Press release

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High-tech building insulation:
EU research project INNOVIP is developing new technologies for long-lasting and cost-effective vacuum insulation panels

Munich – The demands from Brussels are ambitious: by 2050, office and private buildings in Europe must lower their CO_2 footprint by around 90 percent, compared to 1990 levels[1]. Optimal thermal insulation will play a key role. Vacuum insulation panels (VIPs) are particularly promising in this regard, but are still very expensive and difficult to work with. Moreover, to ensure a high level of market acceptance, the lifetime of the panels has to be improved. The INNOVIP project, which has received around Euro 5 million of EU funding, aims to solve these problems through innovative technologies and the development of new materials. The international project team led by the Munich-based Forschungsinstitut für Wärmeschutz e.V. (research institute for thermal insulation, known as FIW Munich) will be working towards a further improvement in the efficiency of the VIPs as well as the development of features such as anti-mould coatings and increased fire resistance.

Effective insulation systems in buildings are key to optimizing their energy performance. Vacuum insulation panels, or VIPs, are an extremely effective and space-saving solution. They utilise the fact that a vacuum is an extremely good insulator. VIPs comprise a porous core material encased in an airtight envelope. The air trapped in these layers is evacuated and the envelope is then heat-sealed. The core material prevents the insulation panels from crumpling when the air is evacuated.

Currently, vacuum insulation panels generally comprise a core of pressed pyrogenic silica or mineral fibres. Using a new type of protective envelope and alternative fillers – for example ground perlite – the INNOVIP consortium, which includes research institutes and companies from seven EU countries and Israel, aims to enhance the competitiveness of this highly-efficient solution. Specifically, the project partners have defined the following goals to:

- improve the thermal performance by at least 25%
- achieve a minimum standardised service life of 25 years with minimum deterioration
- develop an innovative production process incorporating simplified wrapping procedures, and through this to reduce manufacturing costs by 20% compared with those of conventional vacuum insulation panels.
- reduce insulation material costs by around 30% compared to established vacuum insulation systems and conventional insulating materials (based on the cost per square metre of thermally equivalent insulation systems).

[1] cf. „A Roadmap for moving to a competitive low carbon economy in 2050“ dated March 8, 2011

- provide additional functionality and durability including resistance to deleterious effects such as mould growth.

Fit for the future: efficient insulation for up to 50 years

The envelopes used to cover the porous core material play a particularly important role when it comes to the efficiency of VIPs. Modern VIPs are already very efficient, but this performance can be lost over a period of years. Christoph Sprengard from the coordinating institute, FIW Munich, explains “The reason for this an increase in internal pressure, caused by the slow penetration of air and humidity into the vacuum elements. This causes their thermal conductivity to increase, which means that insulation decreases". The new design for the envelopes that the INNOVIP project partners are aiming for should therefore have at least 40% lower permeability for water vapour and air and thus guarantee good insulation performance for up to 50 years.

By amalgamating several production steps, the labour-intensive wrapping of prefabricated core material with envelopes can be considerably simplified. The use of a loose pyrogenic silica powder permits a lower density for the filler compared to compressed panels, which leads to a saving in materials and production costs. Furthermore, the lower density reduces thermal conduction in the core.

Through the improvements in the envelopes, it will also be possible to use much less expensive core materials than pyrogenic silica. In the research project, expanded perlite powder is being examined as an alternative. This has significantly larger pores, which, due to the increased number density in the larger spaces, requires a higher vacuum in the panels and thus places higher requirements on the envelope. While vacuum panels with perlite, also called volcanic glass, do display thermal conductivity properties that are around one third higher than those with a silica core, they are significantly less expensive to produce. The lifetime of perlite-based panels can be extended to 50 years by using a small quantity of desiccant.

To ensure the most efficient thermal performance possible, the design of the panel edges will also be improved and assembly optimised. In this way, unwanted thermal bridges are reduced when the panels are assembled, as up to now gaps have occurred where the edges do not fit together perfectly. The researchers want to achieve additional efficiency enhancements by using advanced porous materials (APM) as supplementary insulation in the gap between the panels mounted on the building.

VIP manufacturing costs lowered by 30%

"Overall, we expect to be able to reduce the manufacturing costs of VIPs by 30% through the innovations we want to achieve in the core materials, envelopes and production processes", says Sprengard. The loose silica powder makes it possible to produce more efficient and thereby thinner panels. Thus they are not only more flexible to use – for example, they can be used to retrofit even existing buildings– they are also cheaper thanks to the lower material costs for the core. For applications where very thin insulation panels are not necessarily required the even less expensive alternatives with perlite cores can be used. Even the further enhanced envelopes are more cost-effective than those previously used. Added to this is the much accelerated manufacturing process, thanks to the new technology, which is likewise contributing to the cost reduction.

Robust, versatile and easy to handle

INNOVIP insulation panels will feature special cover layers, which will protect the sensitive vacuum elements from mechanical and environmental influences and simplify transport and assembly. In addition to the mechanical protection, these innovative cover layers also offer further opportunities – for example, by coating them with nano particles, bacteria in the ambient air can be destroyed, thereby improving the air quality. Anti-mould and anti-fungal coatings are also conceivable, as is moisture buffering in the case of high ambient air humidity, and increased fire resistance. In this way, the VIPs can be optimised for different applications and be used both indoors and outdoors.

About INNOVIP

The INNOVIP project ("Innovative VIPs with multi-functionalities for the building sector" – Grant Agreement No. 723441) which is funded by the European Commission was launched in autumn 2016, and by 2019 will receive around Euro 5 million in funds from Horizon 2020, the EU Framework Programme for Research and Innovation. A total of 13 companies and research institutes from seven European countries and Israel are participating in the project. INNOVIP is coordinated by the FIW Munich. Other German partners include the Bavarian medium-sized company va-Q-tec AG from Würzburg, the Fraunhofer Institute for Process Engineering and Packaging IVV in Freising and the Bavarian Research Alliance in Munich.

About the Bavarian Research Alliance GmbH (BayFOR)

The Bavarian Research Alliance GmbH provided the INNOVIP consortium with extensive support during the application phase and assisted in the drafting of the contract with the European Commission. In the current project, BayFOR will assume responsibility for project management and the dissemination of scientific results. BayFOR is an organization whose purpose is to promote Bavaria as a centre for science and innovation within the European Research Area. It supports and advises Bavarian scientists and stakeholders from the private sector on European research, development and innovation funds. The focus is directed at the Framework Programme for Research and Innovation “Horizon 2020”. As a partner in the network for SMEs “Enterprise Europe Network” (EEN), BayFOR provides specific advice for SMEs which are interested in EU research and innovation projects. BayFOR is a partner institution in the Bavarian Research and Innovation Agency (www.research-innovation-bavaria.de) and is supported by the Bavarian State Ministry of Education, Science and the Arts. For further information please visit www.bayfor.org/english.

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