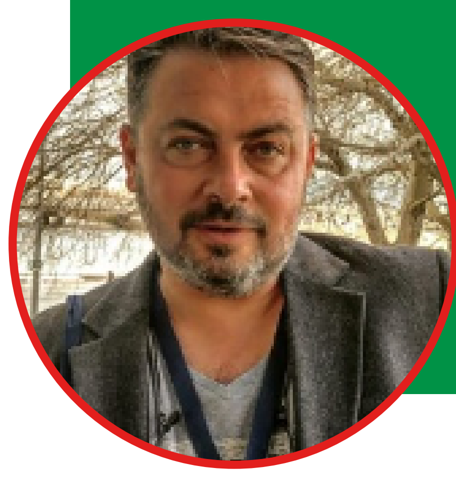
In this talk I will highlight, on the example of iron-oxide system, an approach, combining laser spectroscopy and mass-spectrometry with detailed simulations [1]. The experiments deliver information on time-temperature history and concentration field data for gas-phase species and condensable matter under well-defined conditions. The simulations, which can be considered as in-silico experiments, combining detailed kinetic modeling with computational fluid dynamics serve both for mechanism validation via comparison to experimental observables as well as for shedding light on quantities inaccessible by experiments. This approach shed light on precursor decomposition, initial stages of iron oxide particle formation, precursor role in flame inhibition and provided insights into the effect of temperature-residence time history on nanoparticle formation, properties and flame structure [2-5].

1. I. Rahinov, J. Sellmann, M.R. Lalanne, M. Nanjaiah, T. Dreier, S. Cheskis, I. Wlokas, " Insights into the Mechanism of Combustion Synthesis of Iron Oxide Nanoparticles Gained by Laser Diagnostics, Mass Spectrometry, and Numerical Simulations: A Mini-Review"Energy & Fuels2021, 35, 1, 137–16
2. M. Poliak, A. Fomin, V. Tsionsky, S. Cheskis, I. Wlokas, I. Rahinov, "On the mechanism of nanoparticle formation in a flame doped by iron pentacarbonyl", Physical Chemistry Chemical Physics, 17, 680-685, 2015
3. S. Kluge, L. Deng, O. Feroughi, F. Schneider, M. Poliak, A. Fomin, V. Tsionsky, S. Cheskis, I. Wlokas, I. Rahinov, T. Dreier, A. Kempf, H. Wiggers, C. Schulz, "Initial reaction steps during flame synthesis of iron-oxide nanoparticles", CrystEngComm, vol 17 (36), pp- 6930-6939, 2015
4. J. Sellmann, I. Rahinov, S. Kluge, H. Jünger, A. Fomin, S. Cheskis, C. Schulz, H. Wiggers, A. Kempf, I. Wlokas " Detailed simulation of iron oxide nanoparticle forming flames: Buoyancy and probe effects" Proceedings of the Combustion Institute, 37 (1) 1241-1248, 2019
5. Lalanne, M.R., Wollny, P., Nanjaiah M., Menser J., Schulz C., Wiggers H., Cheskis S., Wlokas I., Rahinov I. "Early particle formation and evolution in iron doped flames." Combustion and Flame, 2022 (in press)

Meet the Speakers

Prof. Igor Rahinov

Department of Natural Sciences, The Open University of Israel



Materials and technologies for Energy transition.

The growth of the global population to over seven billion people, which has increased energy consumption and in turn natural resource depletion, pollution, waste disposal and anthropic CO2, has made "energy transition" and "circular economy" the essential challenges for the future. The talk will be focused on the strategy of the Center for Sustainable Future Technologies of the Italian Institute of Technology to develop a future generation of nanomaterials, processes and systems to limit the environmental impact of production, distribution and use of energy from the perspective of a sustainable and circular economy.

The following main topics will be faced: 1.Nanomaterial production and transformation into devices for green energy, green fuel production, energy management and waste valorization; 2. Design and Development of Microbial Platform for bio-production from waste; 3. Technologies for the realization of devices and systems integration in an energy transition perspective.

An overview of technologies and facilities of the Center of Research (https://www.seastar.center/) will be provided across the production of materials for catalysis, electrodes, membranes, photovoltaics, and for combustion, hydrogen, green fuels. The Center provide also top-level knowhow on micro- and nano-scale structural, compositional, optoelectronic, in-situ and in-operando characterization. Technologies and processes on power electronics, sensing, fuel cells, photovoltaics, batteries, supercapacitors, engines/combustion systems, waste valorization, (photo)catalysis, recyclability and durability of materials, new fabrication technologies with reduced environmental and energy impact, recyclability and durability of materials will be covered.

Meet the Speakers

Prof. Candido Fabrizio Pirro

Professor of Physics of Matter at Politecnico di Torino
Director of the Center for Sustainable Future Technologies of the Italian Institute of Technology

Email: fabrizio.pirri@polito.it