Book of Abstracts

DAY 1 - 10/06/2025

PLENARY #1 Xudong Yang, Department of Building Science, Tsinghua University, China : "*Performance Based, Energy Efficient Indoor Air Pollutant Control*"

Background: Modern built environments are filled with various natural or man-made air contaminants. Attention has been paid to the increasing sensitivity of the public to potential health implications of indoor air quality (IAQ). Performance-based approach which is built upon accurate modeling and simulation of indoor air pollutant characteristics, has obvious advantages over the "prescription-based method" to achieve better indoor environment with higher energy efficiency. Unfortunately, the IAQ world seems not ready to move into this route that the building energy field has adopted for decades.

Methods: Emission source control, effective ventilation, and air cleaning are the three approaches to achieve better indoor air quality. Laboratory and field measurements of air contaminant levels as well as source/sink characteristics are the key to forming effective control solutions. On-line air pollutant monitoring provides an extended "eye" to reach out remote sites at larger scale and collecting "big data." Advanced simulation technologies combining these key features provide an effective tool to predict the indoor contaminant levels and optimize the control strategies. New functional materials are at the forefront of technology development in order to achieve long-term goal of indoor air pollution control and prevention.

Contents: The presentation will discuss the key approaches in actively preventing indoor air pollution from happening in the first place. Mechanistic air quality models based on sound laboratory test data have emerged in recent years. Field verifications at different levels of complexity and time duration have also been tried. Advanced air cleaning could potentially reduce the demand of ventilation requirement, achieving the dual goal of improving IAQ and reducing energy consumption. However, a lot more efforts are required to bring new technologies into engineering practice. The presentation will conclude by listing a number of opportunities and challenges to make research results readily useful rather than simply academic exercises.

KEYNOTE #1 Christian Serre, ENS, CNRS, ESPCI, France : "*Porous solids for sustainable energy efficient indoor air quality*"

Keywords: Metal Organic Frameworks, indoor air quality, heat reallocation, shaping, scale-up

At the Institute of Porous Materials from Paris, we have devoted a long-term effort to the synthesis and structural characterization of new functional, robust, porous (and scalable) MOFs based on high valence transition metal cations constructed from various types of ligands (carboxylates, phosphonates, phenolates).[1] For instance, robust Al, Zr of Fe polycarboxylates based MOFs have been extensively explored for heat reallocation,[2] as well as, more recently, for the capture or degradation of air pollutants (Volatile Organic Compounds, NOx),[3], including in a view of cultural heritage preservation.[4] Prior any practical use, this requires their scale-up and shaping under green scalable routes.[5] Finally, we will show a few representative examples of their utilisation for low energy penalty efficient indoor air quality systems.[6]

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DAY 1 - 10/06/2025

ORAL #1 **Matthias Thommes**, Institute of Separation Science and Technology, Department of Chemical and Bioengineering, Friedrich-Alexander-University Erlangen-Nürnberg, Erlangen, Germany: *"Recent Advances in the Adsorption Characterization of Nanoporous Materials"*

Nanoporous materials (e.g. carbons, zeolites, metal organic framework materials, ordered and hierarchically structured meso-macroporous oxides etc.) have been the subject of extensive research targeted towards a wide range of applications because of their unique textural properties such as increased surface area and the ability to customize the pore size and pore size distribution. In addition, unique nano-confinement effects, such as for instance enhancements in the adsorption capacity, reaction kinetics, ion selectivity and gas solubility can be observed within narrow nanopores. Moreover, confinement induces shifts in the phase diagram of pore fluids and alters their thermophysical properties. Hence, in order to utilize effects of nano-confinement in the various application areas (e.g.,separation, catalysis, gas-energy storage) a detailed understanding of the interplay between effective fluid-fluid and fluid-(pore) wall interactions on the one hand and the effects of confined pore space and pore geometry/pore network on the other hand is required. For this, a detailed characterization of the surface properties and pore network architecture is required.
Within this context, we focus on fundamental aspects associated with the adsorption-, phase- and wetting behavior of fluids in nanoporous materials and will link this with recent advances in the application of advanced and novel adsorption methodologies for assessing key aspects of their pore network characteristics and surface properties.

ORAL #2 **Jianhua Fan**, DTU, Denmark : *"Smart Phase Change Materials for Thermal Energy Storage"*

The presentation discusses the development of a flexible thermal energy storage system based on the stable supercooling of sodium acetate trihydrate (SAT). It highlights the key challenges in latent heat storage, including low thermal conductivity, phase separation, and unstable supercooling, and explores material modifications to overcome these barriers. Various additives, such as extra water, thickening agents, and liquid polymers, were investigated to enhance stability and performance. Experimental studies on SAT-based heat storage units demonstrated high heat transfer rates, stable supercooling, and efficient latent heat release. The findings contribute to advancing PCM-based thermal storage for sustainable energy applications.

ORAL #3 **Guillaume Maurin**, ICGM, Univ. Montpellier, CNRS, ENSCM, Montpellier, France: *"Computational approaches to MOFs in Indoor Air Management"*

Metal-Organic Frameworks (MOFs) are an emerging class of porous solids for the selective capture of contaminants and for water-sorption based heat reallocation. The number of crystal structures is growing exponentially and they cannot be all tested experimentally for these overall applications. Advanced molecular simulations, High-throughput computational screening and Machine Learning tools play a key role to narrow down the list of candidates and gain in-depth understanding of the microscopic mechanisms in play to further provide design rules to develop MOFs with improved performances. This presentation will deliver recent illustrations in the field of indoor air contaminant capture, water-based heat pump/chiller and dehumidification.

ORAL #4 **Rafik Belarbi** *1,2*, La Rochelle University, France : *"Development of Eco-Friendly Material in Sustainable Buildings"*
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2 Department of Architecture, Canadian University Dubai, Dubai, UAE

The building sector faces a pressing need to reduce both energy consumption and environmental footprints. This work examines eco-friendly materials grounded in natural fibers and recycled aggregates, aiming to boost occupant comfort and durability under varied climatic conditions. A multi-scale methodology—combining microtomography, advanced heat-air-moisture (HAM) modeling, and field measurements—captures how these materials moderate indoor humidity, reduce condensation risks, and lower life-cycle impacts. Our numerical approach accounts for sorption hysteresis and advection, enabling accurate predictions of thermal and hydric behaviour across diverse operating scenarios.

Our numerical approach encompasses sorption hysteresis, advection, and thermos diffusion, enabling precise simulation of moisture transport and temperature variations within both conventional and bio-based envelopes. Laboratory experiments use a dual-climatic chambers to replicate external conditions such as temperature and humidity levels, providing direct validation of model accuracy. At the same time, image-based modeling identifies how microstructural changes—including pore connectivity and swelling phenomena—affect water retention and potential risks of fungal growth or material degradation.

A similarity law was applied to shorten the timescale required for investigating the aging of plant-based materials. Scaled-down experimental configurations were designed to faithfully reproduce, within reduced durations, the moisture and heat transfers observed at full scale. The consistency between both scenarios was verified, enabling the optimization of wetting-drying cycles and accelerating the evaluation of degradation processes. Furthermore, phase change materials (PCMs) were incorporated into vegetal concrete formulations to store and release latent heat, resulting in enhanced thermal regulation and reduced temperature peaks in building envelopes. Climate chamber assessments showed a significant attenuation of temperature fluctuations, without compromising mechanical or environmental properties. These approaches pave the way for durable, high-performance construction solutions that address contemporary comfort and energy-saving requirements in the building sector.

Results show that hemp-lime concretes, recycled glass composites, and vegetated roof systems effectively mitigate temperature swings, cut energy use, and enhance indoor air quality. We also highlight the effect of aging on mechanical properties and underscore the synergy between design strategies and material selection. These findings reveal the advantages of integrating advanced material characterization, building simulation, and life-cycle analysis to devise sustainable envelopes that align occupant comfort with environmental objectives. The proposed framework offers a robust path toward resource-efficient, resilient building solutions tailored to a range of climate zones.

PLENARY #2 **Mircea Dinca**, Princeton University, USA : "*Building water-stable MOFs for Buildings", Mircea Dincă, Julius J. Oppenheim, Adam J. Rieth, Karla Ravin*

Metal-organic frameworks (MOFs) have emerged as serious contenders as advanced materials for enabling water sorption-based climate control applications. These include atmospheric water capture, heat pumps, desiccation, humidity control, and thermal batteries. Here, I will discuss the fundamental chemical principles that allow MOFs to display water stability as would be required in such applications[1]. I will show how thermodynamic principles allow the derivation of "isoreticular curves", which predict the relationships between the pore features of a given material and the measurable water sorption properties, namely critical relative humidity for condensation, maximal capacity, and pore size or temperature for the onset of water sorption hysteresis[2]. Through this analysis, we propose guidelines for the maximization of sorption capacity at a given relative humidity with minimal hysteresis and discuss the theoretical limits for capacity at low relative humidity.

On the application side, I will show how MOFs have enabled a new design for efficient air-conditioning systems that are commercially deployable in both industrial and residential settings.

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KEYNOTE #2 **Jensen Zhang**, Executive Director, SyracuseCoE – New York State Center of Excellence in Environmental and Energy Systems, Syracuse University, USA; Professor, Department of Mechanical and Aerospace Engineering, College of Engineering and Computer Science, Syracuse University, USA; Visiting Professor, School of Architecture and Urban Planning, Nanjing University, China : "*Managing IAQ at Multiple Scales and the Role of Air Cleaning"*

Indoor air quality (IAQ) is vital to human health, wellbeing and performance as people typically spend over 80% of their time indoors. Indoor pollutants originate from both indoors and outdoors. To devise an energy-efficient and cost-effective approach to improving IAQ, it is necessary to consider source control, ventilation and air cleaning strategies across multiple scales – from the outdoor environment around buildings to inside buildings, to rooms, and to the microenvironment around the occupants that directly affect the human exposure and intake of the pollutants. In this talk, we first present a 3-dimensional view of the IAQ engineering: the scales (of environments), the species (of pollutants) and strategies (of IAQ control and assess the potential and limits of the various IAQ control strategies across the different scales. Attention will then be given to the role of air purification. Various air cleaning and purification technologies such as filtration, ionization, catalytic oxidization, biofiltration, sorption by both traditional sorbents (e.g., activated carbons) and more advanced materials (e.g., MOFs - Metal Organic Frameworks) will be evaluated. They will be compared for their performance and efficacy under realistic indoor space conditions. The talk will end with an outlook to the future challenges in air technology development and applications for the built environment as well as a brief introduction to SyracuseCoE's approach to advancing the field through academic-industry collaborations.

KEYNOTE #2 Jensen Zhang : "*Managing IAQ at Multiple Scales and the Role of Air Cleaning*" (continued)

KEYNOTE #3 Ioannis Papakonstantinou, UCL, UK : *"Harvesting Energy from the Cold Universe: The Missing Piece in the Renewables Puzzle?"*

On a bright, warm day, the more than 1TW of installed solar power capacity Worldwide works tirelessly to light up our houses, charge our cars, power our business and in general, to seamlessly support our daily lives. This remarkable achievement has been made possible by over 60 years of advancements in photovoltaics, which convert the incoming Solar radiation into useful energy. However, for the Earth to maintain a stable temperature, it must dissipate heat at a rate roughly equal to the power it receives from the Sun. This natural thermoregulation process, known as radiative cooling, taps into the infinite heat capacity of the ultracold Universe to release excess heat from Earth's surface into the outer space. Recently, scientists have recognised that this vast, outgoing heat transfer could be harnessed, offering a new renewable pathway toward sustainable energy transition. This talk will cover the fundamentals of radiative cooling, will discuss recent advances in the photonic innovations lab, and will conclude with practical applications including passively cooling our spaces and vehicles, generating electricity in the dark, co-harvesting energy from the Sun and the outer space and more.

ORAL #5 Lei Fang, Department of Environmental and Resource Engineering, DTU, Denmark : "*Application of water phase change for heat storage in solar heating systems*"

Heat pump is an energy-effective technique to heat buildings using available environmental heat sources. Solar irradiation and ambient air are the most accessible heat sources; however, the availability of solar irradiation and the temperatures of ambient air are unstable. To provide constant heating, heat storage is required. Water is the most used medium for heat storage due to its sustainability, low cost, and environmental friendliness. In practice, the acceptable volume of the water tank and the water freezing point limit the heat storage capacity of a water tank. This lecture presents a special technology that can extract both sensible and latent heat of water. It doubles the energy storage density of a water tank and increases 100% heating output by collecting the low-temperature ambient heat.

ORAL #5 Marco Daturi, Université de Caen, ENSICAEN, CNRS, France : "*The relevance of spectroscopic techniques to select and design porous materials for indoor air quality*"

Indoor air quality represents a main concern in urban areas. To face this problem, intense efforts are provided by a number of research groups worldwide, exploring different approaches for air filtering, pollutant absorption and/or direct catalytic abatement of pollutants. Porous materials (and specifically MOFs) represent one of the best options for highly performing and sustainable materials. In this speech, we will show (via different case studies) how vibrational spectroscopy can shed a light on the physical and chemical properties of the porous solids to understand and enhance their sorption properties, selectivity and sustainability. Examples will be provided on different investigations for VOC adsorption, molecular conversion at low temperature, and air humidity regulation, using an unique platform equipped with state-of-the-art techniques.

ORAL #7 **Huibo Zhang**, Department of Architecture, School of Design, Shanghai Jiao Tong University, China : "*Hygrothermal performance of cost-effective porous materials using alkaline-activated inorganic cementitious additives", H. B. Zhang, and W. X. Lv*

This study systematically investigates the hygrothermal behavior of eco-friendly porous humidity regulation materials synthesized through an alkaline activation process. Four distinct substrate materials - expanded perlite, coal gangue, expanded vermiculite, and natural zeolite - were fabricated into composite matrices using novel inorganic cementitious binders derived from alkali-activated synthesis. Comprehensive characterization was conducted through coupled experimental analysis of thermophysical properties, moisture transport dynamics, and microstructural evolution via mercury intrusion porosimetry (MIP) and scanning electron microscopy (SEM).

Experimental results demonstrate that all synthesized composites exhibit exceptional moisture adsorption-desorption hysteresis characteristics, with coal gangue-based (MBV = 4.23 g/(m^2•%RH)) and perlite-based (MBV = 3.54 g/(m^2•%RH)) materials achieving superior moisture buffer values (MBVs) exceeding established thresholds for effective hygroscopic regulation. Microstructural analysis revealed a statistically significant correlation (R^2=0.95) between MBV enhancement and the volumetric fraction of sub-10 nm mesopores, while capillary saturation capacity showed strong dependence (R^2=0.90) on open porosity metrics. Additionally, thermal conductivity exhibited a linear relationship with gravimetric moisture content, indicating coupled heat-moisture transfer mechanisms.

Field validation under natural summer conditions demonstrated practical efficacy, where perlite-based coatings and prefabricated panels reduced interior relative humidity fluctuations by 6.2% and 31.1% respectively compared to non-treated benchmarks during hygric loading cycles. The optimized material systems present dual advantages: 1) cost-efficient utilization of industrial byproducts (coal gangue incorporation >40 wt%), and 2) scalable manufacturing through ambient-temperature curing processes.

These findings establish a microstructure-property-performance framework for designing alkali-activated cementitious composites, providing critical insights for developing sustainable building envelopes with passive humidity regulation capabilities. The proposed materials offer viable solutions for energy-efficient indoor climate management, particularly in tropical and subtropical regions facing high humidity challenges.

ORAL #8 **Alba Marcellan**, ESPCI - Sorbonne university, France : "*Biobased, biodegradable, tough hydrogels from itaconic acid monomer",*

Hiam Abou Khachfe[1,2], Etienne Barthel[1], Nadège Pantoustier[1], Carine Robert[2], Alba Marcellan[1]
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2- Institut de Recherche de Chimie Paris IRCP, UMR 8247 (PSL – Chimie ParisTech)

Hydrogels are 3D cross-linked polymer networks capable of retaining significant amounts of water within their structure and still have the properties of solid materials. They can help reduce the need for traditional raw materials while maintaining interesting mechanical and functional properties.

Hydrogels materials have been increasingly studied and developed for various applications. Initially employed in hygiene products, their use has expanded to include food packaging, agriculture applications and even chemical sensors. Hydrogel also find applications in biomedicine, thanks to their swelling properties. However, most of these commercial hydrogels are petroleum-based and non degradable, resulting in serious environmental concerns.

To overcome these limitations, various natural polymers such as collagen, chitosan, alginate, cellulose, etc. have been used as potential substitutes for petroleum-derived synthetic hydrogel. Even though they are bio-based and biodegradable, the high molar mass of these polymers complicates the control of their architectures. Additionally, they often require grafting with petroleum-derived monomers to achieve desired swelling properties.

In this context, we successfully developed a fully biobased hydrogels using itaconic acid, a biobased monomer extracted from Aspergillus terreus fungi. The synthesis was optimized to occur under mild, environmentally friendly conditions, utilizing itaconic acid to create the hydrophilic polymer network, thereby offering a renewable and eco-friendly alternative to traditional petrochemical-based acrylates hydrogels. A series of gels was synthesized by exploring the effect of cross-linking density and cross-linker nature. These gels were stable in water, with an outstanding water capacity, exceptional swelling behavior, and robust mechanical properties. These properties were evaluated for different hydrogel formulations as well as under various conditions (pH and ionic strength). A detailed study was conducted to examine the behavior and optimize the properties of these hydrogels, aiming to improve their performance for a wide range of potential applications.

ORAL #9 **Raphaël Brun**, Saint-Gobain, France : *"IAQ at Saint-Gobain: from lab materials development to buildings in situ monitoring"*

Maintaining a low level of pollutant is key to ensure a good Indoor Air Quality (IAQ) in our homes. Among the indoor pollutants having a high impact on human, Volatile Organic Compounds (VOCs) are recognized as critical because of their ubiquity and hazardousness under typical indoor conditions. Numerous solutions to mitigate indoor pollutants are available, and act on different aspects: (i) ventilation to ensure sufficient air renewal; (ii) low emissive construction materials to limit pollutant sources; (iii) air treatment device to actively remove specific indoor
pollutants (VOCs, PM); and (iv) depolluting materials to passively capture indoor VOCs. Combination of solutions is key to maintain our indoor environment in a safe zone.

During this presentation, Saint-Gobain Research & Development strategy related to IAQ is described. Set-ups and methodology based on international standards have been designed to assess the impact of materials on VOC emission and develop depolluting materials. Besides, academic collaborations have led to the development of a model to study the long-term behavior of depolluting construction material (with Pr. Zhang, Syracuse University, US), and improve our understanding of the interaction between depolluting construction materials and VOCs (with Pr. Thévenet, CERI EE, Douai, FR). Besides, measurement protocols have been developed to assess IAQ at room and building scale. They are based on continuous on-line monitoring through qualified and validated sensors (CO2, TVOCs, light VOCs, as well as acoustics, thermal and visual comfort descriptors), coupled with air sampling on passive cartridges and liquid and gas chromatography (HPLC, GS-MS) for specific VOC detection and quantification. An application example of this methodology in UAE schools and universities will be presented.

DAY 2 - 11/06/2025

ORAL #1 Yimo Luo, Hunan University, China : *"Research on adsorption heat storage with salt hydrates and its performance in building heating application"*

The adsorption heat storage technology with hydrated salt is regarded as one of the most promising technologies for solar energy seasonal storage in buildings as a result of high heat storage density, low working temperature and low heat loss. In the lecture, the performance of composite salt hydrates based on $SrCl_2 \cdot 6H_2O$ will be introduced both at the material level and reactor level.

ORAL #2 Jinzhe Nie, Beijing Jianzhu University, China : *"Experimental study on indoor air moisture and toluene sorption performance of typical MOF materials"*

This study investigates the sorption performance of typical organic framework materials (MIL-101(Cr), MIL-100(Fe), MOF-303(Al), aluminum fumarate) for indoor air moisture and toluene, aims to identify materials that enhance indoor air humidity control and purification. Dynamic gravimetry method measuring sorption isotherms was used to analyze the moisture sorption performance of these materials. Breakthrough method was used to measure their toluene sorption performance. In addition, the competitive adsorption influence from moisture to toluene was measured using breakthrough method. The results show that the MOF materials have much higher adsorption performance for pure moisture or toluene than activated carbon. The moisture content has strong influence on toluene adsorption. MIL-101(Cr) show the highest adsorption capacity and low temperature desorption potential.

ORAL #3 Doyun Won, NRC, Canada : *"Evaluating Indoor Air Cleaning Technologies at NRC: From Small-Scale Testing to Real-World Applications"*

The National Research Council Canada (NRC) operates a range of specialized facilities to assess the performance of indoor air cleaning technologies, from a small-scale 50 L chamber to a full-scale 31 m³ room and research houses. This presentation will focus on the evaluation of two advanced materials—metal-organic frameworks and photocatalyst-based materials—for formaldehyde removal in a controlled small-scale chamber. Additionally, the talk will highlight research conducted in a full-scale chamber and research house, demonstrating how laboratory findings translate into real-world applications through scale-up testing.

ORAL #4 Moises Pinto, IST, Universidade de Lisboa, Lisbon: *Sustainable indoor air quality for the cultural sector: the SIMIACCI project*

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The transition to climate-friendly practices is a major challenge for all sectors of the EU economy, including the Cultural and Creative Industries (CCIs). CCIs use significant amounts of energy to control volatile organic compounds (VOCs), nitrogen oxides (NOx), hydrogen sulfide (H2S), and humidity levels in indoor air, which is essential for the preservation of our cultural heritage artefacts. The long-term conservation of many cultural artefacts requires very stringent low concentrations of these pollutants (VOCs, NOx and H2S), well below the normal levels required for other types of buildings, such as commercial and residential buildings. Traditional indoor air quality (IAQ) solutions often fall short in efficiency and environmental impact to achieve the required quality levels. There is an urgent need for solutions that are both acceptable to curators and conservators, and at the same time environmentally, socially and economically acceptable in the current climate transition.
Bringing together 15 partners from 7 European countries, SIMIACCI is an ambitious 4-year project, started in 2025 and funded under the Horizon Europe programme. It aims to improve the efficiency of IAQ management in Galleries, Libraries, Archives, and Museums (GLAMs) across Europe, thereby enhancing the conservation of cultural heritage artefacts while reducing energy consumption. To achieve this goal, SIMIACCI will introduce a portfolio of tailored innovative technologies (Fig. 1).
The main objective of the project is to deliver industrial-grade metal-organic framework adsorbent materials for advanced air purification, leveraging from outstanding results for some of these materials [1-4], along with a smart, wireless IAQ monitoring system tailored for GLAMs (Fig. 1). In this presentation, the main scientific challenges related to the capture of indoor pollutants underlying the SIMIACCI solutions will be discussed.
SIMIACCI strives to promote the adoption of its solutions in other sectors through dedicated exhibitions reaching and the launch of its label, ensuring a long-term impact and scalability, thus enhancing GLAMs' leadership in sustainable practices. The project will develop prototypes to be showcased in GLAMs of different sizes and

contexts.These demonstrations will provide real evidence of energy and resource-efficient solutions, reducing energy demand by 30-50% and extending the conservation time of cultural heritage artefacts.

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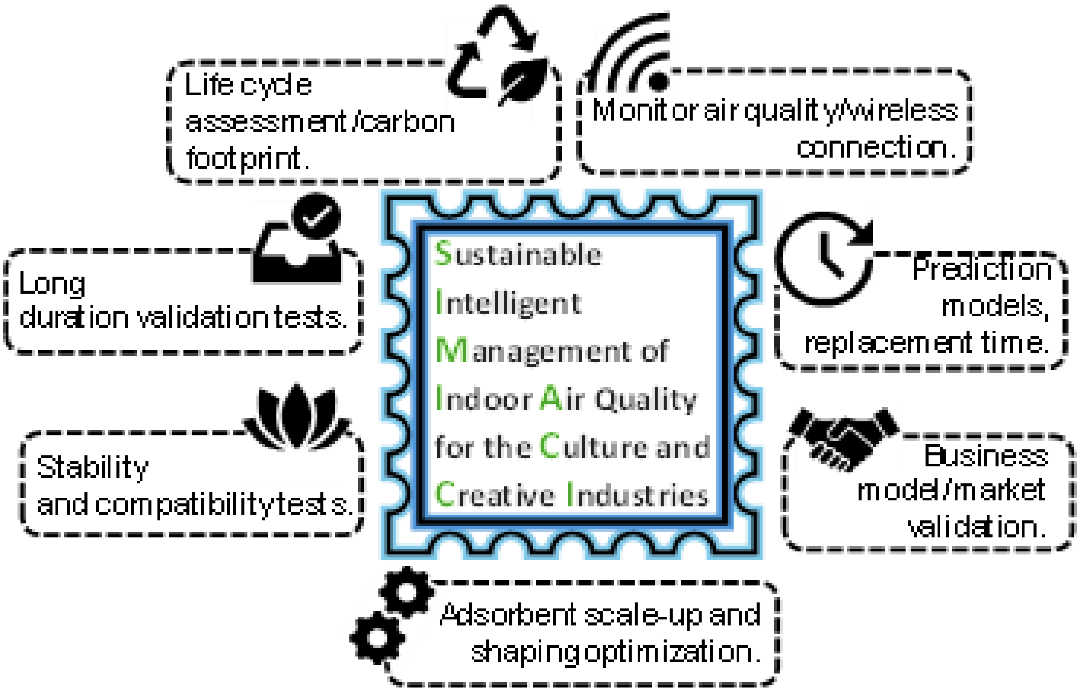

Fig. 1. Main lines of work that are integrated in SIMIACCI.

ORAL #5 **Zhiwen Luo**, Welsh School of Architecture, Cardiff University, UK: *Climate resilient buildings and cities for sustainable energy and environment*

The changing climate, characterized by rising average temperatures and more frequent, intense heatwaves, is placing significant strain on our built environment. These changes are leading to increased building energy consumption and heightened risks of overheating. Buildings and their surrounding urban environments are deeply interconnected, and both are profoundly affected by the evolving climate. In this presentation, I will discuss our recent research, which explores how to design climate-resilient buildings and cities that not only reduce carbon emissions but also mitigate environmental risks, particularly heat exposure. Our work investigates the complex interplay between buildings and urban environments under a warming climate, offering strategies for sustainable urban development and enhanced resilience.

ORAL #6 Jean-Pascal Sutter, Laboratoire de Chimie de Coordination du CNRS, Toulouse, France: *Supramolecular porous architectures*

F. Marocco Stuardi, N. Roques, C. Barthes, J.-P. Sutter

Keywords: H-bonded Open Frameworks (HOF), Indoor air quality, water sorption

We are developing H-bonded Open-Frameworks following a bimodal approach involving ionic building-blocks with complementary charges.1,2 The supramolecular assembly relies on ionic/charge-assisted H-bonds know to be much stronger than conventional H-bonds. All these supramolecular porous architectures (SPA) are obtained from aqueous solutions and contain H2O guests, these frameworks are therefore stable towards hydrolysis. Interestingly, H2O sorption is a reversible and fast process even for the fluxional derivatives.
The robust ionic H-bonded assemblage scheme allows the formation of isostructural frameworks with different R groups located in the channels. This decoration of the channel walls permits modulating the sorption characteristics of CO2 or H2O.
Interestingly, the SPAs are easily recycled/regenerated.

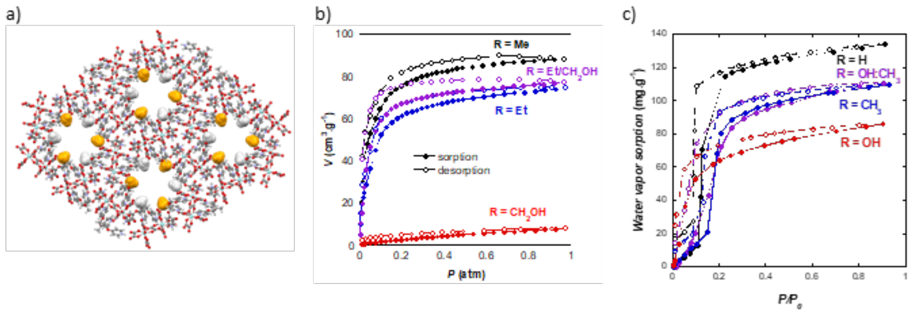

Figure. a) Representation of SPA-1(R)1 highlighting the R-groups decorating the channel walls; b) CO2 adsorption ( ) and desorption isotherms ( ) measured at 195 K for the SPA-1(R) materials; and c) H2O-vapor adsorption (full line) and desorption (dash line) isotherms measured at 293 K for SPA-1(R).

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ORAL #7 Lihong Lao, Department of Mechanical and Aerospace Engineering, Syracuse University, USA : "*Smart Materials for the Built Environment*"

Thermal and moisture management in the human body or built environment is essential to thermal comfort and health performance of humans in daily life. Smart materials that can switch structures and properties depending on external stimuli have attracted increasing attention in regulating heat and moisture transfer and maintaining thermal comfort, such as in smart clothing and building systems. Although various materials and manufacturing breakthrough, many of these technologies still face limitations in design versatility, material compatibility and multifunctionality.

ORAL #8 Liangzhu Leon Wang, Concordia University, Canada: "*Advances in Research on Urban Microclimate and Impacts on Built Environment*"

This seminar presents leading-edge research on urban microclimates and their impacts on the built environment, with an emphasis on intensifying climate hazards such as urban heat islands and indoor overheating. It reviews key investigation methods—including computational fluid dynamics, field measurements, wind-tunnel experiments, and AI-driven approaches—and highlights how factors such as vegetation, water bodies, and building geometry influence local climates. Results reveal that urban greenery can mitigate heat by several degrees Celsius while building heat vulnerability indices pinpointing areas at the highest risk during heat waves. Despite notable advances, challenges persist, including limited non-isothermal validation and the need for large-scale benchmarking datasets. Moving forward, enhanced sensing capabilities, robust data sharing, and improved multidimensional modeling are essential for developing climate-resilient design strategies, guiding policy, and ultimately fostering healthier, more sustainable urban environments.