PRESS RELEASE

Innovative strength for the construction industry: Fraunhofer IBP presents exciting developments in the Building Innovation Cube, clever building materials and intelligent products for more comfort and energy efficiency at BAU 2017

The building industry is in serious need of innovative drive – at least that's the impression that could arise after looking at corporate research and development expenses. But the conclusion is premature: The building industry consists of a complex value creation chain with upstream and downstream industrial and service provision sectors specializing on the building process. This is the point of departure for the scientists at the Fraunhofer Institute for Building Physics IBP, who work together with industry partners and in national and international research projects to develop application-oriented system solutions and innovative products for the building sector. At the special show "Fraunhofer CityLaboratory – Shaping living spaces with research and development" (Hall C2, stand 538) at the BAU 2017 trade fair, held from January 16 to 21, 2017 in Munich, Fraunhofer IBP will present visitors a selection of its developments and contributions to increasing innovative strength in the building industry.

The Building Innovation Cube – Simulation meets reality

In the Fraunhofer IBP's Building Innovation Cube visitors will among other things experience the simulation of indoor climate as reality. The researchers will demonstrate the connection between technological innovations for indoor climatization and the latest dynamic simulation environments. The room module is equipped with a variety of conventional and innovative indoor climate elements. At the same time a "Digital Twin" visualizes the room, bringing it to life as a 3-D model. This lets visitors experience the actual climate effects in the room, which can then be verified in the virtual model. And vice versa the Digital Twin can be used to first simulate new indoor climate parameters which can then be experienced in a real environment.

A number of innovative technologies and product solutions from the Fraunhofer IBP were applied in the Building Innovation Cube:

The **"Chilled Water Wall" ("*Klimabrunnen*")**, a multi-climate device, combines the advantages of surface cooling systems with the effective dehumidification of ambient

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air in a single system, while at the same time positively influencing room acoustics. Both rooms and individual zones can be climatized without negative effects such as drafts or ventilation noises, while intelligently bypassing the limiting factors of conventional radiation cooling systems. By regulating water temperature, the room can be cooled and dehumidified in the summer, and in the winter humidity is added to dry heated air . The possibility of zone-based air conditioning is another benefit. Individual room areas can be specifically cooled using radiation effects. This makes substantial potential energy savings possible, especially for example in production facilities and in high-ceilinged entry halls, since only those zones where people are located are climatized.

Researchers at the Fraunhofer IBP have developed a new solution using a **high-tech membrane** that ensures sufficient ambient humidity in mechanically ventilated office buildings during the winter months. This membrane achieves hygienic air humidification at low energy levels by separating air and water flows in the ventilation system. Good air humidification is achieved with water temperatures as low as 20 degrees centigrade, enabling energy-efficient use of available residual heat.

The **Interpanel® ceiling and wall system** can influence several indoor climate parameters at the same time. The system creates a comfortable indoor climate and also optimizes room acoustics with a high-performance radiation cooling system that operates constantly and does not create condensation water below the ambient air's dew point. The system also reacts quickly to user requirements and provides for the integration of illumination in the elements. The prefabricated construction simplifies installation, while the multi-functionality means easier interface coordination, lower construction volumes and makes upgrades more attractive.

Started by the Fraunhofer IBP, the office initiative **BÜRO-INITIATIVE** works to create an economical working environment in office spaces that promotes both health and performance. It combines research and practical experience to provide important impulses and responses to the need for human-oriented, trouble-free working environments. For example, the Fraunhofer scientists identified overheard conversations in the office as one particularly frequent disturbance. Here the negative factor is not so much volume as linguistic intelligibility. The ability to mask or drown out distracting sounds at the workstation is very important in combating distraction. Together with an industry partner the Fraunhofer IBP has developed a **sound-masking floor-standing luminaire** that transmits acoustic signals making incoming conversations unintelligible without reducing their volume.

In the Digital Twin a variety of highly different **software tools** demonstrate the impacts of these products: VEPZO (short for Velocity propagating zonal model), a zone-based indoor climate and flow simulator, makes it possible to quickly assess indoor air flow and temperature distributions; high-resolution flow calculations are possible using CFD (Computational Fluid Dynamics). The simulation software product WUFI® Plus simulates the indoor climate as well as the hygrothermal conditions in the building

section and can thus address comfort and energy requirement questions. Furthermore, methods such as Life Cycle Assessment (LCA), analyze the ecological impact of a product, process or service over its entire life journey. The Life Cycle Costing method allows assessment of all of the costs incurred by a product or service.

Noise-free ventilation

Adequate ventilation is absolutely necessary for a comfortable indoor climate. Frequently however external noise (traffic sounds, noise from nearby construction, etc.) is so loud the window can't be opened as long as desired. A new technical development from the Fraunhofer IBP, in collaboration with industry partners, can help here. The basis is conventional automatic windows which open when sensors detect the need for ventilation. Entirely new however is the "Ear at the window", which automatically closes the window as soon as a particular exterior noise level is reached. Then once for example the offending freight train has passed by, the window is opened again. Fraunhofer IBP scientists conducted measurements and calculations on the noise control effects to technically validate the concept and used human test subjects to validate the psychoacoustic aspects of the system.

Clever building planning

Complicated complex building projects and the increasing demand for affordable residential space call for time-efficient and cost-cutting solutions. Building Information Modeling (BIM) is growing in popularity in the planning stage as well as during construction and even in subsequent building operation. All interested parties, from the planner to the construction principle and all the way to Facility Management and the widest possible variety of tradesmen access a digital data model during of the entire lifecycle of a structure. As part of the BIMiD ("BIM-Referenzobjekt in Deutschland") reference project initiative, supported by the German Federal Ministry for Economic Affairs and Energy, the Fraunhofer IBP is working with the Fraunhofer Institute for Industrial Engineering IAO to securely anchor this trend in Germany as well. In various reference projects, BIM is to be demonstrated using specific construction projects. The knowledge gained is to be made available to the German construction and real estate sectors. The concluding 7th BIMiD-expert symposium will be held during the BAU fair trade on January 20.
Further information is available at www.bimid.de/veranstaltungen.

Functional systems and the materials of the future

Digitalization is not the only way to help cut costs and save time: major potential can also be leveraged in modular construction. Accordingly, scientists at the Fraunhofer Center Building Technology, a partnership between the Fraunhofer IBP, the Rosenheim

University of Applied Sciences (Hochschule Rosenheim) and the fenestration testing institution ift Rosenheim (Institut für Fenstertechnik e.V.), have developed an innovative insulation system consisting of prefabricated components. The modules, which have adaptable shapes, are installed on the construction site in the pre-installed holders, considerably reducing construction time requirements on location. The removal is equally simple, therefor system can be easily deinstalled when necessary.
The special show will also present insulation systems using innovative building materials made of geopolymers and lightweight concrete instead of the conventional concrete. Geopolymers, also referred to as alkaline-induced binders, are cement-free and have higher strength property values than concrete. Because of their good freeze-thaw stability, they are already in use for example for the construction of airstrips in Australia. Among other things industrial by-products such as ashes, slags or dust can be used to make alkaline-induced binders, which in turn helps combat the rising scarcity of resources such as sand or gravel.

Textile reinforced lightweight concrete combines the properties of a light and porous substance with a stable building material. The targeted modification of the lightweight concrete formulation using appropriate extra substances and additives can also influence thermotechnical and acoustic properties as well. This opens up a large number of new application areas and marketable solutions for this functional building material.

Natural construction materials for healthier buildings

In the EU project "ECO-SEE" the Fraunhofer IBP conducted research into new natural construction materials following the principle of "building healthier and more energy-efficient buildings". The research consortium developed internal walls and highly insulated external walls made of wood and natural insulation materials such as cellulose and sheep's wool, together with water vapor-permeable, hygrothermic and moisture-storing plasters (e.g. lime, clay). These walls offer improved adsorption properties and photocatalytic (light-induced) oxidative degradation properties for volatile organic substances such as formaldehyde. In the EU project the scientists had to comply with the following requirements: The products developed had to consume at least 15 percent less energy for manufacture, transport, storage, sales and disposal, had to have at least 20 percent longer lifecycles and had to cut construction costs by at least 20 percent. Their results are now being presented at the joint Fraunhofer stand at the BAU 2017 fair trade: Ecological and energy-efficient wall elements that can be prefabricated using renewable resources for exterior facades and internal walls and featuring wooden frames, insulated using hemp, cellulose, sheep's wool and functional plaster.

The "Chilled Water Wall" ("Klimabrunnen"), a multi-climate device, combines the benefits of radiation cooling systems with effective dehumidification of indoor air in a single system.
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The sound-masking floor-standing luminaire sends acoustic signals that render conversations in the office environment unintelligible. © Fraunhofer IBP

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