CALL FOR PAPERS
Abstract Deadline • October 15, 2017
Perugia - Italy • June 4-14/2018

14th
International
Ceramics
Congress
June 4-8/2018

8th
Forum
on
New Materials
June 10-14/2018
CIMTEC 2018 - 14th International Conference on Modern Materials and Technologies - will be held in Perugia, Italy, June 4 to 14, 2018. CIMTEC 2018 will consist of the 14th International Ceramics Congress (June 4-8) and of the 8th Forum on New Materials (June 10-14), each of them including a number of Symposia, Special Sessions, and Conferences. As a major longstanding event for the international materials community, CIMTEC will again gather together a large and qualified audience of materials scientists, physicists, chemists and engineers and of experts of a wide range of the most demanding application areas of modern materials, from the molecular and nanoscales to large complex integrated systems.

The National Research Council of Italy (CNR), the Italian National Agency for New Technology, Energy and the Environment (ENEA) will act as major endorsers of CIMTEC 2018 together with the World Academy of Ceramics (WAC), The International Ceramic Federation (ICF) and the International Union of the Materials Research Societies (IUMRS).

The Chair, Co-Chairs and CIMTEC 2018 Committees invite you to foster the progress in the field by contributing with your expertise to what promises to be a very comprehensive and exciting meeting, and to enjoy the immense unique artistic heritage and wonderful landscape of Umbria district.

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Symposium CA
Progress in Powder Processing Science and Manufacturing for Advanced Ceramics and Composites

The classical route based on powder synthesis, processing and sintering keeps up its relevant role in the mass production of advanced ceramics. This despite the increasing palette of available emerging processing methods.

R&D in this area is especially focused on innovative synthesis of high performing (e.g. nano) powders and their processing with highly reliable, predictable, cheaper and clean production cycles.

Of interest to this symposium, that follows the ones on the same subject of previous CIMTEC Conferences, are oxide and non oxide dense or porous bulk materials and particulate composites that find extensive use in an expanding range of room and high temperature civilian, industrial and defense applications.

Novel techniques and rational improvements of the conventional methods for powder synthesis; refined meso- and nano-scale characterisation of ultra fine powders coupled with an accurate control of surface chemistry and inter particle forces in colloidal processing; advances in forming techniques and green body characterisation and processing; state-of-the-art sintering theory and practice to approach a rational design of micro and nano structure for desired performance in the final products are main topics for this symposium. In all focus areas of interest to this symposium, developments in both experimental and theory and simulations will be the topics of discussion. Innovations in manufacturing allowing a more rational use of raw materials and less labour and energy may also be discussed.

Session Topics

CA-1 Advances in powder synthesis and characterisation
Powder Synthesis
Solid state techniques
Solution processes (coprecipitation, polymer complex method, Pechini method, etc.)

CA-2 Colloidal processing
Surface chemistry
Surfactants, dispersants, complex agents
Control of interparticle forces
Suspension rheology
Slurry technology
Novel additive systems
Agglomerate softening/removal

CA-3 Shape forming and green body processing and characterisation
Surface chemistry in ceramic forming
Role of and new processing aids
Improved mixing/granulation procedures
Conventional and microwave drying
Advances in shape forming (pressing, moulding, injection moulding, slip/tape casting, plastic forming,...)
Emerging forming methods (freeze casting, gel casting, additive free forming,...)
Forming of large/complex shape components
Green body characterisation and processing
Debinding processes
Computer-aided processing
Modelling and simulation of forming and consolidation

CA-4 Sintering
Free sintering (solid state, liquid phase, transient-liquid sintering, reactive sintering)
Constrained sintering
Pressure-assisted synthesis (HP, HIP, gas pressure synthesis)
Atmosphere-controlled sintering
Grain growth and micro/nanostructure evolution and control
Refined interfaces characterisation
High fidelity characterization of the sintered microstructures
Control of porosity during sintering

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Simulation of sintering and interface dynamics  
Effects of sintering additives  
Nano/micro structure control by powder processing  
Structural and functional properties characterization and property/structure relationships  

CA-5 Innovation in fabrication and technology  
Novel powder processing approaches for energy efficiency and environmental compatibility  
Recent trends in powder based ceramic manufacturing processes  
Challenges in lab to factory transitions for ceramics  
Case studies of industrial practice from powder synthesis to final product

Session Topics

CB-1 Solution-based processing  
Solution-based processing of functional nanostructures:  
nanoparticles, fibres, thin film devices, coatings, membranes,  
bulk porous and mesoporous materials, aerogels  
nanocomposite and hybrid structures  
Functional characterisation in view of application:  
mechanical, electronic, dielectric, magnetic, optical,  
chemical, electrochemical, biomedical  

CB-2 Polymer derived ceramics  
Design and synthesis of novel preceramic polymers  
Conversion mechanisms to oxide and non-oxide ceramics  
In situ formation  
Advanced and innovative fabrication techniques for precursor-derived monoliths, fibers, metal-ceramics and ceramic-ceramic composites, hybrid materials, coatings, membranes, foams  
Nanostructure characterisation  
Structural and functional properties  
Modelling of materials, processes and functions  
Engineering and industrial applications  

CB-3 Microwave processing  
Advances in the understanding of microwave-materials interaction  
Dielectric properties measurement  
Temperature control during microwave processing, non-contact temperature sensing systems  
Microwave assisted synthesis, deposition processes, melting, joining, surface sealing  
Microwave sintering of oxide and non-oxide ceramics, and composites  
New theories, and modelling of materials and processes  
Structural and functional characterisation of materials  
Advances in production techniques (hybrid heating, sintering in inert atmosphere...)  
Scale-up of microwave processing and application  

Symposium CB  
Non Conventional and Emerging Routes to Advanced Ceramics

This symposium will cover recent progress and emerging novel approaches in a number of non conventional or novel processing techniques capable of embodying ceramic materials with unique properties not possible or difficult to be achieved with conventional methods and/or provide simplified and/or environmentally benign and energy saving “green” processing routes. Covered will be dense or porous materials, functional nanoparticles and hierarchical nanostructures, fibres, thin and thick films, and laminated, composite, graded and hybrid structures. Mechanisms and kinetics of processes, new directions and challenges for the design at atomic/molecular scale of complex high performing, micro-, meso- and macro-structures with optimized properties for a range of ongoing and potential applications will be enlightened as well as advances on the state-of-the-art computation applied to the design of materials and processing, and novel characterization and imaging tools.  
Sessions will encompass solution based processing routes, non conventional and novel forming and sintering techniques with particular emphasis on electric field- and pressure-assisted techniques and microwave processing, latest advances in polymer derived ceramics and in layered, functionally graded materials and hybrid structures. A session will offer place to contributions highlighting general issues related to energy, environmental and material saving aspects for sustainability. Finally, three Focused Sessions on “Bio-inspired and Bio-enabled Processing”, “Additive Manufacturing” and “SHS Ceramics” will substantiate the Symposium programme.  

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CB-4 Electrical field and pressure assisted synthesis and sintering
- Fundamental mechanisms and control of SPS and FS
- Modeling and simulation of electrical field and flash activated densification
- Consolidation phenomena, phase constitution
- Property evaluation
- SPS hybrid techniques

CB-5 Functionally Graded Materials
- Design criteria synthesis and processing of FGM bulk materials, composites and hybrids
- Functionally graded thin films and coatings
- Characterization, structure and functionality
- GMs for (and in) mechanical and thermomechanical applications
- FGMs for (and in) functional and multifunctional applications
- Modeling and simulation of materials and processes

CB-6 Other non traditional or novel routes
- Cold sintering
- Electrophoretic forming
- Ultra-high Pressure Materials Synthesis
- Shock materials synthesis and compaction
- Microgravitational Processing
- Directional Solidification from Eutectics
- Fluxes synthesis
- Controlled crystallization of Undercooled Glasses
- Others

CB-7 General Issues on Green and Sustainable Manufacturing of Advanced Ceramics
- Energetic and environmental aspects of green ceramic processing
- Rare and strategic materials substitution, conservation, recovery and recycling
- Life-cycle assessment for sustainability

Focused Session CB-8
Bio-inspired and Bio-enabled Processing
Complex multifunctional nano structured materials with peculiar and specially designed electrical, magnetic, electro chemical, bioresponsive and structural properties resulting from bio inspired processing routes are stimulating growing research as they involve such diverse areas as molecular recognition and self assembly, self healing, hierarchical patterning, biotemplating and microorganisms-mediated materials synthesis.
Covered by this Session, that follows the ones on the same topics held in previous CIMTEC Conferences, will be topics ranging from the biomolecular- directed growth and microstructure pattern formation of ceramic meso/nanostructures in bulk and thick/thin film, organic-ceramic composites and hybrids, ceramic-metal heterostructures to their embodying with special functionalities for a number of potential applications in, e.g., high performance light-weight structures, efficient biosensing materials and catalysts, improved biomedical materials with stimuli-adaptive, self-assembly and self-repairing properties and in electronic, optical and photonic devices.

Session Topics
- CB-8.1 Self-assembly, mineralization and hierarchical organization; hybrid structures
- CB-8.2 Structure and mechanics of bioinspired materials
- CB-8.3 Bioinspired functional surfaces
- CB-8.4 Bioinspired materials (e.g. self healing, adaptive, stimuli-responsive)
- CB-8.5 Bioinspired cellular materials and lightweight structures
- CB-8.6 Bioinspired materials for biomedical applications
- CB-8.7 Modeling and simulation of processes and structures
- CB-8.8 Application and performance of bioinspired materials

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Focused Session CB-9
Additive Manufacturing
Additive manufacturing (AD) includes a very different range of green and cheap fabrication techniques in which a solid physical model of the part is made directly from a 3-D Computer-Aided Design (CAD) file so offering a new freedom to shape complex parts without the constraints imposed by forming, machining, or joining. Depending on the specific AD technique, (multi)layered ceramics, membrane-like ceramic structures, complex shaped bulk dense or porous ceramics may be fabricated by versatile, client customizable, cost effective techniques, (multi)layered ceramics, membrane-like ceramic structures, complex shaped bulk dense or porous ceramics may be fabricated by versatile, client customizable, cost effective and environmentally conscious procedures.
This Focused Session, which follows the ones on a similar subjects held in previous CIMTEC Conferences, will address recent achievements e perspectives in AD technologies, applicability, advantages and shortcoming of each particular technique and manufacturing issues, properties and reliability of products and components.

Session Topics
- CB-9.1 Selective Laser Sintering
- CB-9.2 Laminated Object Manufacturing
- CB-9.3 Fused Deposition Modelling
- CB-9.4 Stereolithography
- CB-9.5 Direct writing
- CB-9.6 Powder bed fusion
- CB-9.7 Other/emerging AD routes

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Special Session CB-10

SHS Ceramics

The remarkable improvements in the SHS process underwent within the last several years have expanded substantially the field of application of SHS as an effective, simple, low-cost method for the production of various industrially useful ceramics. A variety of high performing nanopowders and (multi)layered nanostructures of nitrides, carbides, cermets and complex mixed oxides is today being produced and exploited in such diverse fields as metal working, biomedical implants, solid state lighting, catalytic systems as well as in advanced functional devices. Aim of this Focused Session, following those on the same subject held in previous CIMTEC Conferences, is to overview recent achievements in the theory and modelling of the self-combustion process, in the design, processing and applications of SHS ceramic-based material and enlighten perspectives for a more effective penetration of the SHS technology in the industry.

Session Topics

CB-10.1 Theory and modeling of SHS processes and structural transformations

CB-10.2 SHS of powders from the micro- to nano-scale. Consolidation of the SHS-powders (sintering, HP, SPS, HIP, etc.)

CB-10.3 SHS of bulk materials (functional and structural ceramics, composites, metal/ceramic composites, foams...)

CB-10.4 Solution combustion synthesis of ceramic nanopowders and materials

CB-10.5 Application and industrialization

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Symposium CC
Ceramics and Composites for Enhanced Tribologic and Corrosion Performance in High-demanding Applications

Several developments in materials science have expanded the quest for corrosion and wear resistance of ceramics. Examples are the advance of biomaterials and biomimetics, which necessitate finely engineered surface and volume structures, causing new problems for their reliability due to contact mechanics and/or chemical attacks already in mild wear conditions. Likewise, the higher performance capabilities of new material classes such as hybrid composites from organic and ceramic materials shifts the application limits to be defined by tribologic and corrosion resistance. Environmental barrier coatings have become an important subject for corrosion and wear studies. Revisions of old concepts bring new life to the development of applications for cement-based materials with according demands for the characterization under wear and adverse environmental conditions. New lightweight structures from 3D generative manufacturing and other porous, structured and multiphase materials bring new challenges for the modelling of materials under chemical and mechanical loading.

This symposium, that follows the ones on the same subject of previous CIMTEC Conferences, will update progress in fundamental aspects and mechanistic understanding at micro- and nano-scale of the corrosion, friction and wear behaviour in a variety of high demanding conditions. It shall also outline basic criteria and technical achievements in devising routes for improved corrosion and tribologic resistance.

Materials covered include: i) oxide and non-oxide ceramics in form of thin films, coatings, composites and bulk material; ii) hybrid materials: metal-ceramic and polymer-ceramic based composites and nanocomposites; iii) fullerenes, graphene, diamond, DLCs and other carbon-based materials.

Furthermore, we seek for contributions which demonstrate state-of-the-art and improvements in the modelling and simulation of corrosion and wear across the different orders of time and length scales and covering structural and microstructural studies linked to property changes.

Session Topics

CC-1 Friction and wear
- Fundamentals of friction, contact mechanics, wear, adhesion, and lubrication
- Coatings, surface engineering and nanostructuring
- Self-lubricating surfaces, solid lubricants
- Friction and wear at micro/nanoscale
- Theoretical studies and computer simulations
- Testing and characterization
- Tribology related applications

CC-2 Corrosion
- Basics of corrosion processes: thermodynamics and mechanisms
- Measuring corrosion: testing methods and evaluation strategies
- Simulating corrosion: kinetic laws, analytical and numerical description
- Corrosion of porous materials and powders
- Corrosion by fluids: gases, water, solutions, hydro/solvothermal conditions, physiological fluids
- Melt corrosion: hot corrosion, natural and artificial slags and metal melts
- Relations between erosion, wear and corrosion
- Corrosion damage: mechanical and physical property changes and lifetime prediction
- Corrosion protection: Surface structuring, barrier coatings and their interaction

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CIMTEC 2006, Acireale, Sicily. Carlo Montemagno, UCLA, USA, delivers his Keynote Lecture on “Molecular Engineering Biomimetic Materials and Systems”. 
Symposium CD
Joining of Inorganic Materials: From Macro- to Nano-length Scales

The demand for joints of ceramics, glasses and their composites is still growing. New applications ranging from nano- and micro-mechanical systems to space components are continually being innovated. They require specialised joining solutions that enable the utilisation of the materials’ unique properties to meet complex end-product requirements. Challenges arise when components of differing materials with often incompatible behaviour must be joined. The understanding across length scales and research disciplines is thus crucial for the development of, reliable, fast and energy-efficient routes for inorganic materials integration in nano-, micro- and macro-scale devices and systems. The nano-scaled surfaces and interfaces of the materials need to be understood well and functionalized, as their properties ultimately control the reliability of material joints and systems at macroscale.

This symposium, which follows the ones held on similar subjects at previous CIMTEC Conferences, will discuss fundamental and practical issues of the joining of inorganic materials, at different length scales and from both the experimental and theoretical viewpoints concerning: physical-chemistry of surfaces and interfaces; wetting and interfacial reactions; diffusion and compound formation; joining techniques (soldering, brazing, solid state and transient liquid phase diffusion bonding and microwave/laser/electron beam welding, nano-bonding and sintering, femtosecond laser irradiation joining, ultrasonic nano-welding…); joint characterisation and testing; lifetime and reliability predictions of joints, and their in-service performance.

Contributions to every aspect of materials joining, from nano-materials science, theory of interfaces to practical issues of joining techniques are welcome. Specific matters on which the authors are encouraged to submit contributions include: i-Nano-materials science for joining inorganic materials; ii-Modelling of materials joints and processes at different length scales (from atomic scale modelling of interfaces to engineering scale simulations); iii-Experimental and theoretical studies on thermodynamics, diffusion kinetics, wetting and adhesion; iv-Control of the structure and properties of joint surfaces and interfaces; v-(Nano-/ Micro-/Macro-)Joining of ceramics, glasses, composites; vi-Application engineering from micro- to macro-scale.

A special focus will be put onto the development of joining processes by controlling the surface and interface properties at the nano-scale.

Session Topics

CD-1 Nano-scale interface of dissimilar materials
- Interface science for integration of inorganic materials (Nano-)Thermodynamics and kinetics of interface formation
- Mechanisms of wetting and adhesion
- Characterisation and control of interfaces for high quality joints

CD-2 Micro-/nano-joining
- Mechanisms and materials science of micro-/nano-joining
- Nanoscale effects
- Micro-/nano-joining techniques
- Development of nanostructured joining materials

CD-3 Macro-joining
- Advances in joining methods and materials
- Joints of dissimilar materials
- Prediction, measurement and control of residual stresses
- Joint behaviour (strength, thermal and chemical stability, reliability…)
- Joint modelling, design, characterisation and analysis

CD-4 Application engineering
- Joining and integration issues at the macro-, micro- and nanoscales in diverse areas
- Joining of nanostructures and their integration into devices and systems
- Joining techniques for microelectromechanical systems and microelectronic packaging
- Space, automotive, energy, biomedical and other ongoing or forecast applications

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Advances in synthesis and engineering of functional nanomaterials now provide the possibility of fabricating powders and thin films with atomically precise structures and defined phase boundaries. Such interfacial materials can generate electronic systems that nature does not produce in the bulk and can therefore complement existing technological concepts and invent new ones. Functional nanostructures and hetero-structures with hybrid compositions and interfaces offer unique platform for designing materials architectures for device applications. The possibility of creating well-defined interfaces and the opportunity of connecting different materials can generate novel electronic phases and lead to unprecedented phenomena at oxide-oxide junctions, for instance, two dimensional electron gas behavior. Besides the size and surface effects, the modulation of electronic behaviour due to junction properties leads to new synergies and concepts for purpose-driven synthesis of multimaterial architectures. The growing possibilities of engineering nanostructures of various compositions (pure, doped, composites, heterostructures) on different substrates has intensified the research on the integration of different compositions in multi-layers and stacked systems, which warrants an intensive exchange of information among materials developers and device engineers. Moreover, advancement in the controlled synthesis and processing of nanostructured, nanocomposite and hybrid functional materials offers the greatest potential to efficiently contribute to essential goals of environmental sustainability, for instance, by discovering processes that are ecological and will enable both energy and resource efficiencies to offer a circular materials economy. This symposium will focus on the multifunctional materials and techniques that offer advanced processing, improved properties, and low-cost/low-temperature synthesis, with a strong focus on the recent innovation in nanotechnological approaches and the assessment of their industrial impact. Special emphasis will be given to novel synthesis approaches, functionalization, processing, and characterization of nanoparticles, nanowires, nanoscopic films and their heterostructures. Application of nanostructures in catalysis, energy and sensing applications, nanocomposites in structural lightweight materials, nanostructured coatings for photovoltaic, bio-medical and optical applications will form the major scientific thrust areas.

It will provide an international forum for the presentation of technological advances, and latest research on the state-of-the-art in innovative processing and device applications of new materials to meet the challenges of sustainable energy and environment technologies. Interested and committed individuals from academia, national laboratories, industries and start-up companies are invited to contribute by submitting their abstracts on the following and related topics.

**Session Topics**

**CE-1 Innovative processing of nano- and heterostructures and films of functional materials**
- Chemical processing of nanomaterials: electrosprinning, plasma-assisted chemical vapor deposition, atomic layer deposition and microwave-enhanced synthesis, sol-gel, and chemical solution techniques
- Atom- and energy-efficient processing of advanced nanomaterials and nanocomposites
- Innovative techniques for characterization and manipulation of nanostructures
- Fabrication of interface-driven functionalities and multi-material heterostructures
- Synthesis, functionalization and assembly of nanomaterials and nanocomposites
- Scaled-up production of nanomaterials

**CE-2 Functional metal oxide nano- and heterostructures**
- Metal oxides nanomaterials for chemical and biological sensors
- Transparent conducting oxides and heterostructures for energy harvesting
- Nanocrystalline oxide and nanocomposites for excitonic solar cells
- Anisotropic metal oxide nanostructures for photovoltaics
- Piezoelectric nanostructures for self-powered systems
- Heterostructures for plasmonic energy transfer
- Nanodevices: fabrication and large-scale integration

**CE-3 Functional materials and sustainability**
- Nanomaterials for renewable fuels and energy generation
- Nanomaterials for energy storage devices
- Nanomaterials for high efficiency usage of energy: photocatalysis, solar hydrogen solid-state lighting and thermoelectrics
- Nanotechnology for water purification and desalination
- Integration of functional metal oxide nanostructures in devices
- Industrial production, implementation and commercialization of sustainable systems
Symposium CF
High and Ultra High Temperature Ceramics and Composites for Extreme Environments

Revolutionary improvements in operating efficiency or performance characteristics require increasingly hostile operating environments. For example, handling of molten metals exposes materials to extreme temperatures, reducing conditions, and thermal shock. Other applications of interest include leading edges for hypersonic aerospace vehicles, flow-path components for advanced aerospace propulsion systems, refractories for steel, glass, and Specialty metal processing, and many others. Ceramic materials and ceramic matrix composites are candidates for many applications that involve severe temperatures, chemical reactivity, or mechanical stresses.

In recent years, a number of oxide and non-oxide ceramic materials have been investigated for use in extreme environments. This symposium will examine the critical aspects in four different areas: 1) Synthesis and Processing; 2) Corrosion, Oxidation, and Testing; 3) Mechanical and Thermal Properties; and 4) Characterization. The materials of interest comprise a wide range of ceramics including conventional oxide ceramics such as alumina and zirconia to more specialized compositions such as boride, carbide, and nitride materials. The materials of interest can be monolithic, single phase ceramics, porous materials, multi-phase particulate ceramics, or composites. Ternary carbide materials (i.e., the MAX phases) are the subject of a separate symposium and are excluded from this one.

Session Topics

CF-1 Synthesis and processing
New materials and novel synthesis routes
Production of nano-powders, coatings, and engineered architectures
Carbothermal and borothermal reduction
Polymer derived ceramics and solution synthesis routes
In-situ reaction synthesis
Shape forming methods such as pressing, tape casting, extrusion, etc.
Additive manufacturing and net shape forming
Densification kinetics

CF-2 Corrosion, oxidation, and testing
Thermodynamic modelling and computational tools
Analysis of reaction mechanisms and kinetics
Testing in simulated hypersonic flight conditions or other operational environments
Highly energetic reaction environments
Correlation of laboratory testing to application environments
Simulation and modelling of degradation reactions
Phase equilibria and thermodynamic tools
Non-equilibrium reaction analysis

CF-3 Mechanical and thermal properties
Strength and fracture toughness
Elevated temperature properties
Testing above 1600 °C
Finite element simulations and other models
Testing under combined loads (e.g., mechanical and electrical)
New test methods
Ab-initio calculations and other predictive tools

CF-4 Characterization and analysis
Advanced characterization methods
In-situ and in-operando characterization under extreme conditions
Electron microscopy and high resolution imaging
Emerging characterization tools for structural materials
Spectroscopic methods
Thermodynamic and kinetic studies

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Symposium CG
Progress in Nano-laminated Ternary Carbides, Nitrides and Borides (MAX/MAB) Phases and Derivatives Thereof (MXenes)

This Symposium aims at being an international forum in which the different aspects of the MAX phases and other layered carbides and nitrides and their 2D derivative compounds, viz. the MXenes, are discussed. The MAX phases are layered hexagonal machinable ternary early transition metal carbides and nitrides. Currently the MAX phases number over 70, with new ones, especially 413's and solid solutions still being discovered on a routine basis. The recent discovery of out of plane ordering, (o-MAX) and in-plane ordering (i-MAX) phases and their 2D derivative have greatly enriched and invigorated the field. The re-discovery of layered transition metal borides (MAB) phases that share some, but not all, similarities with the MAX phases is also a new and exciting development.

The International Symposium “Progress in Nano-laminated Ternary Carbides Nitrides and Borides (MAX/MAB) Phases and Derivatives Thereof (MXenes)” will focus on the latest advances in understanding the chemistry/processing/properties/microstructure relationships in the MAX/MAB and MXene phases. The proposed sessions will cover the gamut from density functional theory calculations to transport properties, to new phases, both predicted and synthesized, to ambient and high temperature mechanical properties including creep and oxidation. How the MAX phases are converted to MXene and the properties of the latter will also be covered. Lastly, a session will be devoted to current and potential applications of these novel, exciting and unusual phases.

Session Topics

CG-1 Bulk and thin film transport properties of the MAX/MAB/MXenes
CG-2 New MAX/MAB/MXenes
CG-3 Room temperature mechanical properties of the MAX/MAB/MXenes
CG-4 High temperature mechanical and oxidation properties of the MAX/MAB/MXenes
CG-5 MAX/MAB and MXene composites and their properties
CG-6 Electronic properties, ab initio calculations and structural characterization
CG-7 Synthesis and fabrication of MAX/MAB/MXenes
CG-8 Functional properties of MAX/MAB/MXenes
CG-9 Energy storage
CG-10 Applications of the MAX/MAB and MXene phases

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Symposium CH
Ceramic Thin Films and Coatings for Protective, Tribological and Multifunctional Applications

This symposium focuses on cutting edge experimental, theoretical and manufacturing issues associated with advanced thin and thick film deposition techniques and surface modification processes. These processes allow the realisation of surfaces with enhanced properties and/or novel multi-functionality; thereby enabling them to meet present requirements and future challenges for more efficient, reliable, inexpensive, and clean applications that serve the technological needs of our society. Of interest are materials systems based on oxide and non-oxide ceramics; new carbons; metal-ceramic, organic-ceramic and nano-composites; and hybrid and graded structures.

Focus will be on:
- Advances in deposition, surface modification and nanostructuring techniques
- Refined characterisation and properties at meso- to nanoscale
- Protective coatings aimed at improving the high-temperature thermal, chemical and physical degradation of components in both oxidising and harsh environments
- Thermal barrier coatings (TBCs) to increase the operating temperature of static and dynamic components in advanced gas turbines and in a number of other high temperature applications
- State-of-the-art tribological thin films and coatings used in, for example, cutting tool and machining, medical devices, electronic displays, hard disks, optical coatings etc.
- Smart and multifunctional thin films and coatings: self-cleaning, anti-microbial, anti-smog, catalytic, electrically/magnetically/optically stimuli-responsive etc.
- Modelling, simulation and data-base development for coatings

Session Topics

CH-1 Advances in deposition, surface modification and characterisation techniques
- Thermodynamics and kinetics, heat and mass transfer and in-situ monitoring of the deposition
- Process modelling and simulation
- Advances in deposition techniques: CVD/PVD, thermal spraying, sol-gel, self-assembly, lithography, etc.
- Ion beam, laser and electron-beam surface processing; thermochemical treatments
- Substrate materials, substrate treatments; post-deposition treatments
- Advances in characterisation techniques and non-destructive testing

CH-2 High temperature protective coatings in oxidising and harsh environments
- Corrosion resistant coatings
- Abrasion, erosion resistant coatings
- Multifunctional coatings
- Coating design, processing, performance
- Characterisation of reaction scales
- Degradation processes, life-time assessment
- Effect of applied stress
- Advanced applications in gas turbines, diesel engines fuel cells, aerospace industry, coal gasification, metal casting

CH-3 Thermal barrier coatings
- Design methodologies
- Multifunctional and nano-structured coating systems
- Hybrid coatings and new processing methods
- Interfacial phenomena
- Residual stresses, ageing phenomena, failure mechanisms
- Testing and non-destructive evaluation
- Modelling and life prediction
- Smart TBCs (e.g., self diagnostic, self healing, damping coatings)
- Advanced applications in gas turbines, aero-engine parts, fuel cells, etc.

CH-4 Tribological thin films and coatings
- Hard single- and multi-layer, graded and nanocomposite thin films and coatings
- Surface treatments for friction and mechanical improvement
- Adaptive self lubricating coatings
- Interfaces and interphases
- Hardness, toughness, friction, wear and thermal characterisation
- Friction and wear mapping
- Nanoindentation and small-scale plasticity
- Nano- and microtribology of nanostructured and amorphous films
- Machining, cutting and forming tools applications
- Hard coating applications in microelectronics, magnetic recording and optical devices, computer disk drives, inkjet printing, precision instruments, medical devices and implants, automotive, aerospace, industry, agriculture etc.

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In-situ diagnostics, multiscale modelling and novel design and testing strategies
Lifetime and reliability issues

CH-5 Smart and multifunctional thin films and coatings
Self cleaning, catalytic, anti-microbial, anti-smog, antirefection, self-healing damping coatings and films
Passive and active coatings that respond to electrical, magnetic, and optical inputs
Coatings that respond to chemical and bio-based stimuli

CH-6 Modelling and simulation of coatings and films
Data bases for materials and their functionality
Modelling of materials performance, relationship of simulations to performance
Image-based and scattering methods for measuring and modelling ceramic coatings and films

CH-7 Industrial processing in advanced surface technologies
Robotics and robot kinematics, manufacturing and industrial engineering

Theory and experimental evaluation of physical and chemical processes related to material functions such as transport phenomena, defect chemistry, interface reactions, separation and catalysis mechanisms, etc..
Novel design and fabrication of components and devices
Evaluation of material/component/device performance
Advances in testing methods
Modeling of structure and properties of porous ceramics
Application engineering of porous ceramics

Session topics
CI-1 Novel processing and synthesis of porous ceramics (nano to macro), including Additive Manufacturing
CI-2 Absorption, capillary phenomena, molecular thermodynamics of fluids and intermolecular interactions within the porous network
CI-3 Structure and functional, mechanical and thermal properties of porous ceramics; structure/transport/functional properties relationships
CI-4 Advances in the characterization of the porous structure (adsorption and intrusion porosimetry, thermophotometry, high resolution microscopy, image analysis, scattering techniques, computed tomography, etc.)
CI-5 Modeling and simulation of porous structure and properties
CI-6 Progress in applications of porous ceramics in: gas filtration and separation
micro filtration and ultrafiltration
catalysis and catalysis supports
membrane reactors
functional applications
energy applications
advanced industrial applications

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Symposium CI
Porous Ceramics for Environmental Protection, Energy-related Technologies and Advanced Industrial Cycles

The focus of this Symposium is to discuss innovative approaches to develop, characterize and apply porous ceramics with a high volume of tailored porosity, ranging in size from Angstroms to millimeters. These porous ceramics include high surface and cellular architectures such as honeycombs, foams, hollow fibers, fiber networks, membranes, nano-, micro- and meso-porous materials, monoliths and coatings possessing hierarchical porosity, as well as structures produced by additive manufacturing technologies or the replication of biological templates. Such porous components can find use in a wide range of emerging applications in environmental protection, water purification, energy production and saving, molecular scale sensing, optical devices and a number of advanced industrial applications.

The main topics that will be addressed are:
New materials and synthesis mechanisms
Materials optimization at the nano- and meso-scale
Symposium CJ
Advances in Electroceramics: Processing, Structure, Properties, and Applications

Improvements in basic knowledge and practical exploitation of their unique properties, has established electrical ceramics as a central and fast developing sector in materials research, resulting in a significant impact on several areas of modern technologies. The increasing demand for even more refined or novel properties hardly to be competitively met by other materials is fuelling the interest for improved or new processing routes and deeper understanding of the fundamental materials science to meet requirements coming from a variety of advanced civilian and defence applications.

Materials with unusually high dielectric constant, with low loss and low temperature resonance coefficient at very high frequencies, lead-free piezoelectrics, multifunctional materials such as multiferroic heterostructures and ionic and mixed solid electronic conducting ceramics are but some examples of the ongoing developments in the area which massively makes use of the opportunities offered by nanoscience and nanotechnology, and by computational modelling and new theory.

Major focus will be on:
- Development of new and more efficient processes, better characterisation tools of bulk, crystalline, glassy and amorphous materials, thin films, multilayers, superlattices, nanomaterials, nanostructures and hybrid materials; advances in thin-film and related micro/ nano-fabrication techniques and "bottom-up" approaches that offer the potential for high-density integration of nanoscale devices
- Fundamental mechanisms, novel (multi)functional characteristics and behaviour of materials such as electronic structure, quantum effects, phase transitions, transport phenomena, defects, diffusion, domain structure and switching, grain boundary controlled mechanisms, nanosize effects, surfaces and interfaces, dielectric, piezoelectric, magnetic and optical properties, ageing and fatigue, reliability, fractals, modeling and simulation, etc.
- New developments in devices including fuel cells, batteries, high energy density capacitors, gas separation membranes, tunable dielectrics for microwave applications, piezoelectric composites, sensors and actuators, MEMS/NEMS devices, and related integration technologies.

Session Topics

**CJ-1 Dielectrics and microwave materials**
- Fundamentals, synthesis, processing, characterisation
- Capacitor dielectrics
- Mott insulators
- Microwave and millimeter wave dielectrics
- Tunable dielectrics
- LTCC
- New thin film materials and integration technologies
- Packaging and interconnect issues

**CJ-2 Ferroelectric, piezoelectric, pyroelectric, and ferroelastic ceramics**
- Synthesis and processing: polycrystalline ceramics and composites, thin/thick films, single crystals, novel materials
- Lead-free ferroelectrics and piezoelectrics
- Relaxor ferroelectrics
- Theory and modelling
- Characterisation
- Electromechanical behaviour and piezoelectric applications
- Thin film devices
- Capacitor applications, MLCC
- Sensor applications
- Novel applications

**CJ-3 Multiferroics and magnetoelectric ceramics**
- Theory and modeling of single phase and composite multiferroics
- Non-oxide, organic-inorganic and 5-d oxide multiferroics
- Advances in materials synthesis and processing
- Magnetoelastic characterization and electric field control of magnetization
- Domain walls and dynamics of multiferroics
- New effects
- Devices and applications

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Symposium CK

Functional Magnetic Oxides

Due to their many active and competing degrees of freedom, functional magnetic oxides show a plethora of phenomena, ranging from complex magnetic ordering to multiferroicity, from fully polarised spin transport to colossal responses to external fields, thus offering a huge potential for both rich basic physics as well as unprecedented technological applications. However, the complexity inherent to various crystal structures, electronic systems, exotic orbital and charge rearrangements, different atomic coordination, relativistic effects, defects, etc. continuously challenge the community working on magnetic oxides. The symposium will therefore gather scientists active in the fields of advanced synthesis and characterization techniques, as well as modeling and “materials-by-design” approaches. The classes of materials addressed will range from manganites to nickelates, from cuprates to ferrites, from cobaltates to other transition metal oxides (including 4d and 5d), from perovskites to spinels. In addition to bulk-related physics, particular attention will be devoted to phenomena occurring under reduced dimensionality (such as oxide-based heterostructures, nanostructures, thin films, superlattices), with emphasis on 2DEG systems, spin transport across oxide interfaces, proximity effects, electronic reconstruction, physics of domains and domain walls. Finally, the symposium will address possible applications of magnetic oxides, in electronics and energy, such as magnetic tunnel junctions, spin torque devices and magnetic refrigerators.

Session Topics

CK-1 Magnetic oxide thin films interfaces and heterostructures
CK-2 Spin transport in magnetic oxides
CK-3 Electronic structure and correlation effects

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“Manipulation of a Magnetic Moment by Spin Transfer” was the Invited Lecture delivered by Nobel Prize Albert Fert at CIMTEC 2006, Acireale, Sicily.
Symposium CL
Inorganic Materials Systems for Advanced Photonics

The fruitful exploitation of optical ceramics and glasses and related photonic structures and devices as crucial pivots for the development of several enabling technologies provides a large spectrum of functionalities that allow us to face successfully socio-economic challenges in many fields going from energy production and saving to efficient and clean industrial cycles, from environmental protection to fast efficient novel communication systems, from structural monitoring to quantum technologies and to healthcare applications.

This Symposium, that follows the several ones on similar subject held at previous CIMTEC conferences, is to provide latest insights on fabrication, characterization and exploitation of photonic structures based on ceramics (oxides, oxynitrides, fluorides, sulphides, chalcogenides, etc.) inorganic non-metallic glasses, glass-ceramics, and ceramic/metal and glass/metal combinations in the form of nanostructured, bulk and graded materials and coatings, fibres, thin films, superlattices and other small confined systems, nanomaterials, nanocomposites and functional nanoparticles.

Focus will be on theory, modelling and simulation of materials and processes, green and advanced fabrication protocols (self assembly, particle beams, light irradiation, micromachining, colloidal processing...) and up-to-date characterization of structure, non-linear optical properties, tunability, nanosize effects etc. of novel inorganic photonic materials systems for light generation, detection, and manipulation including e.g. luminescent and laser materials, smart optical fibres, active plasmonic heterostructures, novel confined nano-micro structures etc. covering the UHV-IR electromagnetic spectrum.

Contributions from Academia and industry on upgraded or novel application and prospective new approaches to photonic-based technologies are also firmly encouraged.

Session Topics

CL-1 Photonic nanomaterials and nanostructures
- Optically active colloidal nanoparticles, nanowires, 1D and 2-D nanomaterials, nano/micro cavities...
- Optically active nanostructured materials
- Plasmonic nanostructures

CL-2 Luminescent and chromogenic ceramics and glass systems
- Phosphors
- Scintillators
- Other luminescent materials
- Chromogenic materials

CL-3 Transparent conducting and non-conducting ceramics
- Transparent Conducting Oxides (TCOs)
- Non-Oxide transparent conducting ceramics
- Insulating/dielectric transparent ceramics

CL-4 Electro-optical and magneto-optical materials
- Electro-optical and magneto-optical ceramics
- Electro-optical and magneto-optical functionalized glass systems

CL-5 Laser materials
- Fiber laser
- UV-Vis-NIR-MIR-laser materials
- Photonic crystals for laser applications
- Novel laser crystals

CL-6 Inorganic optical fibers
- Passive, low-loss optical fibers
- Active and smart optical fibers

CL-7 Photons management
- Lasers
- Waveguides
- Luminescent systems
- Frequency conversion
- Switches, modulators
- Sensing
- Imaging
- Single photon sources and detectors
- Integrated optics

CL-8 Advances in characterization techniques
- Synchrotron radiation based technologies (NEXFAS, XANES, XPS, ...)
- Scanning probe microscopies, confocal microscopy, SNOM
- Interferometer techniques for imaging and testing
- SERS, CARS, Raman, Brillouin and optical spectroscopies
- THz spectroscopies
- Advanced imaging techniques and innovative tools

CL-9 Ongoing applications and forecasts
- Solid state lighting, displays
- Optical communications
- Quantum technologies
- Bioimaging
- Healthcare
- Clean energy
- Aerospace, defense, security
- Structural health monitoring
- Laser-assisted manufacturing and micro/nano fabrication

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Symposium CM
Science and Technology for Silicate Ceramics

Silicate ceramics account for over 80% of the ceramic industry turnover on a global basis. Future expansion is also predicted on increasing demand from construction and domestic uses, driven by improved life standards and demographic growth. In such a competitive and dynamic landscape, process and product innovation proved to be the key for growth. Ceramic technologies have been continuously upgrading and manufacturers are looking to industry 4.0 processing systems. The purpose of this symposium is to focus interest on ongoing R&D activities on silicate ceramics: wall and floor tiles, sanitaryware and tableware, bricks and roof tiles, ceramic technology and machinery, glazes and pigments, and raw materials. Matter will cover research work on the properties and behaviour of materials, quality assurance, development of new ceramic products and manufacturing technologies.

Session Topics

CM-1 Smart silicate ceramics
There is an increasing industrial concern on technologies able to provide additional properties to silicate ceramic surfaces, turning them capable of reacting with the environment, so that the ceramics become an active element contributing to the control of the environment and to the energetic sustainability. Contributions on functionalized surfaces (self-cleaning, bacteriostatic or providing high reflectance, controlled grip, wear resistance, magnetic shielding, thermo-hygrometric comfort or energy harvesting) as well as durability, efficiency, scale-up to large surfaces, and testing procedures of multifunctional silicate ceramics are welcome.

CM-2 Green silicate ceramics
Social and technological challenges require a further effort to improve the sustainability of ceramic manufacturing. This session will take stock of technological solutions and processing innovation in the silicate ceramic industry (tiles, sanitaryware, glazes, bricks, etc). A special focus will concern health and environmental issues (e.g., CO2 emissions, crystalline silica, green certificates, reduction of wastes originated during processing) and all aspects of valorization of residues as raw materials in the manufacture of ceramics.

CM-3 Coating and decoration of silicate ceramics
The new scenario drawn by the advent of digital technologies is continuously evolving from decoration towards application of special effects, glazes and functional coatings. The last advances in surface coating and decoration by ink-jet printing and further drop-on-demand technologies will be reviewed. This session deals with materials development and behaviour (ceramic inks, engobes, effects, glazes, etc) including environmental sustainability and green chemistry in colorant manufacturing.

CM-4 Innovative processing in silicate ceramics
The ceramic industry has to tackle the challenges coming from evolving market demand, new construction systems and product standards. This session will focus on innovative manufacturing of silicate ceramics (e.g., large slabs, 3D printing, novel granulation systems, etc) and progress in the processing of composites and geopolymers.

CM-5 Geopolymers
Preparation and characterization: Synthesis and processing; Geopolymerization kinetics; Conversion to ceramics; Composites; Microstructure; Thermal properties; Mechanical properties; Chemical stability and adhesion. Applications: Geopolymer concrete; Waste immobilisation; High-technology applications (electronic properties, bioactivity, catalysis); Commercialization issue.
Symposium CN
Refractories: Meeting Refractory Industry Needs of Today and Its Future Challenges

This symposium will focus on the current “state of the art” in refractory liner materials and on the advances needed in material performance for existing and/or new processes, or by needs caused by modifications of existing ones. Drivers for change; such as rapid changes in raw material availability, environmental concerns, technology changes, or the need for relevant information on refractory material properties or causes of failure; will be discussed. Symposium topics will range from the refractory raw material formulation, manufacture, testing and installation; to analysis of refractory wear/failure causes; to controlling refractory wear and improving liner material performance using existing and/or advanced analytical tools or thermodynamic process modelling; to the increased energy, environmental, and education needs of refractory users and manufactures. Contributed papers will cover achievements and challenges from the perspective of either the refractory user, installer, or producer; and will focus on shaped and unshaped (monolithic) refractory materials composed of natural and/or synthetic materials.

Session Topics

CN-1 Raw Materials Needs
Natural raw material, their characterization and performance — including changing industry needs and material sustainability
New/improved refractory raw materials and additives (natural and synthetic) to meet shifts in refractory performance needs
Raw material phase relationships and reactions occurring during product installation, sintering, or use that impact microstructure development and/or product performance

CN-2 Product Testing and Quality Control
Testing and improving physical properties; such as thermal shock, spalling, hot strength, fracture resistance, creep, thermal conductivity, and MOE
Quality control and analytical tool use to improve refractory product quality, consistency, performance, or that reduce unit cost
Evaluating and controlling monolithic materials property changes that occur during storage, mixing, installation, drying, and firing; including those caused by composition and additives
Continuously monitoring variables and/or material properties related to refractory failure in severe service applications
Microstructure analysis as it relates to material performance (using SEM, TEM, cathodoluminescence, high temperature confocal laser microscopy, optical microscopy, or other analytical tools)

CN-3 Product Manufacturing and Installation
Advances in refractory manufacture, installation, and/or system repair/maintenance
Monitoring refractory performance as it relates to material repair/replacement

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Advanced inorganic fibre composites are enabling materials for a number of energy efficient and eco-friendly applications in aerospace, power generation, ground transportation, chemical, and nuclear energy applications. However, despite the considerable progress made in recent years in the fundamental understanding of inorganic fibre composites, a lot still remain to be done to fully utilize the excellent capabilities of these materials. A deeper insight of the mechanisms governing fibre composites behaviour in demanding situations, the development of reliable life prediction methodologies, design tools, and improved or innovative approaches to low cost manufacturing are among the many priorities for research and industry.

This symposium (which follows the several ones on a similar subject held at previous CIMTEC Conferences) will feature latest achievements in the basic physico-chemical principles of inorganic fibrous composite technology and processing science, bulk and interface characterization, property assessment, and fiber composite design and production. Modelling of properties and behaviour, and application engineering studies in severe thermomechanical and aggressive environments are among its scope, as well as exploiting factors affecting reliability and low cost processing.

Ceramic (Refractory, Glass, Glass-Ceramic) Matrix Composites (CMCs), Ultra High Temperature Ceramic Composites (UHTCCs), Carbon-Carbon (C/C) composites, and Metal Matrix Composites (MMCs) are of great interest. In addition, new developments in the processing and manufacturing as well as characterization of reinforcements such as long and short fibres, filaments, nanofibers, nanotubes, and in-situ composites will also be covered.

**Session Topics**

**CP-1 Production and properties of reinforcements, preforms, and matrix materials**
- Manufacturing, processing, properties.
- Fiber architecture: laminates, weaves, braids.
- Preforming methods and technologies.
- Nanoreinforcements (nanofibers, nanotubes, nanorods, nanowires, etc.)
- Development and testing of new inorganic fibers

**CP-2 Interfaces/interphase**
- Fiber coating, interfacial bond control
- Structure and microstructure of interfaces
- Computational modeling of interfaces/interphases

**CP-3 Processing and fabrication of MMCS, CMCS, and C/C composites**
- Solidification processing, extrusion, rolling, electrodeposition, etc.
- Reaction bonding, diffusion bonding, chemical vapour infiltration, melt infiltration, sintering, hot pressing, HIPing, spark plasma sintering, colloidal processing, etc.
- Net shape processes, computer-aided component design and fabrication, rapid prototyping, process modelling.
- Additive manufacturing technologies
- Green and eco-friendly processing and manufacturing technologies
- Joining, attachment, machining, and repair technologies

**CP-4 Ultrahigh Temperature Ceramic Composites (UHTCCs) and Laminated Composite Structures**
- Processing and fabrication of UHTC composites with refractory boride, carbide, nitride matrices
- Interfacial and thermomechanical characterization
- Testing and integration technologies for UHTCCs
- Design criteria for laminated composites
- Structural analysis
- Mechanisms of delamination

**CP-5 Property, modeling and characterization**
- Microstructural characterization, influence of processing on the microstructure
- Thermomechanical properties, static and dynamic characterization
- Micromechanics and interfaces
- Fracture, fatigue and creep mechanisms, plastic and superplastic behaviour
- Wear and friction behavior
- Effect of strain, temperature and environment on microstructure and properties
- Modelling at micro-, meso- and macroscopic level including environmentally induced damage, mechanical damage, toughness
- Environmental durability and life prediction

**CP-6 Composites for thermal management**
- Design, development, and testing of thermal protection systems (TPS)
- Light weight, high conductivity materials for thermal management (C/C and CNT composites, Al/SiC, Cu-based systems, Si3N4 in-situ composites, etc.)
- Bonding and integration technologies, thermal contact materials
- Nondestructive evaluation, quality assessment, health monitoring, etc.

**CP-7 Applications**
- Aeronautics, space transportation systems, and space structures
- Aircraft and automobile brakes, friction components
- Power generation, fuel cells, microturbines
- Automotive and ground transportation, armors and shields
- Environmental and waste remediation, nuclear industries
- Chemical and process industries

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Symposium FA

Materials Issues in Flexible and Stretchable Electronics

Flexible and stretchable electronics is empowering unprecedented approaches to ubiquitous electronics: owing to its mechanical compliance, it offers opportunities for many new applications in energy transformation and storage, deformable displays, wearable electronic systems, memory devices, compliant large area electronics and in bioelectronics.

Major challenges for research is to achieve both excellent long-term reliable mechanical soundness and electronic performance, joined with compatibility with living tissues and low-toxicity when biomedical applications are involved. The intrinsic mechanical properties of molecular and polymeric organic semiconductors in principle render them ideal candidates for a range of flexible and conformable devices. Nevertheless, when very high performing active electronic components are required, inorganic materials and novel nanomaterials may be the preferred options, demanding alternative device architectures to accommodate for the respective mechanical properties.

This symposium aims at presenting timely research in materials, their mechanics, designs, modelling, novel phenomena and techniques enabling the fabrication of flexible, stretchable and ultra-conformable electronics for the diverse fields of ongoing or potential applications, with special focus on demand on materials and prospective solutions.

Session topics

FA-1 Materials and fabrication processes
- Emerging Organic, Inorganic and Hybrid active device materials (conductors, semiconductors, dielectrics)
- Functional electronic inks for flexible and stretchable electronics
- Advanced growing, printing and patterning technologies for flexible and stretchable electronics
- Nonplanar fabrication processes
- Substrates and encapsulating/barrier materials and methods

FA-2 Device physics, mechanics and design
- Charge injection, transport and generation phenomena in materials for flexible/stretchable electronics
- Design of highly stretchable/deformable and conformable electronics

FA-3 Applications of flexible/stretchable electronics
- Electronics and optoelectronics: flexible/stretchable thin film transistors, bendable/stretchable/conformable electronic circuits, sensors, light emitting diodes
- Flexible energy conversion/storage: solar cells, thermoelectric generators, fuel cells, batteries, supercapacitors, energy harvesters
- Biomedical: conformable neural interfaces, implantable soft devices, bioMEMS, prosthetic skin
- Transducers: e-textiles, wearable electronics, cyber-skin, flexible MEMS, microsensors, microactuators, etc
- Bio-inspired systems in organic electronics for biotechnology and medical applications

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Towards Next Generation Solar Cells: Emerging Materials, Phenomena and Device Architectures

Driven by the recent advances in production capacity and cost reduction, emerging thin film photovoltaic technologies based on chalcogenide semiconductors, amorphous/micromorph silicon and nano/micr/poly-Si are becoming of increasing interest for market segments especially due to their superior performance in integrated applications. Copper zinc tin sulphide/selenide solar cells (CZTS) and their derivatives based on abundant and non-toxic element also are an attractive option, as well as a number of alternative inorganic materials systems that are being actively explored. Dye and nanomaterial-sensitised and organic solar cells are also progressing in terms of efficiency and lifetime and are expected to pave the way to very-low-cost photovoltaics, whereas hybrid organic-inorganic solar cells based on perovskite compounds, being credited for very promising low-cost, high efficiency solar cell technology, will be the object of a Focused Session “Perovskite Photovoltaics”. In order to push the current efficiency limit from 43% towards and possibly beyond the 50% mark, next generation nano-architectured solar cells are being addressed to exploit a whole range of new physical effects like intermediate bands, multiple exciton generation, hot-carriers and up/down conversion.

Success of the above emerging and prospective solutions calls for the availability of reliable materials systems and device architectures capable of efficiently harvesting the full spectrum of solar energy.

The Symposium “Towards Next Generation Solar Cells: Emerging Materials, Phenomena and Device Architectures”, which follows those on similar topics held in previous CIMTEC Conferences, provides a forum for materials scientists and experts from industry to discuss major advances in the aforementioned fields, from latest developments in inorganic thin film/dye sensitized/organic/hybrid devices to new findings and approaches for next generation solar cells, focusing on fundamental materials science and processing, on new concepts and theories for light management, and on device physics, manufacturing, reliability and long-term stability.

Session topics

**FB-1 Thin-film photovoltaics**
- FB-1.1 Silicon thin films and multi-junction Si solar cells
- FB-1.2 CIGS (and related compounds) and CdTe solar cells
- FB-1.3 Kesterite and other novel materials/concepts for inorganic thin film PV

**FB-2 III-V solar cells**
- FB-2.1 III-V tandem solar cells (inc. III-V tandems on Si)
- FB-2.2 III-V QW and QD solar cells

**FB-3 Organic, dye sensitised and nanoparticle photovoltaics**
- FB-3.1 Small organic molecule and polymeric solar cells
- FB-3.2 Dye-sensitised and nanomaterial-sensitised solar cells
- FB-3.3 Quantum dot solar cells

**FB-4 Multiple energy level devices**
- FB-4.1 Intermediate band solar cells
- FB-4.2 Up or down conversion for solar cells

**FB-5 Excited state enhanced solar cells**
- FB-5.1 Hot-carrier solar cells
- FB-5.2 Multi-exciton generation
- FB-5.3 Hot luminescence devices
- FB-5.4 Other novel concepts

**FB-6 Advanced light trapping for photovoltaic devices**
- FB-6.1 Plasmonic coupling
- FB-6.2 Photonic and nanophotonic light trapping

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Focused Session FB-7
Perovskite Photovoltaics

Hybrid and organic solar cells are very promising power sources of renewable energy due to significant progress achieved in their conversion efficiency and processing technology. Among them, perovskite-based hybrid solar cells is an emerging and fastest advancing field capable of combining simple and low cost manufacturing with very high performance, reaching an efficiency beyond 20% and competing silicon-based solar cells. Short-term and long-term stability, potential environmental impact related to the use of lead, innovative device designs, reliable and reproducible processing for large area modules and adequate measurement protocols for solar cell efficiency are among the important R&D issues for this challenging interdisciplinary research area which presents fascinating opportunities across chemistry, solid-state physics, and electronics. The main topics of this Focused Session are related to material preparation and characterization, modelling, device performance, and manufacturing of perovskite-based photovoltaic devices, including lab-made single cells, tandem cells and large area modules. The fundamental properties of hybrid perovskite as semiconductor and ionic crystal will also be important topics for discussion.

Session topics
FB-7.1 Material synthesis and processing
FB-7.2 Theoretical modelling of materials and devices
FB-7.3 Device architecture and optimization
FB-7.4 Material and device stability
FB-7.5 Design of lead-free new materials
FB-7.6 Scale up and module development
FB-7.7 Life cycle, environmental study, solar cell efficiency measurement protocols

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Symposium FC
Hydrogen Production and Storage

Hydrogen obtained from dissociation of water with renewable energy, nuclear or the water-gas shift reaction in advanced gasification technologies provided with CO2 capture and sequestration, has been identified as one of the strategic technologies for an appealing, clean, abundant, safe and cost effective energy carrier for a low carbon economy.

Implementing hydrogen as an environmentally friendly, sustainable and efficient energy carrier, however requires major challenges for its production, storage and use to be solved. Breakthroughs in materials research to find effective robust catalysts and new storage techniques that satisfy weight, volumetric, safety and cost requirements are critical for hydrogen to penetrate the market. Crucial is gaining a deeper understanding of the phenomena that govern the interactions of hydrogen with materials, to exploit the enormous opportunities offered by nanotechnology and to develop modelling and simulation strategies for predicting reaction pathways, materials properties and systems behaviours in order to effectively implement the hydrogen technology. Furthermore, hydrogen as an intermediate energy carrier for the CO2 reduction to synthetic hydrocarbons is increasingly important especially for mobile and seasonal storage of renewable energy.

“Hydrogen Production and Storage” will bring together world leading experts from Physics, Chemistry, Materials Science and Engineering to share up-to-date scientific and technical advances in the field, and to highlight outstanding problems and guidelines for future research. Fundamental aspects of catalysis, separation and purification processes; chemistry and physics of hydrogen bonding, adsorption and release mechanisms; materials synthesis, processing and characterisation; system implementation and performance evaluation including safety and economics issues will be featured.

Technical programme areas:

**FC-1 Hydrogen production**
- FC-1.1 Thermochemical
- FC-1.2 Photoelectrochemical
- FC-1.3 Photobiological and photo-bio-mimetic
- FC-1.4 Biomass/waste reforming
- FC-1.5 Microbial Electrolysis Cells (MEC)
- FC-1.6 Electrolysis from renewable energy
- FC-1.7 HT electrolysis (Hybrid cycles)
- FC-1.8 Water-gas shift in advanced coal gasification
- FC-1.9 Hydrogen quality assessment

**FC-2 Hydrogen storage**
- FC-2.1 Metal hydrides
- FC-2.2 Complex hydrides
- FC-2.3 Chemical hydrides
- FC-2.4 Organic hydrides
- FC-2.5 Physisorption of hydrogen on high surface area adsorbents e.g. carbon based material, metal-organic frameworks and nanostructures
- FC-2.6 CO2 reduction with hydrogen to synthetic hydrocarbons
- FC-2.7 Theoretical modelling
- FC-2.8 Storage testing, leak detection, safety, economic issues, etc.
The potential of electrochemical energy storage in batteries and supercapacitors is enormous, ranging from small sizes for mobile electronics to medium sizes for transportation to large sizes for electric grid storage. Electrochemical energy storage is also the most appealing option for the effective utilization and implementation of renewable energy sources such as solar and wind to establish a cleaner environment. Understanding, controlling, and predicting the structure and properties of solids and the development of new materials with novel synthesis approaches and enhanced properties have driven the energy storage field for the past three decades. Although the performance level and cost of the current generation of storage devices are acceptable for mobile applications, novel intuitive concepts are needed for next-generation of high-performing electrochemical energy storage systems at an affordable cost with improved safety to penetrate the major new markets. Design and synthesis of new electrode and electrolyte materials, advanced characterization methodologies including in situ techniques to understand at the atomic and nanoscale the surface, bulk, and interfacial characteristics, and computational analysis to predict materials behaviours and guide the design of new materials are among the main challenges for developing new next generation of high-performance materials.

The International Symposium “Electrochemical Energy Storage Systems: the Next Evolution” will emphasise breakthroughs in materials and energy storage systems for practical implementation. The Symposium will cover advances in electrode and electrolyte materials for rechargeable batteries, including new cell chemistries, novel electrode architectures, in situ and ex situ characterization, advanced computational methodologies, new cell configurations, and system development, along with addressing reliability, lifetime, cost, safety, and environmental issues for practical implementation.

Session topics

FD-1 Batteries
- Rechargeable batteries: anodes, cathodes, and electrolytes
- Cell chemistries: Li-ion, Li-S, Li-air, Na-ion, Mg-ion, Al-ion, all solid-state, redox flow, etc.
- Bulk, surface, and interfacial characterizations
- Computational modeling
- Cell design

FD-2 Supercapacitors
- Supercapacitors
- Pseudocapacitors and hybrid devices
- Electrodes and electrolytes
- Cell design

FD-3 Application engineering
- Case studies: transportation, load-leveling, mobile electronics, etc.
- System design
- Reliability and lifetime
- Safety / environmental / cost issues

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The high consumption of primary energy is one of the characteristics of our modern society. Deterioration of urban air-quality, growing dependence on insecure energy sources, and global warming are forcing the re-examination of conventional energy conversion systems throughout the world. Although new combustion technologies emit far less toxic pollutants comprising hydrocarbons, nitrogen oxides, carbon mono-oxide and particulates than in the past, the increasing energy demand is resulting in growing insistence to reduce pollution. This has brought in emission legislation all over the world, in particular the legally binding treaty on climate action as outcome of the 2015 Paris Climate Conference (COP21), requiring the introduction of new energy conversion technologies and zero-emission vehicles. Among the various available energy conversion systems, fuel cell technology represents one of the most viable candidate solution to these drawbacks.

Fuel cells deliver energy at high efficiency by consuming electroactive chemicals that are supplied on-demand to the cell as in a conventional thermal combustion system. Fuel cell technology can thus contribute to achieve the targets concerning with reduction of greenhouse gases emissions, increase of renewable power sources and energy efficiency. This complies with the vision for a low carbon economy by 2050. Such vision includes both hydrogen produced through renewable sources fuelling a fleet of fuel cell vehicles and high efficiency distributed power generation with fuel cells providing electrical power and heat.

The International Symposium “Fuel Cells: Materials and Technology Challenges”, through the contribution of experiences coming from several different disciplines, will focus major advances in materials science, processing and device manufacturing of the different fuel cells. Original papers are solicited on all types of fuel cells. Of particular interest are recent developments of advanced materials, novel stack designs, emerging electrochemical cell technologies, fuel cell for portable, automotive and CHP applications, optimization and breakthroughs in performance. Reviews of the state-of-the-art fuel cell performance for specific applications, including consumer devices, electric vehicles, and distributed energy systems, may also be submitted.

Contributions are invited in the following and related areas:

**FE-1 Solid Oxide (SOFCs) and Molten Carbonate (MCFCs) Fuel Cells**
- High temperature solid oxide fuel cells
- Intermediate temperature solid oxide fuel cells
- Materials issues in solid oxide fuel cells
  - Oxygen ion, proton and mixed conductors: conduction mechanisms
  - Ceramic and metallic interconnects; sealing materials
- Mechanical and thermal properties
- Surface and interface reactions
- Direct conversion of organic fuels in solid oxide fuel cells
- Direct carbon fuel cells
- SOFC cell and stack design, electrochemical performance, reliability, degradability, fuel versatility
- Demonstration of SOFC systems
- MCFC materials development
- Corrosion issues in MCFC
- MCFC demonstration plants
- Modelling of materials and devices

**FE-2 Proton-conducting (PEFCs) and Alkaline (AFCs) Polymer Electrolyte Fuel Cells**
- New and improved proton-conducting polymer membranes
  - Hybrid organic-inorganic materials, polyaromatic polymers, nanocomposites...
- Electrode materials and electrocatalysts: poisoning effects
- Electrode membrane assembly
- PEFC stacks for automotive application
- PEFC stacks for stationary generation
- Fuel cell testing
- Modelling of materials and fuel cell performance

**FE-3 Direct Alcohol Fuel Cells (DAFCs)**
- Electrocatalysts for alcohol oxidation
- Methanol/ethanol tolerant cathode electrocatalysts
- Non-noble metal catalysts
- Methanol/ethanol impermeable membranes
- DMFCs and DEFCs for portable and assisted power unit (APU) applications

**FE-4 State-of-the-art application engineering and demonstrations**
- Combined heat and power (CHP)
- Distributed power generation
- Transport
- Portable power

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Symposium FF

Progress in Materials and Devices for Direct Thermal-to-Electric Energy Conversion

This symposium will explore state-of-the-art thermoelectric, thermionic and thermophotovoltaic materials and technologies for direct thermal-to-electrical energy conversion. Material and device designs directed to optimise efficiency and cost/performance aspects of direct thermal-to-electrical conversion will be enlightened with emphasis on tailoring electrical, thermal and optical properties to the demand of applications.

Focus will be on direct conversion into electricity of the waste heat emitted by a number of sources such as industrial furnaces, power plants, automobile exhausts and geothermal heat sources as well as the solar thermal energy. Covered will be materials issues such as: theoretical studies on band structure, crystal chemistry, transport properties, energy transfer processes, etc.; novel synthesis and processing routes for polycrystalline and single crystal bulk materials, nanostructured materials, 3-D architectures, composites and nanocomposites; low dimensionality structures such as thin films, superlattices, quantum dots and nanofibers; advanced characterisation of electrical, optical, thermal and mechanical properties. Device design and performance and system integration will also be enlightened for ongoing or forthcoming applications in direct thermal-to-electrical energy conversion technologies. Emerging ideas and proposal studies of novel concepts for direct thermal-to-electrical energy conversion working in tandem with other energy conversion technologies (i.e. fuel cells, PV-TE hybrid systems, etc.) will be interesting topics to enrich the debate.

Session topics

FF-1 Theoretical concepts and basic approaches for high efficiency thermal-to-electrical energy conversion
- Band structure
- Crystal chemistry
- Transport properties

FF-2 Novel materials for high efficiency thermal-to-electrical energy conversion
- New thermoelectric compounds
- Nano-composite and nanostructured thermoelectric materials
- Materials for thermionic applications
- Emitter materials and PV diode materials for thermophotovoltaics
- Functionally graded materials
- Structural and mechanical characterisation
- Process modeling and simulation
- New testing methods

FF-3 Devices technologies and applications for thermoelectrics, thermionics, and thermophotovoltaics
- Device design, fabrication, integration and testing
- Cost/performance and reliability issues
- System simulation and demonstration
- Novel and emerging approaches for thermal-to-electrical conversion systems
- Commercialisation and market prospects

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Symposium FG
Magnetic Materials for Energy

Magnetic materials are widely used in several important applicative sectors related to energy conversion, electric power generation, transportation, power electronics and information technology and can play a crucial role in the realization of technologies aimed at energy saving and CO2 emission reduction.

Hard and soft magnetic materials find for example different applications in permanent magnets, and in the generation and conversion of electric power. Their optimisation could benefit different strategic sectors, e.g. hybrid and electric vehicle motors, wind power generation, energy harvesting.

Among energy-efficient technologies an important role is also played by magnetocaloric materials for their possible exploitation in solid-state refrigeration and power generation.

In addition, micro/nano structures based on magnetic thin films pave the way to new classes of devices, sensors and components (e.g. converters, inductors) that can give a strong impact to energy efficiency in important technological sectors such as information technology and the consumer electronics.

This Symposium will highlight recent developments in the realization of novel magnetic materials and devices and in their properties optimisation for ongoing and foreseeable energy applications.

The sessions will welcome contributed papers related to the design, simulation and theory, preparation, processing, characterization and properties optimisation of:

FG-1 Hard magnetic materials
FG-2 Soft magnetic materials
FG-3 Magnetocaloric and multifunctional magnetic materials
FG-4 Magnetic devices and components for energy applications

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The use of solar energy to drive chemical and energy processes, and the chemical storage of solar energy are the key elements to move to a low-carbon economy, sustainable society and to foster energy transition. For this reason, there is a fast-growing scientific interest on this subject, which is part of the general effort for a solar-driven chemistry and energy, the chemistry of the future. Realize this challenge requires the development of new ideas, concepts and innovative photocatalytic materials. Photocatalysts are widely utilized to clean and remediate our environment and their use in advanced devices to produce electrical energy or solar fuels in rapidly expanding. Semiconducting photocatalytic materials possess multifunctional properties, which allow their use in various areas from photocatalytic environmental remediation, water splitting for hydrogen fuel, CO2 reduction, self-cleaning coatings, electrochromic devices and sensors, and low cost solar cells. The nano-architecture design of these materials is of critical relevance to achieve these different functional characteristics and realize an efficient energy conversion. There is the need to gather together multiple competences to accelerate the development of these nanomaterials for solar energy and environmental applications. This Symposium aims to provide a multi-disciplinary forum for scientists, engineers and industry experts to break new ground in the discussion, and realize a cross fertilization and progress in the understanding of the design criteria for their use. Among the recent developments that will be highlighted in the symposium are advances in synthesis of novel materials with tailored nano-architecture; the preparation of thin films and nanostructures; the advanced characterization by experimental and theoretical methods of these materials and of their structure-performance relationships; processing techniques, device fabrication and stability; advances in environmental applications and in air quality improvement; novel concepts, technologies and materials for photocatalysis.

Session topics

FH-1 Design elements and advanced concepts for photofunctional materials
Band-gap engineering of photocatalysts: optical, electronic, and catalytic modifications
Multiphoton band-gap engineering, photonic materials
Superhydrophilic, amphiphilic and antifogging surfaces
Hybrid photocatalytic nanomaterials, Heterojunctions
Optimizing interfaces in multilayer systems
New types of quantum-dots and robust sensitizers, antenna effects

FH-2 Understanding fundamentals of photoinduced processes and charge transport
Charge transfer and recombination
Theoretical and computational investigation
Computational screening of new materials
Relation between nanostructure and photofunctional behavior
Photoelectrochemical devices

FH-3 Design approaches for advanced applications
Development of high surface area and porous photocatalytic materials and photoanodes
Photoactive nanodevices, hierarchical photoactive materials
Innovative materials for third generation solar cells (dye sensitized solar cells, quantum dot cells, tandem/multi-junction cells, hot-carrier cells, etc.)
Photocatalytic solar fuel (H2, CO2 reduction) generation
Selective photo-oxidations for organic synthesis, tandem systems
Environmental applications: air / water treatment, antibacterial surfaces
Photo-catalytic fuel cells, artificial leaf

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Symposium FI
Materials and Technologies for Next Generation Solid State Lighting

There is a stringent demand world-wide for the development and adoption of highly efficient solid state lighting technologies to achieve radical energy savings. LED is now a technology that is finding its path towards the general lighting market, both indoor and outdoor. Significant advances in the understanding of materials, devices and systems are driving the development of novel light sources and light integration concepts.

Despite performances of organic LEDs (OLEDs) are still lower and costs still higher than LED lighting technologies, OLED lighting devices start to benefit from their strong advantages (large surface, lightness, thinness, ability to be color-tunable, flexible and transparent, recyclability). To fully develop its potential and capitalize on its highly desirable figures of merit, OLED technology must address a number of technical, scientific and technological issues related to materials, manufacturing processes, device architecture and system integration. These issues specifically include the development and use of performing phosphorescent emitters and transport materials compatible with dry and wet processes, the development of low cost methods to prepare the substrate – rigid or flexible - with the needed interconnections, the deposition and patterning of the electrodes and the organic stack, the inclusion of photonic structures to tailor the optical properties.

The purpose of this Symposium is to provide a highly cross-disciplinary forum for scientists, engineers and industry experts for ground-breaking cross-fertilization between the different area of expertise in the field of solid state lighting. The symposium will highlight recent advances in the synthesis of novel materials, thin films and nanostructures; characterization of layers and interface properties on the nano- and micro-scale; novel optoelectronic device architectures such as planar and vertical OLETs (organic light-emitting transistors); advanced manufacturing of materials and devices; and innovative photonic structures for tailored light out-coupling.

Topics of interest include (but are not limited to):
- Design and synthesis of novel LED materials
- Design and synthesis of molecular materials, nano-structures and thin-film
- Nanofabrication and assembly techniques for photonic structures
- Advanced optoelectronic device architectures – OLED and OLET
- Optical and electronic properties
- Charge injection and transport
- Modeling of optoelectronic properties of materials
- Device physics and modeling
- Thin films, heterostructures, Interfaces
- Structure-properties relationship
- Dry, wet and hybrid processing and manufacturing
- Device and system integration

Abstracts may be submitted in one of the following sessions:

FI-1 Material design and processing
FI-2 Optoelectronic and photonic processes
FI-3 Electro-optical-structural characterization
FI-4 Device architectures and system integration

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CIMTEC 2014, Montecatini Terme. Pulickel M. Ajayan, Rice University, USA, delivers the Plenary Lecture “Nanoscale Engineering - Challenges and Opportunities”.

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Symposium FJ
Development and Application of New Functional Transparent Conducting and Semiconducting Inorganic Materials

Oxide based electronics are seeing an increasing set of applications based on new materials and the ability to tailor structure and functionality to enable new functionality. This includes improved TCs new semiconductors for high speed and wide bandgap electronics, new piezoelectric materials and photovoltaic absorbers. Achieving this requires an increasingly broad materials set but also structural diversity from amorphous to epitaxial and the inclusion of new hybrid materials. Increasingly diverse structures with complex composition including amorphous and crystalline metal oxide materials as well as wide band-gap nonoxide materials including e.g. nanowire networks and quantum dot structures are extending device designer’s palette of transparent conductors and semiconductors by addressing a variety of cutting edge applications in flexible electronics, new active optoelectronics, even spin photonics. New advanced in materials and processing are also extending the range of the more experienced use of transparent conducting oxides in large area flat-panel displays, thin-film solar cells, antistatic coatings, functional and smart glasses and a number of other applications.

Underlying the development of new functional materials for example organic and nanotube based TCs is the need for a clearer and predictive understanding of basic materials science such as the electronic structure, carrier and trap origin, mobility and scattering, and doping mechanisms which govern conductivity and transparency, coupled with a better insight into interfacial and chemical compatibility issues and the development of models of the performance limits of materials and devices.

Objective of the International Symposium “Development and Application of new Functional Transparent Conducting and Semiconducting Oxides”, which follows the discussions on related subjects held at previous CIMTEC Conferences, is to gather specialists from academia and industry to highlight updated developments in the area from fundamental science to materials synthesis, processing techniques device development and advanced/novel/prospective applications.

Contributions may be proposed in the following or related topics:

FJ-1 Fundamentals
Basic Theory of functional electronic oxides
Materials Genomics of functional oxides including
Electronic structure
Doping mechanisms
Carriers origin and dynamics
Optimizing band structure
Surfaces and interfaces in hybrid structures
Amorphous vs crystalline materials basic physics and application considerations
Characterizations of basic TC properties including inoperando

FJ-2 Material design and device development
Advanced crystalline materials
ZnO based materials
p-type transparent conductors
Indium-free TCs
Amorphous metal-oxide materials
Non-oxide transparent conductors
Nanowire/nanotube arrays and Q-dot based transparent structures
Other novel materials/concepts
Device characterisation and properties
Growth Approaches
PVD/CVD
Atomic layer deposition
Spin coating, spray pyrolysis and other chemical techniques
Direct writing/printing/patterning
Novel tools and equipment for device fabrication
Interfaces and chemical compatibility issues
Modeling and simulation of materials and devices

FJ-3 Applications
Flexible electronics (e.g. roll-up displays, electronic paper)
Transparent devices (TTFTs) and applications including TC active layers
Photovoltaics
Piezoelectrics
Wide Bandgap Power Electronics
OLED/OPV
Advances in smart/functional applications e.g. photocatalytic/active/protective coatings,
smart windows, etc.
Other advanced/novel/emerging applications
Building Applications
Multifunctional materials including porous materials

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Symposium FK
Materials Challenges for Sustainable Nuclear Fission and Fusion Technologies

Nuclear energy, both fission and fusion, will provide a clean, safe, and cost-effective sustainable energy resource, and is expected to grow significantly in order to meet future energy demand globally. This growth should proceed without adverse impacts to global environmental and climate change. To meet this grand challenge several nuclear initiatives were proposed aiming to develop advanced nuclear energy technologies and systems that would meet future needs for safe, sustainable, environmentally responsible, and economical energy. Materials technologies will play a key enabling role to improve economics and long-term reliability of any new advanced nuclear systems. The superior structural material performance will allow higher temperature design and operation for higher thermal efficiency, longer lifetimes, and improved reliability with reduced down time. In addition to the high temperature mechanical properties, resistance to radiation damage is also a key obstacle to improve materials performance and reliability.

The International Symposium on “Materials Challenges for Sustainable Nuclear Fission and Fusion Technologies” will provide an exciting melting pot to foster international collaboration and crosscutting coordination to advance the science and technology of future nuclear fission and fusion energy. The symposium will focus up-to-date advances in materials research and development, nuclear components and systems design, irradiation effect and damage, and theoretical modelling for both advanced nuclear fission and fusion technologies and applications. Advanced materials such as high-temperatures metals, superalloys, ceramics, metal- and ceramic-matrix composites, and functional materials and coatings will be of interest. Basic scientific understanding of radiation effect and damage to the materials microstructure and properties via theoretical modelling and experiments relevant to fission and fusion application environment will also be covered.

Contributions are invited in the following and related areas:

- **FK-1 Structural components for nuclear fission and fusion applications**
  - High-temperature metallic alloys and superalloys
  - Metal-matrix composites
  - Oxide-based and non-oxide-based ceramics
  - Ceramic-matrix composites

- **FK-2 Low activation structural materials for nuclear fusion systems**
  - Ferritic and martensitic alloys
  - Vanadium alloys
  - SiC and SiC matrix composites

- **FK-3 Materials for first wall components of nuclear fusion systems**
  - Plasma facing materials
  - Blanket materials

- **FK-4 Functional materials**
  - Insulators
  - Superconducting magnets
  - Coatings

- **FK-5 Nuclear fuel materials**
  - Processing, microstructure, and properties relationship
  - Oxide-base nuclear fuels
  - Non-oxide-based nuclear fuels
  - Metal-base nuclear fuels
  - Thermomechanical modelling
  - Recycle of nuclear fuels
  - Advanced fuel cladding materials and coatings

- **FK-6 Radiation effects**
  - Defect production and properties
  - Microstructure evolution
  - Mechanical property changes
  - He and H effects
  - Theoretical modelling

- **FK-7 Materials modelling and database**
  - Modelling of performance
  - System design and modelling
  - Materials and mechanical properties database

- **FK-8 Crosscutting materials issues for nuclear fission and fusion systems**

- **FK-9 Systems integration and interface design and components**

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Focused Session FK-10
Materials Issue in Nuclear Waste Treatment and Disposal

This session will focus on the treatment and disposal of low and high level nuclear wastes from commercial power generation, fuel reprocessing, and defense operations. Technologies for interim, short-term, and long-term storage and disposal are of interest, including mature processes as well as new and innovative technologies. The goal of the session will be to identify and provide solutions to materials issues in the global integration of waste treatment technologies.

Specific topics will include:

FK-10.1 Waste form development, including glass, ceramic, and metallic waste forms
FK-10.2 Challenging waste constituents, such as actinides, noble metals, and volatile species
FK-10.3 Waste form modeling, performance testing, and advanced characterization techniques
FK-10.4 Design and operation of waste immobilization facilities
FK-10.5 Repository design, requirements, and licensing

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CIMTEC 1990 - Montecatini Terme.
Along the evolutionary timescale, living organisms have perfected a widespread diversity of highly sophisticated structures, from the molecular to the macroscopic scale, to perform diverse and complex biological functions. These includes not only chemical and biological processes, but also interactions with light and charge transport relevant to many physiological processes.

Only recently material scientists have started to explore photonic, electronic and biomedical devices based on biological and bio-inspired materials. Groundbreaking results have also been shown by the direct use of living organisms to produce materials in situ or as scaffolds for the direct in vivo construction of devices. Hybrid architectures of artificial components (e.g. polymers, nanoparticles) with biological structures can be obtained either by self-assembly and chemical synthesis / modification or directly produced by living organisms.

The symposium “Biological, biohybrid and bioinspired materials: from electronics and photonics to medicine” will cover many classes of biological and bio-inspired materials for a number of applications. These will include photosynthetic pigments and reaction centers, biosilica, calcite, silk, melanins, DNA, and various structural proteins. The symposium will mainly focus on the materials side; it aims to combine the fundamental understanding of physical mechanisms underlying the biological and bio-inspired materials with devices applications, emphasizing the key role of chemical and physical aspects.

This approach is meant to enlarge the community of researchers traditionally involved in materials science, including the contribution of biologists and biotechnologists, thus eyeing up new directions and languages in the future directions of development.

**Session topics**

**FL-1 Classes of materials and their synthesis and chemical modification**
- biological photonic crystals
- plant and bacteria photosystems
- biosilica, calcite and other inorganic materials
- silk
- DNA
- melanins
- cellulose
- structural proteins

**FL-2 Electronic devices with biological and bio-inspired materials**
- sensors
- photodetectors
- memory devices
- transistors
- electronic interfaces with living cells and tissues

**FL-3 Photonic devices with biological and bio-inspired materials**
- photonic crystals
- waveguides
- lasing
- structural colors

**FL-4 Bio-medical devices with biological and bio-inspired materials**
- materials for drug release
- platforms for regenerative medicine
- neuronal interfaces

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Non-volatile memory devices are currently key elements of several electronic and portable systems (digital cameras, solid state disks, smartphones, computers, e-books, tablets,...) and their market and potential applications are expected to continuously increase in the next years. Several advanced non-volatile memory concepts (RRAM, PCM, MRAM, STT-MRAM, FRAM, memristive devices,...), exploiting innovative materials and storage mechanisms, are under investigation to achieve better performance, higher scalability, and to address novel applications for more efficient, intelligent and secure computing systems. Besides pursuing the downscaling of non-volatile memories in terms of minimum size and integration density, the new paradigm is also directed to devices that can integrate multiple functionalities, such as computing and storing information at the same time. This approach will enable the fabrication of novel nanoelectronics circuits with potential applications in several fields, including computing schemes emulating the brain functionality, flexible electronics and non-volatile logics.

This symposium will address recent advances on non-volatile memory devices, with focus on innovative storage concepts, new materials and devices, integration schemes and selectors for the storage elements, understanding and modelling of the physical mechanisms for data storage down to the nanoscale, memristive devices and novel applications for von Neumann Computing and beyond.

Session Topics

FM-1 Magnetic, ferroelectric and multiferroic materials for memory devices
MRAM and spin transfer torque (STT) MRAM memories

FM-2 Resistance switching (RRAM) and Phase Change (PCM) Memories
Advances in materials and technologies for resistive memories (RRAM and PCM)
Advanced characterization techniques, theory and modelling of resistive memories
New materials and concepts for PCM, including low-dimensional cells, layered and super-lattice phase change materials
RRAM based on graphene and 2D materials
Polymer-based and hybrid organic & inorganic memory devices
3D architectures, cross-bar arrays and advanced selectors

FM-3 Emerging applications for non-volatile memories
Memristive devices and novel memristive-based circuits
Materials and devices for neuromorphic-engineering and brain-inspired computing
Non-volatile logics based on resistive memories and hybrid CMOS/non-volatile memory circuits
Flexible electronics, radiation-hard memories, space applications
The 6th International Conference “Novel Functional Carbon Nanomaterials” will highlight recent achievements and challenges in the synthesis, structural control and modeling of carbon allotropes including nanodiamonds, diamond-like carbon, fullerences, nanotubes, graphene and graphene-related structures, as well as high surface area carbon networks, which are promising for a range of emerging applications in energy conversion and storage, water purification, high-speed nanoelectronics, optoelectronics, photonics, quantum information processing, quantum computing, biosensing, drug delivery, medical imaging, thermal management, catalysis, lubrication, etc.

All aspects of new chemistry, science and technology of growth, functionalisation, characterisation, and electronic, optical, mechanical, thermal and biomedical applications will be covered. Of special interest will be the development of multifunctional and hierarchical architectures based on nanocarbons as building blocks and on integration technologies of carbon-based nanostructures with other inorganic or organic materials to realize micro/nanodevices encouraging novel viable approaches in interfacing materials science, engineering and biology.

**Session Topics**

**FN-1 Growth and processing**
- 2D structures – graphene and beyond
- 1D structures – nanotubes and nanofibers
- Nanodiamond: synthesis, deagglomeration, purification, functionalisation
- DLC and nanodiamond coatings: CVD and epitaxy for large area growth
- Solution processing of carbon nanomaterials
- Roll-to-roll processing and layer transfer techniques
- Hybrid and multilayer materials
- Top-down and bottom-up growth techniques for CNTs, graphene and other nanocarbons
- Assembly into hierarchical architectures and heterostructures
- Core-shell structures
- In-situ monitoring of growth

**FN-2 Structural characterization**
- Structure, texture and topography
- Surfaces and interfaces
- Characterisation methods at single nanoparticle level
- Solid state, electronic, vibrational structure
- Structural defect states and impurities
- sp2-sp3 bonding distributions
- Spectroscopic techniques (Raman, NEXAFS, etc.)
- Surface characterization (STM, AFM, NSOM, RAS, etc.)
- X-ray optics and detections

**FN-3 Properties**
- Electrochemical properties
- Electron transport (bulk injection junction)
- Ionic transport in carbon nanostructures
- Surface conductivity
- Electron emission (field, photo and electron stimulated)
- Superconductivity
- Doping and defects
- Non-linear optical, photonic and optoelectronic properties of carbon nanostructures
- Thermal properties
- Mechanical and tribological properties
- Graphene and carbon nanotube mechanics (fracture, exfoliation)
- Catalytic properties
- Biological activity

**FN-4 Applications**
- Active and passive devices (field effect transistors, field emitters, displays, electron multipliers, radiation detectors, sensors, magnetic and electronic data storage)
- Nanoelectronics, spintronics, quantum information processing
- Optics and photonics
- Energy harvesting: solar cells and other methods
- Energy storage and conversion (batteries, supercapacitors, fuel cells, thermoelectrics, solid state lighting)
- Water desalination and purification
- Catalysis
- Thermal and mechanical applications (heat sinks, heat spreaders, nanolubricants, etc.)
- MEMS/NEMS for mechanical, electrochemical, sensor etc. devices
- Biosensors, gas sensors
- Biomedical applications: bio imaging, drug delivery, regenerative medicine

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Superconductivity is a complex and fascinating macroscopic quantum phenomenon with a variety of useful applications, and it is of major interest both for its fundamental aspects as well as for its prospective impact on future technology. Since the discovery of superconductivity in the cuprates and huge outburst of research activity that it generated, a key challenge remained the understanding of mechanisms of unconventional superconductivity, still under debate in spite of many relevant advances in research and materials development.

Meanwhile many new superconductors have emerged, including ruthenates, cobaltates, borides, borocarbides, doped fullerences and intercalated graphite, organic, heavy-fermion superconductors, and recently hydrides and related materials. They are all accompanied by in-depth characterization of their physical properties by means of a variety of experimental approaches and by successful applications in wires, tapes, processing in electronics and in novel nano-structured technologies.

In recent years novel families of unconventional superconductors have been discovered and have stimulated strong scientific interest: the Fe-based pnictides REFeAsO, MFe2As2, Fe(SeTe), where high-Tc superconductivity is occurring without the Cu ions (characteristic element in cuprates) and in the presence of Fe ions, suggesting in turn that magnetic interactions are the essential ingredients for the underlying microscopic mechanism. Furthermore, latest progress in hydride superconductors will receive due attention as the latest progress is very encouraging. This Conference follows those on the analogous topics in 1990, 1994, 1998, 2002, 2006, 2010 and 2014 organized in the frame of CIMTEC. On one side it will highlight the progresses achieved along the last years in the various issues of fundamental and technological character of the already known superconducting materials. On another side, the Conference will be focused on the recently discovered materials, their characterization, synthesis and processing and the prospective applications. Following the mission of the previous conferences of this type, the focus will be on novel aspects, issues and systems, but attention will be paid as well to all superconducting-related topics, including fundamental aspects of theory, advances in synthesis, functionalization and processing and the latest progresses on the areas of the devices at small scale and large scale ranges.

Session Topics

FO-1 Materials, structure, physical chemistry and general properties
- Oxides (cuprates, insulating cuprates, cobaltates, ruthenates and other oxides)
- Borides and borocarbides (MgB2 and other borides)
- Carbon-based superconductors (fulleride, nanotubes, organic superconductors, intercalated graphite)
- Heavy-fermion superconductors and quantum-critical materials
- Superconducting topological insulators
- Interface superconductivity
- New phases and metastable superconducting high-Tc materials
- Hydrides and related materials

FO-2 New superconductors of the pnictides and related families
- Structural properties (XRD, neutron scattering, electron diffraction, EXAFS, XANES, STM, SEM, TEM)
- Material processing (powder synthesis, single crystal and film growth)
- Order parameters, pseudo-gap, tunnelling, point-contact Andreev-reflection and related experiments
- Phase competitions, quantum critical points and other mechanisms for superconductivity
- Multiband character and related effects
- Superconducting fluctuations and related effects
- Superconductivity under pressure

FO-3 Properties of superconductors (of any type)
- Spectroscopic techniques (optical spectroscopy, IR, Microwave, Raman, NMR, ESR, µSR, inelastic neutron scattering, Mossabuer, AFM, XAS, acoustic spectroscopy)
- Photoemission and ARPES
- SQUID and tunneling spectroscopies
- Thermal, magnetic and electrical properties
- Electric field effect, structures and devices
- Pressure, strain and dimensionality effects

FO-4 Theory and mechanisms (for normal and superconducting states)
- Correlation effects, spin liquids and quantum criticality
- Phonons, spin excitations and strong coupling
- Inhomogeneous order parameters
- Stripes, phases separation and granularity effects
Pressure induced superconductivity
CDW, SDW and superconductivity competition; coexistence of magnetism and superconductivity
Unconventional superconductors: phenomenology and theory

FO-5 Vortex lattice physics
Vortex dynamics
Understanding and control of flux pinning
Electromagnetic characterization of superconductors over wide parameters ranges
Vortex-defect interactions, defect structures, vortex penetration
Complex vortex phases and related phenomena

FO-6 Synthesis and processing
Films, multilayer, wires, tapes and coated conductors
Heterostructures and interface nanoengineering
Josephson junctions and JJ arrays
Nanostructured superconductors
Proximity and interface effects, hybrid structures
High pressure materials

FO-7 Power applications
Cables, transformers, motors and generators, current limiters and magnets
Magnetic energy storage, high field magnets and accelerator technology
MRI and MEG novel devices
New prospective applications

FN-8 Low power applications and superconducting electronics
Microwave filters and passive devices
Josephson and digital devices
Novel SQUID systems, hybrid electronic devices
Superconducting qubits
Single photon nanosized detectors

FP - 12th International Conference
Medical Applications of Advanced Biomaterials and Nano-biotechnology

The convergences of materials, electronics and biological systems at the nanoscale are fuelling unprecedented opportunities in the biomedical field through groundbreaking inventions / innovations in diagnosis and therapy. Major objectives of this conference, which follows the conferences on the same subject held in previous CIMTEC editions, is to provide a synergic approach covering applied chemistry and physics, materials science, electronics, biochemistry and medicine to enlighten how deeper insights into biological events and their interplays with nanotechnology can support the development of new generations of materials, micro- or nano-devices, molecular level approaches and advanced characterizations to address major medical problems.

The conference particularly aims to report recent progress in the synthesis and characterization of new or creatively modified stimuli-responsive, active and multifunctional metals, ceramics, polymers, gels; smart nanoparticles, functionalized 1-D and 2-D nanostructures, Q-dots; hybrids, composites, self-organized materials, hierarchical bio-nanostructures; as well as the potential for their implementation in selected challenging areas of nanomedicine such as (i) multi-scale approaches to regenerate and engineer new soft tissues and hard tissues, (ii) innovative targeted drug delivery and release platforms, and (iii) new materials and systems for medical diagnosis and therapy including multi-modal theranostics. Progress on more “traditional” clinical implants and devices that make use of new microstructured, smart, high strength materials, ultra-low friction and wear materials, high performance bioactive coatings, etc. will also be covered.

Overall, the study of systemic interactions in the body environment such as side effects, biocompatibility and biofunctionality will be essential issues to promote the discussion for bioinspired strategies in materials and device design to be effectively implemented into clinical practice.

Session Topics

FP-1 Advances in biomaterials
Biodegradable polymers
Bioactive and biodegradable ceramics, glasses and glass-ceramics
Biodegradable metals
Hydrogels and hydrocolloids
Nanophase and nanostructured biomaterials, thin film, coatings, fibres
Functional nanoparticles, I-D and 2-D nanostuctures
Stimuli-responsive polymers and gels, liquid crystalline elastomers
Shape-memory and shape-changing polymers and metal alloys
Multifunctional thin films and coatings, multilayer constructs
Antimicrobial materials
Active or stimuli-responsive hybrids and composites, self-organized hierarchical nanostuctures
Supramolecular materials, natural or bio-inspired materials, self-assembled materials
Synthesis, characterization, modelling of structures and functions

FP-2 Tissue engineering and regenerative medicine
Biofabrication of cells and tissue constructs
Additive manufacturing, bio-printing
3D scaffold design, fabrication and evaluation
Layered or graded scaffold structures
Microfabrication techniques (microfluidic tools, bioimprinting, micro/nanopatterning)
Growth factors delivery vehicles
Biomaterials for modulating stem cell microenvironment
Vascularization of tissue-engineered constructs
Self-healing mechanisms
Biomimetic materials for engineering load-bearing tissues
Biomechanics of soft tissues and hard tissues
Evaluation of tissue engineering constructs in laboratory and/or in pre-clinical settings
Mechanobiology of tissue regeneration

FP-3 New therapeutics and intelligent drug/biomolecule/gene delivery systems
Advances in system-responsive materials for delivery systems
Drug targeting, targeting and imaging agents to site-specific delivery
Controlled release systems, triggering mechanisms
Biomaterials constructs for temporally controlled release of multiple factors
Progress in imprinted recognition release systems and implantable micro- or nano-delivery devices
In vitro and in vivo studies, models for drug transport, absorption, metabolism, retention mechanisms and toxicological issues

FP-4 Nanomaterials systems for bio-imaging and theranostics
Synthesis and characterization of inorganic and organic nanoparticulate systems for bio-imaging: metallic, metal oxide, QDs, nanotubes, nanowires, polymers, liposomes, dendrimers, ... Functionalized agents/devices for in vitro and in vivo imaging, diagnostics and therapy (magnetic, photoacoustic, thermal, radiological, multimodal, ...)
Theranostic nanocarriers, multimodal theranostic agents
Multifunctional theranostic nanoplatforms
Biomedical imaging (MRI, MPI, PET, SPECT, ...)

FP-5 Clinical translations in diagnosis and therapy, and in implantable prostheses and micro-nano devices
Musculoskeletal, cardiovascular, dentistry, ENT surgery, ophthalmology, dermatology, post-traumatic, etc.
Implantable neural interfaces
Modelling of tissue/implant systems
Cellular mechanics, micro- and nano-mechanics of tissue/implant interface, biofluid mechanics, numerical simulations
Biological performance: biocompatibility, biodegradation and biological mechanisms of implant failure, host response
Qualification and testing methods
Studies on retrievable implants
Computer aided design and additive manufacturing
Venue
CIMTEC 2018 will be held in Perugia, splendid chief town of Umbria region, placed in the middle of Central Italy. The city is about 170 km from Rome and is placed in a strategic position to reach the most interesting historical and tourist places in Umbria, such as Assisi, Orvieto, Spoleto, Todi, Spello, Gubbio, Montefalco, Trevi, Trasimeno Lake and several others. CIMTEC 2018 includes the “14th International Ceramics Congress” (June 4-8, 2018) and the “8th Forum on New Materials” (June 10-14, 2018).

Conference Venue
Centro Congressi Hotel Quattrotorri
Via Corcianese 260
06074 Perugia - Italy

Technical Sessions of the Ceramics Congress will start Tuesday June 5 morning and continue until Friday June 8 evening. Technical Sessions of the Forum on New Materials will start Monday June 11 morning and continue until Thursday June 14 evening.
The Conference Venue is about 8 km outside Perugia center and cannot be reached easily with public services. A complimentary transfer service between the Conference Hotels and the Conference Venue will be made available for Conference Members.

Scientific Programme
The scientific programme will consist of Plenary, Key-Note, Invited, and Oral and Poster contributions. English will be the official language of the conference.

Abstract Submission
Abstracts are to be submitted on-line by the Presenting Author and prepared according to the on-line Abstract Instructions available at the Congress web site:

http://2018.cimtec-congress.org

Electronic submission ends on October 15, 2017. Acceptance notification will be provided by December 15, 2017. Multiple abstracts from the same Presenting Author are not accepted, in order to open opportunities for the broadest possible participation. Abstracts of previously unpublished matter shall only be submitted. Abstracts of all scheduled oral and poster presentations will be made available on the conference web site to all registered participants at least 15 days in advance of the Conference.

Presentation Formats
Oral Presentations
Electronic presentation (Power Point) facilities will be available including LCD high resolution projector, PC and laser pointer. Cost for any special audio-visual request will be the responsibility of the individual speaker.

Poster Presentations
Authors are kindly asked to follow carefully the guidelines for Poster Preparation that will be made available at the conference web site. Attendance by at least one of the authors is requested for poster presentation.

Publication Policy
CIMTEC organizers will NOT retain the copyright of the contributions presented at the whole CIMTEC 2018. Therefore Authors may submit their contribution to any journal or other media sources they find appropriate.

Social Programme
The Social Programme will include various social activities. Details will be given in the Final Announcement.

Companions Programme
Guided visits to Perugia, Assisi, Todi, Gubbio, Orvieto and other places of high historic, artistic and tourist interest will be available to companions. Detailed programme and registration information will be provided in the Final Announcement.

Provisional Registration
Prospective participants are kindly requested to Pre-register at CIMTEC 2018 website. Presenting Authors shall not Pre-Register as they are automatically filed when submitting the Abstract. The Final Announcement including the Provisional Programme, the Final-Registration Form and the Hotel Booking Form will be made available by March 15, 2018.

Registration Fees

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<thead>
<tr>
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<th>Ceramics Congress</th>
<th>Forum</th>
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<tbody>
<tr>
<td>Full Member</td>
<td>720.00 EUR</td>
<td>720.00 EUR</td>
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<tr>
<td>Student</td>
<td>420.00 EUR</td>
<td>420.00 EUR</td>
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<tr>
<td>Late and on site</td>
<td>800.00 EUR</td>
<td>800.00 EUR</td>
</tr>
<tr>
<td>Full Member</td>
<td>470.00 EUR</td>
<td>470.00 EUR</td>
</tr>
<tr>
<td>Student</td>
<td>470.00 EUR</td>
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Fees include 22% VAT, general and secretariat costs, participation in the scientific sessions, coffees, lunches, printed booklet of the final programme and other conference material, participation in the Social Programme.

Accommodation
Hotel accommodation (B&B) prices range from about 160 EUR/day for 5-stars hotel to about 70-75 EUR/day for 3-stars hotel. Further information and hotel booking forms will be provided with the final announcement and in the web.

Weather
The weather in Perugia at the beginning of June is usually fine with temperatures ranging from 20 to 25 °C during the day and 12 to 15 °C during the night. Clothing suitable for (early) summer is recommended.

Visa Application
All travel, lodging and registration expenses will be the responsibility of the individual participants. Special letters of invitation to be used for Visa application will be provided upon written request addressed well in advance to the Conference organizers, info@technagroup.it including the following information: date of birth, place of birth, nationality, affiliation, full postal address, passport number, issue and expiring dates of the passport.
How to reach Perugia
Perugia is located in Central Italy about 170 km from Rome, and can be reached:

By plane:
To Rome - International Airport “Leonardo da Vinci”.
To Perugia - International Airport of Umbria-Perugia “San Francesco d’Assisi”
A complimentary bus transfer from the airport to Perugia will be available to Members accommodated in Conference Hotels on arrival days (June 4 and June 10, 2018).

By train:
From Rome: Reach the Roma Central Railway Station (Stazione Termini), take the line Rome-Ancona and go down to Foligno Station (about 120 min). Then take the local train to Perugia (30-35 min).

By car:
Perugia can be reached easily by car from any direction via the network of Italian highways.

SUMMARY OF DEADLINES
October 15, 2017
Submission of Abstract
December 15, 2017
Notification of Abstract acceptance
April 20, 2018
Registration at reduced rate

INFORMATION AND CORRESPONDENCE
CIMTEC 2018
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Web site: www.cimtec-congress.org

Congress Center Quattrotorri - Auditorium
A selection of endorsing and cooperating bodies of CIMTEC Conferences

Commission of the European Communities • National Research Council, Italy • Italian National Agency for New Technology, Energy and the Environment • Academy of Sciences of Romania • Academy of Sciences of Russia • Academy of Sciences of Ukraine • World Academy of Ceramics • International Union of Materials Research Societies • International Ceramic Federation • International Institute of Welding • ASM International • International Union of Pure and Applied Chemistry • International Union of Pure and Applied Physics • International Standards Organization • International Thermoelectric Society • The International Society for Optical Engineering • International Association for Structural Control and Monitoring • Versailles Project for Advanced Materials and Standards • European Association of Composite Materials • European Committee for Standardization • European Optical Society • European Society for Biomaterials • European Thermoelectric Society • EURO-CVD • Federation of European Materials Societies • Royal Institute of British Architects • American Carbon Society • Brick Institute of America • The American Institute of Architects • American Powder Metallurgy Institute • American Society for Composites Institute of Electric and Electronic Engineers • Italian Center for Composites • Italian Institute for the Physics of Materials • Italian Physical Society • Italian Society for Optics and Photonics • Japanese Orthopaedic Ceramic Implant Society • Optical Society of America • Society for Biomaterials, USA • The Electrochemical Society, USA • The Japan Society for Applied Physics • The Japan Society for Biomaterials • The Japan Society of Mechanical Engineers • The Japan Society for Composite Materials • The Society for Fiber Science and Technology of Japan