IEA ANNEX 92 NEWSLETTER

Advancing Sustainable Built Environments through Smart Materials

2026 • ISSUE 02

SMBEC 2026 Successfully Concludes in Xi'an

A Global Forum on Smart Materials for Energy-efficient, Low-Carbon Buildings

Organized by the International Energy Agency (IEA) EBC Annex 92 – the 2nd Smart Materials for Energy-efficient Built Environment Control (SMBEC 2026) was successfully held in Xi'an, China, from 31 May to 2 June 2026. The symposium brought together over 200 researchers and industry experts from leading institutions worldwide. More than 50 presentations highlighted advances in smart materials for building energy efficiency, indoor environmental control, thermal energy storage, air purification, and sustainable built environments.

Prof. M. Qin, OA of Annex 92, Chair of SMBEC

Photo from SMBEC 2026

A key highlight of SMBEC 2026 was the growing convergence of materials chemistry, building physics, and building technology, emphasizing the role of smart materials in sustainable and energy-efficient buildings. Lively interdisciplinary discussions fostered new ideas, partnerships, and international research collaborations, providing a valuable platform for future innovation in the built environment.

ABOUT ANNEX 92

IEA EBC Annex 92 aims to advance energy-efficient heating, cooling, and air purification using smart materials, particularly metal–organic frameworks (MOFs) and related composites. Bringing together international expertise in building science, materials chemistry, mechanical engineering, and environmental health, the project bridges research gaps and explores innovative applications in cooling, dehumidification, air purification, and thermal energy storage to support energy-efficient and healthy indoor environments.

IN THIS ISSUE

200+ PARTICIPANTS

50+ PRESENTATIONS

GLOBAL COLLABORATION

SMBEC 2026 | CONFERENCE HIGHLIGHTS

31 MAY – 2 JUNE 2026 • XI'AN, CHINA

A Global Forum for Smart Materials and Built Environments

SMBEC 2026 brought together researchers, academics, and industry experts from around the world to exchange the latest advances in smart materials for energy-efficient and healthy built environments. More than 50 presentations covered topics ranging from materials innovation to building-scale applications. The conference showcased the growing integration of materials chemistry, building science, and engineering. Lively discussions and interdisciplinary exchange fostered new ideas, partnerships, and international collaboration.

KEY FIGURES

200+
Participants

50+
Presentations

12+
Participating countries

25+
Universities & institutions

Broad
Academic-industry collaboration

Conference highlights from SMBEC 2026.

"FROM MATERIALS TO BUILDINGS"

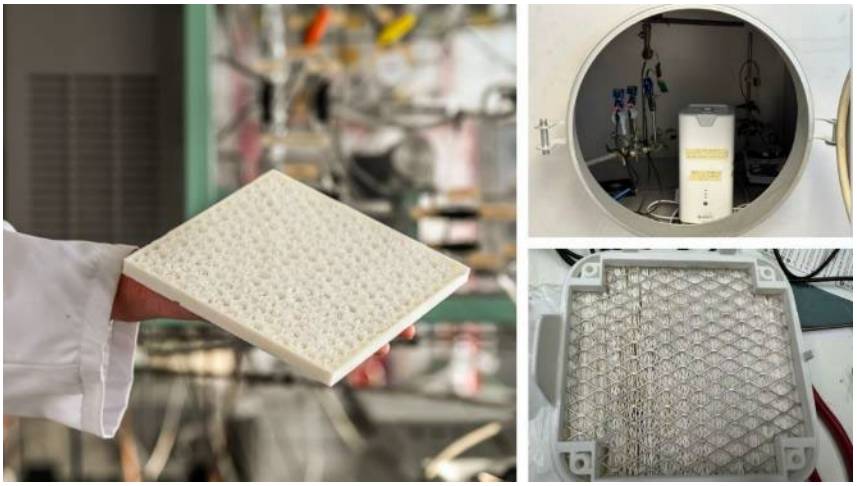
A platform linking materials innovation with practical solutions for energy, comfort, and indoor air quality.

RESEARCH HIGHLIGHTS

AIR PURIFICATION

MOFs for Air Purification

MOFs have strong potential for indoor air purification due to their high surface area, tunable pore structures, and versatile chemistry, which enable the efficient capture of gaseous contaminants. Aluminum-based MOFs such as Al-3,5-PDA (MOF-303) have demonstrated excellent performance for formaldehyde removal under typical indoor humidity conditions. Our recent work has focused on scaling up this MOF from laboratory-scale materials to practical air filters and air cleaners for indoor air purification. MOF-based filter media produced by SquairTech, together with filter and air-cleaner prototypes developed by TEQOYA, are currently undergoing a series of laboratory tests to evaluate their performance under realistic operating conditions.



MOF-based filters and test setup for indoor air purification. (N. Sadovnik)

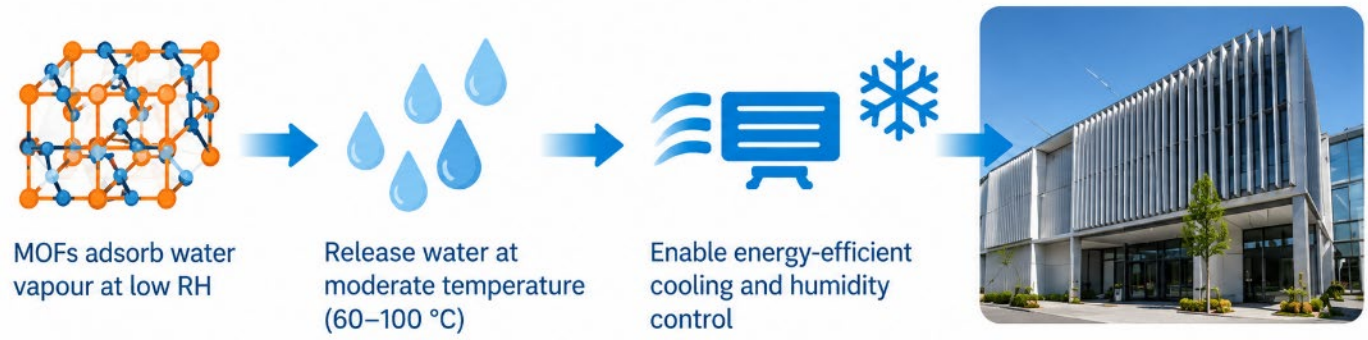
WHY MOFs?

- High adsorption capacity and selectivity
- Tunable structure and surface chemistry
- Stable performance under realistic indoor humidity
- Scalable fabrication into filters and building materials

COOLING & HUMIDITY CONTROL

MOF-based Cooling

MOFs are highly promising water adsorbents for energy-efficient cooling. Their tunable pore chemistry enables high water uptake and efficient water release at moderate temperatures (40–80 °C), allowing cooling systems to be driven by low-grade renewable or waste heat. Combined with high working capacities and excellent stability over repeated adsorption–desorption cycles, these properties make MOFs attractive alternatives to conventional sorbents. MOF-based adsorption cooling technologies, including adsorption heat pumps, chillers, and air-conditioning systems, are now progressing from laboratory research toward practical and commercial applications. At Technical University of Denmark (DTU), ongoing research focuses on developing pressure-driven cooling systems incorporating novel MOF materials to further improve cooling performance and energy efficiency.



Concept of MOF-based desiccant cooling and potential building integration.

OUTLOOK

MOF-based cooling technologies can contribute to low-carbon, resilient and healthy buildings, especially in regions with high cooling demand.

RESEARCH HIGHLIGHTS & NEXT STEPS

ATMOSPHERIC WATER HARVESTING

Atmospheric Water Harvesting

Atmospheric water harvesting (AWH) is emerging as a sustainable approach to addressing water scarcity by extracting water directly from the air. Advances in sorbent materials, particularly MOFs, can enable efficient water production across a broad range of climates, including hot, humid, and arid environments. With their high water uptake and low-temperature regeneration, MOFs offer opportunities to develop decentralized water harvesting systems powered by renewable energy or low-grade heat. The harvested water can support applications such as drinking water supply, agriculture and irrigation, and remote or water-stressed communities, providing a promising pathway toward more resilient and sustainable water systems.

Atmospheric water harvesting unit (left) and use of the harvested water for vegetable cultivation (right). Technology by SJTU and AtmosWell.

- Provide decentralized freshwater supply
- Suitable for diverse climates (hot, humid, and arid)
- Can be powered by low-grade heat or renewable energy
- Potential applications in buildings, agriculture and off-grid communities

Upcoming Activities

SMBEC 2027 will bring together researchers and professionals in **Turin, Italy**, to share the latest advances in smart materials for energy-efficient and healthy built environments. Hosted by **Politecnico di Torino**, the symposium will continue to strengthen international collaboration and accelerate the translation of innovative materials into practical building applications.

CONNECT INFORMATION

Join our community to exchange ideas and collaborate!
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