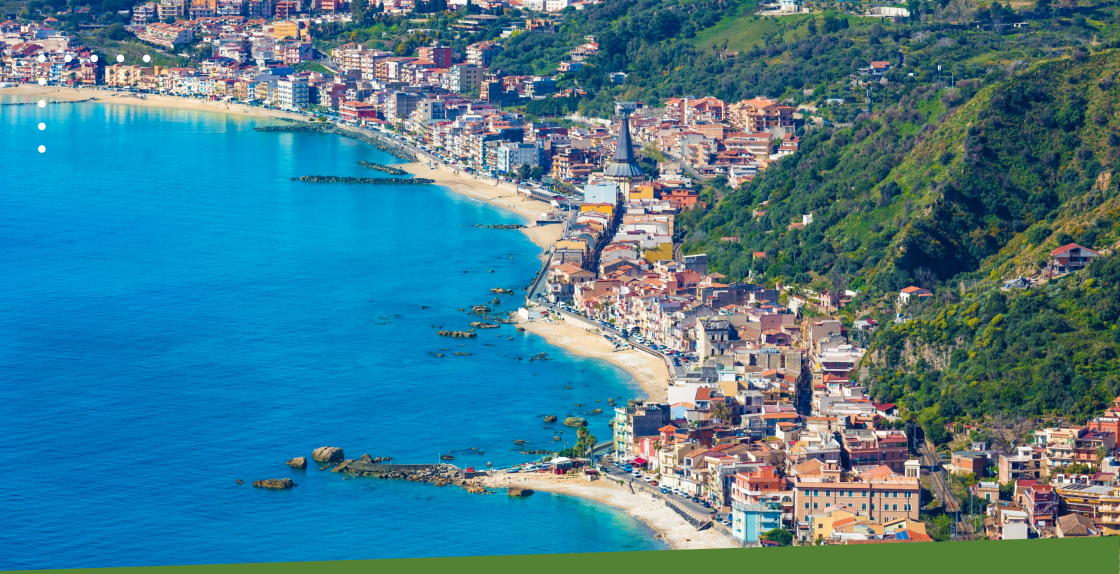

PROGRAM

2025 IEEE INTERNATIONAL WORKSHOP ON

Metrology for Green technologies, REnewable ENergy and ecological SusTainability

GIARDINI NAXOS, ITALY SEPTEMBER 24-26, 2025

METRO GREENST

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IEEE MetroGREENST 2025 Keynote Speakers

Keynote Lecture - Wednesday September 24 - H 10:20

Advanced Sustainable Materials and Sensors for Environmental Monitoring

Zeynep **Altintas**
Kiel University, Germany

ABSTRACT

Ensuring environmental safety and public health requires effective strategies for virus sensing and removal, particularly in water and air systems, where pathogenic transmission poses a persistent threat. However, existing detection and removal technologies often rely on expensive, unstable recognition elements and complex processes that generate secondary pollutants or exhibit limited efficiency. In this keynote, I will present a novel approach that leverages computationally designed, advanced sustainable materials to overcome these limitations. By integrating these materials into sensor platforms and membrane systems, we achieve high-performance virus detection and removal with minimal environmental impact. Specifically, virus-specific sensing materials enabled ultra-sensitive detection of human pathogenic viruses in complex media such as tap water (limit of detection = 0.064 fM), demonstrating excellent selectivity and robustness. Concurrently, functionalized membranes based on polyvinylidene fluoride (PVDF) and polyethersulfone (PES), enhanced with computationally optimized materials, enabled complete (100%) virus removal from contaminated water. This dual-function strategy not only improves the efficiency and specificity of virus monitoring technologies but also advances the development of sustainable, scalable solutions for point-of-care diagnostics and environmental remediation. The results underscore the transformative potential of smart materials in addressing global challenges at the intersection of health, sustainability, and environmental monitoring.

SPEAKER BIOGRAPHY

Zeynep Altintas is a Full Professor and Chair of Bioinspired Materials and Biosensor Technologies at Kiel University, Germany. From 2016 to 2022, she led the Biosensors and Receptor Development Group at the Technical University of Berlin. She has authored over 179 publications and supervised more than 42 Ph.D. and M.Sc. students, in addition to mentoring 16 postdoctoral fellows. Her research has been widely recognized through numerous prestigious

international awards and grants, including the Life Science Bridge Award, the Life Outstanding Investigator Award for Women, the Royal Society of Chemistry Research Award, the Marie Curie Individual Fellowship, and several others. Professor Altintas frequently serves as a reviewer for major research funding bodies such as the European Union (EU), German Research Foundation (DFG), Dutch Research Council (NWO), Humboldt Foundation, Israel Science Foundation (ISF), French National Research Agency (ANR), German Federal Ministry of Education and Research (BMBF), and the Wisconsin Groundwater Coordinating Council (USA). She is Associate Editor of Sensing and Bio-Sensing Research and serves on the editorial boards of Biosensors and Bioelectronics, Scientific Reports, Micromachines, and Materials. An active member of the Royal Society of Chemistry since 2012, she also holds visiting professorships in various EU countries and contributes to the organization of several international conferences.

Keynote Lecture - Thursday September 25 - H 10:40

Machine Learning: Enabler of Sustainable Technologies or Potential Burden on Sustainability?

Donatella **Puglisi**
Department of Physics, Chemistry and Biology, Linköping University, Sweden

ABSTRACT

Machine learning (ML) is rapidly transforming scientific research, technological innovation, industrial processes, and society, offering transformative capabilities in diverse domains such as environmental monitoring and sensing, renewable energy optimization, green chemistry, and smart infrastructure. Yet, this widespread adoption raises critical concerns regarding its ecological footprint. Training complex models – especially deep learning architectures – demands significant computational resources, leading to high energy consumption and considerable carbon emissions. Furthermore, the large-scale deployment of ML in consumer electronics, edge computing, and IoT systems increases reliance on advanced semiconductors and rare-earth materials, exacerbating supply chain pressures and electronic waste. Addressing these issues requires a dual focus: improving computational efficiency and establishing standardized sustainability metrics for ML-based systems.

Here, we present a mature integration of ML with gas sensor technologies in electronic nose (e-nose) systems, as a model for both innovation and sustainable applications. Two case studies highlight ML-enhanced e-nose performance in forensic scenarios and food quality assessment. Our system employs 32 MOS gas sensors across four temperature-controlled banks, acquiring data at 10 Hz over 10 minutes, generating 32×6000 time-voltage matrices per sample. Feature extraction and model training were conducted in MATLAB's Classification Learner, applying consistent methodologies, including 10-fold cross-validation and 60–85 feature sets per case.

The Optimizable Ensemble model consistently outperformed all others. It achieved 98% accuracy in distinguishing post-mortem from ante-mortem samples, and 96% sensitivity and 95% specificity in identifying meat contamination.

These findings underscore the powerful role ML can play in advancing sustainable technologies. However, without deliberate attention to its environmental costs, ML may become a net burden. This contribution aims to catalyze discussion on responsible ML deployment and offers pathways for its alignment with ecological and sustainability goals.

SPEAKER BIOGRAPHY

Donatella Puglisi, PhD, is an Associate Professor of Applied Physics at Linköping University, Sweden, specializing in interdisciplinary research and innovation projects within applied sciences and engineering. Her primary focus is on developing advanced gas sensing devices and machine learning-enhanced electronic noses for odor detection, particularly targeting volatile organic compounds.

Puglisi has led over 25 collaborative research projects across various fields, such as indoor air quality, environmental monitoring, forensic and cancer diagnostics, food quality assessment, and cultural heritage preservation. She has actively contributed to numerous research projects and networks at local, national, and international levels, serving as an advisory board member, external expert, working group member, and research collaborator. Puglisi has published 67 peer-reviewed papers and two book chapters, and has presented her research at over 100 conferences and workshops. She has served in leadership roles in organizing committees, technical and international program committees, advisory boards, and as a session chair, invited, keynote, and plenary speaker. Her teaching experience includes courses in measurement technology and sustainable development. Her professional interests extend to technology transfer, fostering collaborations with industry, research centers, government agencies, and civil society.

Puglisi is a member of the EUROSENSORS International Steering Committee and co-founder and board member of NORNDiP, the Nordic Network for Diversity in Physics, which promotes diversity, inclusion, and female leadership in science. In 2019, she was awarded the Åforsk Entreprenörstipendium, recognizing her as one of Sweden's top 10 innovative entrepreneurs of the year.

IEEE MetroGREENST 2025 Tutorial

Tutorial Session - Wednesday September 24 - H 14:00

Engineering Fuel Cells: Innovative Design, Manufacturing, and System Integration

Giosuè **Giacoppo**
Institute for Advanced Energy Technologies, National Research Council (CNR-ITAE), Italy

ABSTRACT

The increasing demand for clean energy technologies places hydrogen fuel cells at the center of future energy systems. Their integration into portable, stationary, maritime, and aerospace applications requires a robust engineering approach that goes beyond material innovation. Advancements in system design, performance optimization, and scalable manufacturability are essential to support broad-scale deployment.

This tutorial will focus on the fuel cell stack engineering methodology developed over more than twenty years of applied research and prototyping. It will walk through a comprehensive design process — from preliminary sizing based on target performance, flow field architecture, and bipolar plate layout, to executive design, virtual assembly, and detailed testing protocols. The presentation will include real case studies and validated workflows that translate concepts into operational stacks.

A special focus will be dedicated to recent investigations into lattice-based and TPMS-inspired flow field structures. Although still at a relatively early stage, these geometries appear promising for improving gas distribution, water management, and mechanical integration. Additionally, the tutorial will explore advancements in additive manufacturing, particularly Laser Powder Bed Fusion (LPBF), and how it enables the production of innovative bipolar plate configurations that support not only improved design flexibility, but also automation-oriented stack assembly processes.

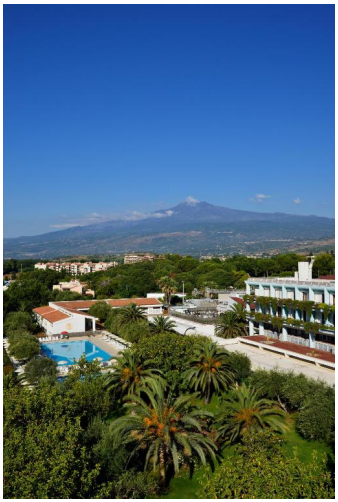
This session will showcase results from national and European projects (e.g., ESA, PRR, FCH-JU) and offer a forward-looking perspective on fuel cell stack integration with a high Technology Readiness Level (TRL), suitable for new energy, transport, and aerospace applications.

SPEAKER BIOGRAPHY

Dr. Giosuè Giacoppo is a senior researcher at the Institute for Advanced Energy Technologies (ITAE) of the National Research Council of Italy (CNR). He holds a degree in Aerospace Engineering and has over two decades of experience in hydrogen-based energy systems, fuel cells, and electrochemical energy storage.

His scientific contributions include the design, simulation, and experimental validation of fuel cell stacks, from low-power portable systems to high-efficiency regenerative units for aerospace missions. Dr. Giacoppo coordinated the development of several prototypes, including a 1 kW stack for ESA and modular systems integrating PEMFCs with electrolyzers and vanadium redox flow batteries. His recent research has focused on the application of 3D printing techniques, such as metal LPBF, to develop lightweight and compact stack architectures aimed at improving both performance and manufacturability. Dr. Giacoppo has authored more than 45 peer-reviewed publications, served as principal investigator in national and EU-funded research projects, and collaborated with industrial partners for technology transfer. He currently leads R&D activities on next-generation bipolar plates and fuel cell integration in hybrid systems, contributing to the advancement of sustainable and scalable hydrogen technologies across multiple sectors.

IEEE MetroGREENST 2025 Venue



IEEE MetroGREENST 2025 will be held at **UNAHOTELS Naxos Beach Sicilia** in Giardini Naxos, Messina, Italy.

The UNAHOTELS Naxos Beach Sicilia is a tourist complex perfectly inserted in Giardini Naxos, one of the most beautiful sea resorts of the eastern coast of Sicily.

The UNAHOTELS Naxos Beach Sicilia is located in Giardini Naxos, 6 km from Taormina and just 45 minutes from the Catania Fontanarossa airport, about 50 km away. The resort is located on the romantic bay of Giardini di Naxos and in addition to the famous and sparkling Taormina, only 20 minutes from the resort, guests can visit the Gole dell'Alcantara and Mount Etna, only 45 minutes away.

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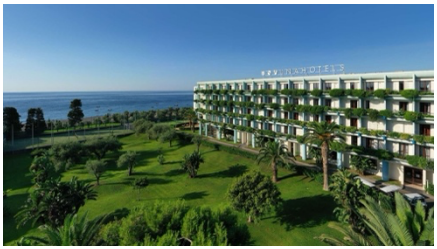

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FINE METROLOGY

Technical Program - Wednesday, September 24

09:00 - 17:00	**Room:** *Sala Affreschi* **REGISTRATIONS**

10:00 - 10:20	**Room:** *Sala Lipari* **OPENING CEREMONY - WELCOME ADDRESSES**

10:20 - 11:00	**Room:** *Sala Lipari* **KEYNOTE LECTURE** **Chairs**: Nicola Donato, *University of Messina, Italy* Donatella Spadaro, *IPCF - National Research Council, Italy*

Advanced Sustainable Materials and Sensors for Environmental Monitoring

Zeynep Altintas, *Kiel University, Germany*

11:00 - 11:20	**Room:** *Sala Affreschi* **COFFEE BREAK - POSTER SESSION #1**

P1-1 **Black-Box Model Transfer for Bacterial-Cellulose-Based Sensors**
Luca Patanè, Francesca Sapuppo and Maria Gabriella Xibilia (University of Messina, Italy)

P1-2 **Hybrid Additive Manufacturing for Embedded Electronics: a Process Integration of FFF and Direct Circuit Printing**
Guido Di Bella, Luigi Calabrese and Laura Arruzzoli (University of Messina, Italy); Mariangela Latino (Institute for Chemical and Physical Processes - CNR, Italy); Giovanni Gugliandolo and Nicola Donato (University of Messina, Italy)

P1-3 **From Microbes to Materials: Sustainable Pigments for Photonic and Industrial Innovation**
Donatella Spadaro (Institute for Chemical and Physical Processes - CNR, Italy); Alessia Tropea (Università di Messina, Italy); Dario Giuffrida (Institute for Chemical and Physical Processes - CNR, Italy); Rosina Celeste Ponterio (National Research Council, Italy); Luigi Mondello (Università di Messina, Italy); Marialuisa Saladino and Carla Rizzo (Università di Palermo, Italy)

P1-4 **Advanced SAPO-34 Composite Coatings for Sustainable TES Applications: Focus on Mechanical Adhesion and Corrosion Protection**
Davide Palamara, Mengistu Gelaw, Luigi Calabrese and Edoardo Proverbio (University of Messina, Italy)

P1-5 **A Perspective on Quantum Dots and Gold Nanoparticles in Dye-Sensitized Solar Cells: from Quantum Mechanics to Future Applications**
Ilaria Citro (National Research Council, Italy); Donatella Spadaro, Mariangela Latino and Giuseppe Calogero (Institute for Chemical and Physical Processes - CNR, Italy)

P1-6 **Microbial Screening for Solar Energy Suppliers Production via Fermentation Processes**
Alessia Tropea (University of Messina, Italy); Donatella Spadaro (Institute for Chemical and Physical Processes - CNR, Italy); Stefano Trocino (National Research Council - Institute for Advanced Energy Technologies, Italy); Daniele Giuffrida (University of Messina, Italy); Cassamo U. Mussagy (Pontificia Universidad Católica de Valparaíso, Chile); Giuseppe Calogero (IPCF-CNR, Istituto dei processi chimico fisici, Italy); Luigi Mondello (University of Messina, Italy)

P1-7 **Graphene and Copper Nanoparticles Based Electrochemical Sensors for the Determination of Glyphosate in Water**
Uswah Yasin and Federico La Barbera (University of Catania, Italy); Stefano Boscarino (University of Catania & CNR-IMM); Antonino Scandurra (University of Catania); Francesco Ruffino and Felice Torrisi (University of Catania & CNR-IMM)

P1-8 **Design of a Dual-Band Microwave Antenna for Highly Effective Tumor Ablation**
Siqi Liu (Beijing Institute of Technology, China); Xiue Bao (Beijing Institute of Technology, China & KU Leuven, Belgium); Yuying Huang (Beijing Institute of Technology, China); Mariangela Latino (Institute for Chemical and Physical Processes - CNR, Italy); Giovanni Gugliandolo, Nicola Donato and Giovanni Crupi (University of Messina, Italy); Victor Hu (Beijing Institute of Technology, China)

11:20 - 12:05 **Room:** *Sala Lipari*
Session 1 - Eco-sustainable sensing strategies in diagnostics
Chair: Dario Giuffrida, *IPCF - National Research Council, Italy*

11:20 **Green Synthesis of Amorphous Iron Oxide-Based Nanoparticles**
Vincenzina Strano (CNR, National Research Council, Italy); Vanna Torrisi, Simona Boninelli and Maria Pilar Miritello (CNR-IMM, Italy)

11:35 **Toward a Fully Eco-Sustainable SERS Sensors for Cultural Heritage Diagnostics**
Dario Giuffrida and Donatella Spadaro (Institute for Chemical and Physical Processes - CNR, Italy); Marialuisa Saladino and Francesco Armetta (Università di Palermo, Italy); Sebastiano Trusso (Consiglio Nazionale delle Ricerche, Istituto per I Processi Chimico-Fisici, Italy); Alessia Tropea (Università di Messina, Italy); Rosina Celeste Ponterio (CNR, Italy)

11:50 **Electrochemistry as a Bridge to Oxidative Stress and Neurotoxicity Mechanism Elucidation: From Rhanterium Suaveolens Plant Based Assays to Mouse Model**
Meryam Chelly (University of Messina, Italy); Sabrine Chelly (University of Sfax, Tunisia); Giuseppe Nania (University of Messina, Italy); Tahia Boudawara (University of Sfax, Tunisia); Giovanni Neri (University of Messina, Italy); Hanen Bouaziz-Ketata (University of Sfax, Tunisia)

12:05 - 12:50	**Room:** *Sala Lipari* **Session 2 - Next-Gen Energy Frontiers: Innovations in Photovoltaics, Fuel Cells, Energy Storage and Beyond - PART I** **Chair:** Ilaria Citro, *IPCF - National Research Council, Italy*

12:05 **An Innovative Prototype for Photoelectrochemical Water Splitting**
Rossana Giaquinta, Carmine Arnese, Giosuè Giacoppo, Orazio Barbera and Stefano Trocino (National Research Council - Institute for Advanced Energy Technologies, Italy)

12:20 **Measurement and Validation Strategy in Adsorbent Coatings for Thermochemical Energy Storage**
Davide Palamara, Mengistu Gelaw and Emanuela Mastronardo (University of Messina, Italy); Andrea Frazzica (CNR-ITAE, Italy); Candida Milone and Luigi Calabrese (University of Messina, Italy)

12:35 **Silicon Particles for Improved Energy Density Anodes in Lithium-Ion Batteries**
Dominika Capkova (University of Limerick, Ireland & Brno University of Technology, Czech Republic); Hugh Geaney, David Mcnulty and Kevin Ryan (University of Limerick, Ireland)

12:50 - 14:00	*Ristorante Oasys* **LUNCH**

14:00 - 14:50	**Room:** *Sala Lipari* **TUTORIAL SESSION** **Chair**: Giovanni Gugliandolo, *University of Messina, Italy*

Engineering Fuel Cells: Innovative Design, Manufacturing, and System Integration

Giosuè Giacoppo, *Institute for Advanced Energy Technologies, National Research Coucil (CNR-ITAE), Italy*

14:50 - 15:35 **Room:** *Sala Lipari*
Session 3 - Next-Gen Energy Frontiers: Innovations in Photovoltaics, Fuel Cells, Energy Storage and Beyond - PART II
Chair: Ilaria Citro, *IPCF - National Research Council, Italy*

14:50 **Metal Oxide Contacts for Enhancing Performance of Silicon Heterojunction Solar Cells**
Salvatore La Manna and Giorgia Franzò (IMM - CNR, Italy); Antonio Terrasi (Università di Catania); Salvatore Lombardo (CNR-IMM, Italy); Giuseppe Bengasi and Marina Foti (3SUN s.r.l., Italy); Silvia Scalese and Maria Miritello (IMM - CNR, Italy)

15:05 **Vanadium Redox Flow Batteries: Sustainable Energy Storage Solutions for a Green Future**
Hafsa Anwar (University of Messina, Italy & CNR-IMM, CNR-ISMN, Italy); Roberta Farina (CNR-IMM & UniCT, Italy); Sebania Libertino (CNR, Italy); Giuseppe E Capuano (National Research Council, IMM, Italy); Maria Rosaria Plutino (National Council of Research, Italy); Maurizio Sacco (ARGO, Italy); Fabio Matera (National Research Council, IMM, Italy)

15:20 **Development and Durability Assessment of Salt Hydrate-Impregnated Silica Gel for Thermochemical Energy Storage**
Emanuela Mastronardo and Davide Palamara (University of Messina, Italy); Antonio Fotia, VIncenza Brancato, Andrea Frazzica (CNR-ITAE, Italy); Candida Milone and Luigi Calabrese (University of Messina, Italy)

15:35 - 16:00 **Room:** *Sala Affreschi*
COFFEE BREAK - POSTER SESSION #1

This session is dedicated to the presentation of the posters scheduled in the morning Poster Session #1.

16:00 - 17:00 **Room:** *Sala Lipari*
Session 4 - Advances in Intelligent Measurement Systems for Smart Grids: Enabling Accuracy, Efficiency, and Resilience
Chairs: Simone Mari, *University of L'Aquila, Italy*
Andrea Fioravanti, *University of L'Aquila, Italy*

16:00 **An Event-Based Approach for Non-Intrusive Load Monitoring in Industrial Power Systems**
Simone Mari, Andrea Credo, Andrea Fioravanti and Edoardo Fiorucci (University of L'Aquila, Italy); Álvaro Hernández Alonso and Daniel Pizarro Pérez (University of Alcala, Spain)

16:15 **Investigation of Time-Domain Current Signatures for Series Arc Faults Detection in DC Systems**

Giovanni Artale, Antonio Cataliotti, Valentina Cosentino (University of Palermo, Italy); Dario Di Cara (National Research Council, Italy); Antonio Di Stefano (Prysmian Electronics, Italy); Vito Ditta (National Research Council - Institute of Marine Engineering, Italy); Nicola Panzavecchia (National Research Council, Italy); Giovanni Tinè (National Research Council - Institute of Marine Engineering, Italy); Aurelio Zinno (University of Palermo, Italy)

16:30 **Measurements and Integrated Strategies for Energy Efficiency in Hospitality Facilities**

Andrea Fioravanti, Simone Mari, Edoardo Fiorucci, Andrea Silvestri, Federico Centi, Haseeb Shams (University of L'Aquila, Italy)

16:45 **Feasibility of Compressive Sensing Application for Supraharmonics Emissions Assessment in Power Systems**

Giovanni Artale, Kharthik Kumar Reddy Bushireddy, Antonio Cataliotti and Valentina Cosentino (University of Palermo, Italy); Dario Di Cara (National Research Council, Italy); Vito Ditta (National Research Council - Institute of Marine Engineering, Italy); Salvatore Guaiana and Nicola Panzavecchia (National Research Council, Italy); Giovanni Tinè (National Research Council - Institute of Marine Engineering, Italy)

19:30	*Giardino Bar Olympus* **WELCOME PARTY**

Technical Program - Thursday, September 25

09:00 - 16:00	**Room:** *Sala Affreschi* **REGISTRATIONS**

09:00 - 10:15	**Room:** *Sala Lipari* **Session 5 - Green Materials and Smart Sensing: Innovations for Circular Economy and Precision Agriculture** **Chairs:** Maria Giulia Faga, *National Research Council, Italy* Slavica Matić, *University of Palermo, Italy*

09:00 **Near-Infrared (NIR) Spectroscopy Detects Early Tomato Brown Rugose Fruit Virus (ToBRFV) Infection in Tomato**
Graziella Agrò (University of Palermo, Italy); Giorgio Masoero (Accademia di Agricoltura di Torino, Italy); Marta Maria Barone, Salvatore Davino and Slavica Matić (University of Palermo, Italy)

09:15 **Early Detection of Powdery Mildews by Electrical Signaling in Two Plant Hosts**
Slavica Matić (University of Palermo, Italy); Pier Paolo Capra (Istituto Nazionale di Ricerca Metrologica, Italy); Giorgio Masoero (Accademia di Agricoltura di Torino, Italy); Andrea Sosso (INRiM - Istituto Nazionale di Ricerca Metrologica, Italy)

09:30 **Citrate Coated Maghemite Nanoparticles for Sustainable Nano-Fertilization**
Vanna Torrisi (CNR - IMM Catania sede universitaria, Italy); Vincenzina Strano (CNR, National Research Council, Italy); Giuseppe Granata, Libera Vitiello and Sandro Dattilo (CNR-IPCB, Italy); Sabrina C Carroccio (CNR - IPCB Catania, Italy); Patrizia Trifilo and Douaa Bekkai (Università di Messina, Italy); Maria Pilar Miritello (CNR-IMM, Italy)

09:45 **Surface Temperature During Friction Tests: the Influence of Green-Synthesized ZnO Particles as Oil Additive**
Giovanna Gautier di Confiengo (CNR, Italy); Mattia Di Maro (Istituto di Scienze e Tecnologie per l'Energia e la Mobilità Sostenibili, Italy); Pier Paolo Capra (Istituto Nazionale di Ricerca Metrologica, Italy); Maria Giulia Faga (STEMS-CNR, Italy)

10:00 **High-Value Resistance Measurements for Temperature Sensitivity Characterization of PLA Composites with Biochar from Olive Pruning Biomass**
Pier Paolo Capra, Andrea Sosso (INRiM - Istituto Nazionale di Ricerca Metrologica, Italy); Mattia Di Maro and Maria Giulia Faga (STEMS-CNR, Italy); Giuliana Magnacca (University of Torino, Italy); Giulio Malucelli (Politenico di Torino, Italy); Donatella Duraccio (CNR, Italy)

10:15 - 10:40 **Room:** *Sala Affreschi*
COFFEE BREAK - POSTER SESSION #2

P2-1 **Modeling and Experimental Validation of Anisotropic Damping in 3C-SiC Resonators for MEMS Applications**
Annamaria Muoio (IMM-CNR, Italy); Angela Garofalo (Milano - Bicocca University, Italy); Saverio De Luca and Francesco La Via (CNR-IMM, Italy)

P2-2 **Development and Optimization of a Miniaturizable System for ATP Detection in Water Samples**
Giuseppe E Capuano (National Research Council, Institute for Microelectronics and Microsystems, Italy); Giuseppe A. Screpis (University of Messina & CNR-IMM Catania & CNR-ISMN Messina, Italy); Domenico Corso (University of Pavia & CNR-IMM, Italy); Fabio Matera (CNR & Istitute of Microlectronics and Microsystems, Italy); Roberta Farina (CNR-IMM & UniCT, Italy); Serena C. R. Reina and Maria Anna Coniglio (University of Catania, Italy); Sebania Libertino (CNR, Italy)

P2-3 **Labelling of Escherichia Coli Using a Porphyrin/CAPTISOL Complex**
Serena C. R. Reina (University of Catania, Italy); Roberta Farina (CNR-IMM & UniCT, Italy); Giuseppe A. Screpis (University of Messina & CNR-IMM Catania & CNR-ISMN Messina, Italy); Giuseppe E Capuano (National Research Council, Institute for Microelectronics and Microsystems, Italy); Domenico Corso (University of Pavia & CNR-IMM, Italy); Maria Antonietta Buccheri (CNR-IMM, Italy & University of Catania, Italy); Nina Burduja and Antonino Mazzaglia (CNR-ISMN & University of Messina, Italy); Sebania Libertino (CNR, Italy); Maria Anna Coniglio (University of Catania, Italy)

P2-4 **Easy Non-Covalent Functionalization of PLA Film with Porphyrin for Heavy Metals Optical Sensing in Water: a Preliminary Study**
Ivana Di Bari (CNR-IMM, Italy); Cristiana Longo (Consiglio Nazionale delle Ricerche -, Italy); Giusy Curcuruto and Emanuela T.A. Spina (Consiglio Nazionale delle Ricerche (CNR), Italy); Grazia M. L. Messina (Università degli Studi di Catania, Italy); Sabrina C Carroccio (CNR - IPCB Catania, Italy); Giuseppe A.M. D'Arrigo and Antonella Sciuto (Consiglio Nazionale delle Ricerche, Italy)

P2-5 **Mobile Network Penetration in Italy: a Preliminary Space and Time Analysis**
Nicola Pasquino and Nunzia Solmonte (University of Naples Federico II, Italy); Daniele Franci and Giuseppe Marsico (ISPRA, Italy)

P2-6 **Evaluation of RF-EMF Exposure in 5G FR1 Band Using IEC 62232 Assessment Methodologies**
Darko Suka (University of East Sarajevo, Bosnia and Herzegovina); Nunzia Solmonte (University of Naples Federico II, Italy); Manfred Ruttner (A1 Telekom Austria, Austria); Nicola Pasquino (University of Naples Federico II, Italy); Nikola Djuric (University of Novi Sad, Serbia)

P2-7 **Assessment of 3D Scanners for Dimensional Verification of Boat Molds**
Emmanuele Barberi, Elnaeem Abdalla Babiker Abdalla, Filippo Cucinotta and Fabrizio Freni (University of Messina, Italy); Simone Panfiglio (NAVTEC, Italy); Fabio Salmeri and Guido Di Bella (University of Messina, Italy)

P2-8 **Application of Digital Image Correlation for Solid Oxide Cells Deformation Measurement**
Linda Barelli (University of Perugia, Italy); Alberto Brodi (ZEISS Group, Italy); Roberto Marsili, Federico Paolucci, Dario Pelosi and Gianluca Rossi (University of Perugia, Italy); Giulio Tribbiani (University of Padova, Italy); Lorenzo Trombetti and Tiberio Truffarelli (University of Perugia, Italy)

P2-9 **CO2 Gas Sensing of Al-Doped ZnO Nanostructures**
Yassine Alaya (University of Messina, Italy); Viviana Bressi (University of Mediterranea of Reggio Calabria, Italy); Claudia Espro and Giovanni Neri (University of Messina, Italy); Irene Cappelli, Enza Panzardi and Ada Fort (University of Siena, Italy)

P2-10 **An Efficient Hydrogen Sensor Device Based on TiO2 Homojunctions**
Yassine Alaya and Claudia Espro (University of Messina, Italy); Noureddine Bouguila and L. El Mir (Gabes University, Tunisia); Antonio Cannuli and Giovanni Neri (University of Messina, Italy)

10:40 - 11:20 **Room:** *Sala Lipari*
KEYNOTE LECTURE
Chairs: Nicola Donato, *University of Messina, Italy*
Donatella Spadaro, *IPCF - National Research Council, Italy*

Machine Learning: Enabler of Sustainable Technologies or Potential Burden on Sustainability?

Donatella Puglisi, *Linköping University, Sweden*

11:20 - 12:35 **Room:** *Sala Lipari*
Session 6 - The Synergic Use of Sensors and Analytical Techniques, Artificial Intelligence and Chemometrics for Safeguarding Indoor and Outdoor Environments in the Field of Cultural Heritage
Chair: Alessio Carullo, *Politecnico di Torino, Italy*

11:20 **Predicting Lithium-Ion Battery Degradation Modes Using a Machine Learning Approach Based on EIS Measurements**
Filippo Battaglia (University of Messina, Italy); Salvatore Gianluca Leonardi and Giovanni Lucà Trombetta (National Research Council of Italy, Italy); Davide Aloisio (National Council of Research, ITAE, Italy); Gioacchino Musicò (National Research Council of Italy, Italy); Giovanni Brunaccini (National Council of Research, ITAE, Italy);

Giovanni Gugliandolo (University of Messina, Italy); Francesco Sergi (National Research Council of Italy, Italy); Nicola Donato and Giuseppe Campobello (University of Messina, Italy)

11:35 **Wireless Sensor Network Design for Cultural Heritage Monitoring**
Marco Sento, Davide Sgrò and Christian Dellisanti (Politecnico di Torino, Italy); Anna Laura Tassi (Università Degli Studi di Milano, Italy); Laura Santagostini (University of Milan, Italy); Alberto Vallan (Politecnico di Torino, Italy)

11:50 **Evaluation of the Stability of Biocidal Molecules Adsorbed on Mesoporous MCM-41 for Use in Air Purification Systems**
Anna Laura Tassi, Alessia Santiglia, Vittoria Guglielmi, Laura Santagostini (University of Milan, Italy)

12:05 **AI-Assisted Quantification of Hydroxyapatite in Treated Archaeological Samples**
Alessia Santiglia, Anna Laura Tassi, Laura Santagostini, (University of Milan, Italy); Martina Sciortino, Annaluisa Pedrotti, Diego Angelucci, Maurizio Zambaldi, Fabio Santaniello and Stefano Grimaldi (University of Trento, Italy); Alessio Carullo, Simone Corbellini and Luca Lombardo (Politecnico di Torino, Italy); Vittoria Guglielmi (Università Degli Studi di Milano, Italy)

12:20 **Towards Sustainable Air Purification: AI-Assisted Quantification of Essential Oils on Mesoporous Silica**
Anna Laura Tassi and Alessia Santiglia (University of Milan, Italy); Marco Sento (Politecnico di Torino, Italy); Laura Santagostini (University of Milan, Italy); Luca Lombardo and Davide Sgrò (Politecnico di Torino, Italy)

12:35 - 13:40	*Ristorante Oasys* **LUNCH**

13:40 - 14:55	**Room:** *Sala Lipari* **Session 7 - Green sensing systems based on bio-polymers** **Chairs:** Salvatore Graziani, *University of Catania, Italy* Francesca Sapuppo, *University of Messina, Italy*

13:40 **Printed Fractal Inductors on Flexible Substrates for Wearable and Green Electronics**
Mattia Scagliotti, Francesca Pescosolido, Matteo Rapisarda, Luigi Mariucci and Antonio Valletta (CNR-IMM, Italy)

13:55 **A Two-Dimensional First-Principle Model for Bacterial Cellulose Sensors: a Single-Ion Foundation for Mechanoelectric Modeling**
Francesca Sapuppo, Luca Patanè and Maria Gabriella Xibilia (University of Messina, Italy)

14:10 **Enhancing the Surface Properties of Bacterial Cellulose for Sustainable Electronic Applications**
Francesca Pescosolido, Mattia Scagliotti, Matteo Rapisarda, Luigi Mariucci and Antonio Valletta (CNR-IMM, Italy)

14:25 **Investigating the Role of Length in Bio Polymer Derived Active Deformation Sensors**
Giovanna Di Pasquale, Salvatore Graziani, Sara Sadat Hosseini and Antonino Pollicino (University of Catania, Italy); Francesca Sapuppo (University of Messina, Italy); Carlo Trigona (University of Catania, Italy)

14:40 **Toward Eco-Friendly and Tunable Flexible Sensors: Effects of Ionic Liquid Structure on BC/PEDOT Composites as Mechanoelectrical Transducers**
Giovanna Di Pasquale, Salvatore Graziani, Sara Sadat Hosseini, Alberta Latteri, Antonino Pollicino and Carlo Trigona (University of Catania, Italy)

15:00 - 15:45 **Room:** *Sala Lipari*
Session 8 - Innovative IoT Solutions for Environmental Sensing, Sustainable Mobility, and Green Infrastructures
Chairs: Enza Panzardi, *University of Siena, Italy*
Irene Cappelli, *University of Siena, Italy*

15:00 **Low-Power Chemoresistive CO_2 Sensing: an IoT-Oriented Alternative to Conventional IR Sensors**
Irene Cappelli, Enza Panzardi and Ada Fort (University of Siena, Italy)

15:15 **Chemical-Aware Autoencoders for Eco-Selective Adsorption of Wastewater Contaminants**
Alessia Lucia Prete (University of Siena, Italy); Duccio Meconcelli and Filippo Costanti (University of Florence, Italy); Sara Bacconi and Emanuele Giordano (University of Siena, Italy); Luca Stefanuto and Tecla Gasperi (Roma Tre University, Italy); Monica Bianchini and Franco Scarselli (University of Siena, Italy)

15:30 **A Scalable LoRaWAN-Based Environmental Sensing System for Cultural Heritage Sites**
Filippo Battaglia, Giovanni Gugliandolo, Giuseppe Campobello and Nicola Donato (University of Messina, Italy)

16:00 - 16:20 **Room:** *Sala Affreschi*
COFFEE BREAK - POSTER SESSION #2

This session is dedicated to the presentation of the posters scheduled in the morning Poster Session #2.

16:20 - 17:20	**Room:** *Sala Lipari* **Session 9 - Innovative materials and sensing platforms for environmental monitoring and pollutants detection - PART I** **Chairs:** Silvia Scalese, *National Research Council, Italy* Simona Filice, *National Research Council, Italy*

16:20 **Sustainable Ethyl Cellulose-Based Raman Sensors Incorporating Ag-Coated MgFe Hydrotalcites Nanoplatelets for Cypermethrin Detection**
Elena Palmieri, Luca Maiolo, Luca Montaina and Ivano Lucarini (CNR-IMM, Italy); Tamara Posati (Istituto per la Sintesi Organica e la Fotoreattività, Italy); Valentina Mussi (CNR-IMM, Italy); Fabio Leccese ("Roma Tre" University, Italy); Francesco Maita (CNR-IMM, Italy)

16:35 **Real-Time Detection of Mercury in Water with a Bacterial Bioluminescent Silicon Photomultiplier System**
Domenico Corso (University of Pavia & CNR-IMM, Italy); Giuseppe A. Screpis (University of Messina & CNR-IMM Catania & CNR-ISMN Messina, Italy); Giuseppe E Capuano (National Research Council, Institute for Microelectronics and Microsystems, Italy); Roberta Farina (CNR-IMM & UniCT, Italy); Serena C. R. Reina, Salvatore Pennisi and Maria Anna Coniglio (University of Catania, Italy); Sebania Libertino (CNR, Italy)

16:50 **A Novel Electrochemical Strategy for the Detection of Ciprofloxacin Using an Halloysite Nano-Clay Based Sensor**
Viviana Scuderi and Simona Filice (CNR, Italy); Lucia Li Donni (Sapienza University, Italy); Michal Stor and Andrzej Krasiński (Warsaw University of Technology, Poland); Silvia Scalese (CNR-IMM, Italy)

17:05 **Screen-Printed Electrochemical Sensor Platform for Nitrate and Nitrite Detection in Water**
Roberta Farina (CNR-IMM & UniCT, Italy); Domenico Corso (University of Pavia & CNR-IMM, Italy); Giuseppe A. Screpis (University of Messina & CNR-IMM Catania & CNR-ISMN Messina, Italy); Maria Anna Coniglio (University of Catania, Italy); Giuseppe E Capuano (National Research Council, Institute for Microelectronics and Microsystems, Italy); Serena C. R. Reina (University of Catania, Italy); Sebania Libertino (CNR, Italy)

20:30	*Stella di Mare Restaurant* **GALA DINNER**

Technical Program - Friday, September 26

09:00 - 12:00 **Room:** *Sala Affreschi*
REGISTRATIONS

09:00 - 10:15 **Room:** *Sala Lipari*
Session 10 - Additive Manufacturing for Green Electronics: Processes, Metrology, and Sustainability
Chair: Guido Di Bella, *University of Messina, Italy*

09:00 **Humid Dry Climatic Chamber for Outdoor Durability Assessment of PLA and PLA-Flax Fiber Composite Sandwich Structures**
Giuseppe Scionti, Davide Palamara, Guido Di Bella and Mohamed Chairi (University of Messina, Italy); Antonino Valenza (University of Palermo, Italy); Luigi Calabrese (University of Messina, Italy)

09:15 **Reverse Engineering and Additive Manufacturing Metrological Evaluation for Sustainable Digitalization in Shipyard Environments**
Guido Di Bella, Simone Panfiglio, Elnaeem Abdalla Babiker Abdalla, Fabrizio Freni, Antonio Cannuli and Roberto Montanini (University of Messina, Italy)

09:30 **Dielectric and Conductive 3D-Printed Materials: Microwave Characterization**
Alessandro Magalotti, Bruno Tamagnini, Kostiantyn Torokhtii, Nicola Pompeo, Enrico Silva and Andrea Alimenti (Roma Tre University, Italy)

09:45 **Advanced Techniques for Accurate Crack Length Monitoring in Bi-Material Adhesively Bonded Joints**
Rosemere de Araujo ALves Lima (IDMEC, Instituto Superior Técnico, Universidade de Lisboa, Portugal); Michele Gulino (University of Parma, Italy); Sofia Teixeira De Freitas (IDMEC, Instituto Superior Técnico, Universidade de Lisboa, Portugal)

10:00 **IR Thermography as a Tool for Quality Control and Safety in PEM Fuel Cells**
Martina Totaro (University of Messina & CNR-ITAE, Italy); Dario Francesco Santonocito and Giacomo Risitano (University of Messina, Italy); Orazio Barbera and Giosuè Giacoppo (CNR-ITAE National Research Council - Institute for Advanced Energy Technologies, Italy)

10:15 - 10:40 **Room:** *Sala Affreschi*
COFFEE BREAK

10:40 - 11:40 **Room:** *Sala Lipari*
Session 11 - Innovative materials and sensing platforms for environmental monitoring and pollutants detection - PART II
Chairs: Silvia Scalese, *National Research Council, Italy*
Simona Filice, *National Research Council, Italy*

10:40 **Sprayed Graphene for Wearable Textile-Based Triboelectric Nanogenerators and Biomechanical Sensors**
Hongyang Dang (University of Catania, Italy & IMM-CNR, Italy); Benji Fenech-Salerno (Imperial College London, United Kingdom); Antonio Leonardi (University of Catania, Italy); Federico La Barbera and Felice Torrisi (University of Catania & IMM-CNR, Italy)

10:55 **Development of a New System for Bacterial Load Detection in Water Samples Exploiting ATP Chemiluminescence Reaction**
Giuseppe A. Screpis (University of Messina & CNR-IMM Catania & CNR-ISMN Messina, Italy); Giuseppe E Capuano (National Research Council, Institute for Microelectronics and Microsystems, Italy); Domenico Corso (University of Pavia & CNR-IMM, Italy); Roberta Farina (CNR-IMM & UniCT, Italy); Serena C. R. Reina (University of Catania, Italy); Fabio Matera (CNR - Istitute of Microlectronics and Microsystems, Italy); Maria Anna Coniglio (University of Catania, Italy); Maria Rosaria Plutino (National Council of Research, Italy); Beatrice Fermi (Sanipur S.p.A, Italy); Sebania Libertino (CNR, Italy)

11:10 **Computational Methodologies for the Design and Investigation of Graphene Oxide-Based Sensors**
Damiano Ricciarelli (CNR-IMM, Italy); Simona Filice and Viviana Scuderi (CNR, Italy); Gaetano Calogero, Giuseppe Fisicaro, Ioannis Deretzis, Ignazio Vacante, Simona Crispi, Rosario Gaetano Viglione, Silvia Scalese and Antonino La Magna (CNR-IMM, Italy)

11:25 **Investigating Hydrodynamic Influences on Coastal Litter Distribution Using UAS Surveys**
Imen Chebbi and Mariachiara Donato (University of Messina, Italy); Stefania Lanza (Geologis srl, Italy); Giovanni Randazzo, Carla Faraci and Claudio Iuppa (University of Messina, Italy)

11:40 - 12:40 **Room:** *Sala Lipari*
Session 12 - Advances in Mechanical and Thermal Measurements for Green Innovation
Chairs: Roberto Montanini, *University of Messina, Italy*
Gianluca Rossi, *University of Perugia, Italy*

11:40 **Metrological Characterization of Low-Cost Sensors for Real-Time Environmental Monitoring Systems in Mobile Applications**
Antonio Cannuli, Fabrizio Freni, Antonino Quattrocchi, Giovanni Briguglio, Sarah Ben Haj Fraj and Roberto Montanini (University of Messina, Italy)

11:55 **Stress Distributions Measurements in Wooden Structural Elements Using Thermoelastic Stress Analysis**
Lorenzo Capponi (University of Ljubljana, Slovenia); Giulio Tribbiani (University of Padova, Italy); Gianluca Rossi (University of Perugia, Italy); Fabrizio Freni, Antonino Quattrocchi, Antonio Cannuli, Mario Valenti and Roberto Montanini (University of Messina, Italy)

12:10 **Integrated Spectral and Geospatial Analysis of Mechanical Vibrations in a Light Urban Vehicle for Piezoelectric Energy Harvesting Optimization**
Antonino Quattrocchi, Andrea Venuto, Fabrizio Freni, Antonio Cannuli and Roberto Montanini (University of Messina, Italy)

12:25 **Experimental Characterization of a Novel Wave Energy Converter: Preliminary Results from Laboratory Testing**
Gabriele Bocchetta, Giorgia Fiori, Marta Cecchitelli, Fabio Leccese, Nicola Pio Belfiore, Andrea Scorza and Salvatore Andrea Sciuto (Roma Tre University, Italy)

13:00 - 14:00	*Ristorante Oasys* **LUNCH**

14:00 - 14:20	**Room:** *Sala Lipari* **CLOSING AND AWARD CEREMONY**