FIW Annual Report 2014

FIW Munich

Forschungsinstitut für Wärmeschutz e. V. München

Content

Dear Members and Friends of our Institute,

2014 was a particularly eventful year. Besides the fields of activity which are described in this report and which are being followed up intensely and adapted where needed, we kept and will always keep in mind our main focus. This means trying our best to contribute to an increase in energy efficiency in the building and industrial sector as an important and cost-effective key component for a turnaround in energy policy and fulfilment of climate protection requirements

Through the National Plan of Action for energy efficiency (NAPE), the alliance for affordable living and building and the climate protection plan, the federal government has now started to give outlines on a core component of its policy: the energy and climate policy.

This is significant because the meaning of a successful energy turnaround and the fulfilment of climate protection requirements goes far beyond our generation, in terms of prosperity and sustainability. This is not only an obligation for all social groupings, but a contribution towards intergeneration equity.

These central issues have to be substantiated with measures, suitable to initiate and accompany an enormous social, economical and ecological transformation process.

There is nothing new about the insight that financial knock-on effects are a crucial political instrument when it comes to mobilizing private capital and therefore activateing, for example, measures related to the building stock.

Meanwhile it is commonplace that the fiscal promotion of energetic renovation of buildings is nearly self-financing. It operates like a small economic stimulus plan for industry, trade and crafts and it serves as the necessary sign of the federal government's trustworthiness in energy and climate policy.

At the moment we have to accept that the decision to adopt fiscal knock-on effects has been postponed again means a failed launch for the most important project of the national plan of action of the federal government "energy efficiency", which we hoped would be the core element of the present government

Still or exactly because of this situation, the economy is still ready to support the requirements of the energy turnaround and the climate protection with its own alliances, for example taking part in the "Hauswende" campaign, an initiative of the geea Alliance for Building Energy Efficiency.

These initiatives illustrate how science and industry, together with crafts, proactively help to reduce prejudices and lack of information.

Targets to which we feel committed, besides many other key responsibilities, pooling scientific expertise and fairly supporting policy, industry and crafts. All against the backdrop of making an important contribution in the fields of science, economy and policy.

The more systematic and purposeful, the more likely the chance is of succeeding.

This is the institute's claim and commitment to which we will consistently remain faithful.

Klaus-W. Körner
Executive chairman of FIW Munich

Guest commentary by Secretary of State Mr. Franz Josef Pschierer

The turnaround in thermal policy is a key element of the energy revolution and the fundamental restructuring of our energy supply. The economic and effective use of energy is most significant for achieving this goal. The Thermal Insulation Day 2015 demonstrates this in a clear and multifaceted way: High efficiency potentials are mainly to be found in the field of the building sector.

We have set ourselves ambitious targets for the energy requirements of buildings. This means making use of the enormous potential in the building sector and reducing the energy requirement of buildings by 20 percent.
On 3 December 2014, at federal level, the German Government tied up a comprehensive package of measures in the framework of the "National Action Plan Energy Efficiency (NAPE)" and the Climate Protection Action Plan to fulfil the essential requirements of the energy turnaround and climate change commitments.
We appreciate the fact that the Federal Government understands energy efficiency as a business model for generating returns on investments and will carry out competitive tenders in future. The Ministry of Economy and Energy plan to substantially participate in the further discussion about the implementation of the NAPE and considerations of a market economically shaping future energy-efficiency policies.

Concerning its energy efficiency politics, the Bavarian Government relies on a balanced set of policy measures, containing information and consulting, financial support and, and only if it would be indispensable, regulatory measures (EU and national levels). The cost-benefit relationship, respectively energy prices and applied technologies determine the success of all initiatives and measurements. To achieve the desired energy efficiency and saving targets, we plan to:

- Improve energy-related Information, increase energy transparency, develop more specific consulting services concerning building projects and builders.
- Energetically improve existing buildings.
- The Bavarian Government reaffirms that tax incentives for energy-related building modernization would motivate additional or completely new sections of the population to invest in their buildings. This subject remains on the agenda of the Bavarian Government.
- Support the medium-sized economy and craft sector, to help them activate their own savings potentials, in cooperation with partners and communities, to enhance their energy efficiency in networks.
- Sponsoring builders of detached or semi-detached houses with the 10,000 houses-program (Energy-SystemHouse), to help them reduce their heating requirements and to customize their supply of energy according to the future energy systems, when renovating an existing building or constructing a new one.
- To encourage enterprises, to renovate building substance with the "Energy Credit Building" program by the LfA, Förderbank Bayern.

I would particularly like to thank the Forschungsinstitut für Wärmeschutz e. V. München for its recognized professional work and the organization of the Thermal Insulation Day 2015 together with the Deutsche Energie-Agentur (dena). I look forward to a successful Thermal Insulation Day 2015 with a variety of discussions during the event.

Franz Josef Pschierer
Secretary of State

Climate Change, Structural Alteration, Energy Transition

These terms surely send a signal. Something has to change. Quickly and decisively. The rate of building renovations to upgrade the energy performance has sunk to an all-time low. If Germany continues at this speed, the climate-specific goals will be very far from being achieved. This is rather strange because Germany and the whole world have undergone great changes. Technologies to increase energy efficiency have been developed further or have been invented. Building culture has changed, architecture has adapted itself to modern circumstances. Human attitude towards issues like environmental protection and climate change is completely different compared to 30 – 40 years ago. To live in an energetically inefficient house does not fit in with our modern society, for which, according to representative surveys, environmental protection enjoys an immensely high priority.

Let me draw a comparison to the German's favourite toy, the automobile. Are you still driving the same car you did in 1978? If you are not an enthusiastic oldtimer fan, you probably prefer current models with all their conveniences. A modern car offers increased comfort, considerably more safety and lower fuel consumption.

The right energy measure for your building also offers you more quality of living, more comfort and also has the additional benefit of a lower energy consumption. You can also choose between different models. The personal choice decides between the models. One might consume more fuel, and have less comfort, the other option could be more efficient. It is a well-known fact to us that cars with a standard fuel consumption of 7 l / 100 km sometimes need more or less fuel, depending on individual driving skills. It is the same with your house – there may be winters when your 7 liter-house needs a bit more and other winters when it needs a bit less energy.

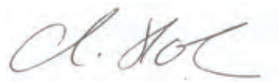
In this current discussion we should always be aware of the fact that we spend nearly 90 % of our time in buildings. The most important requirement for a modern living and working room is maximum comfort and ideal hygienic living conditions with minimum energy consumption.

This means, for example, the effect on the interior area when thermally insulated exterior walls exist, cannot be estimated highly enough. Living in an insulated house means much more cosiness. In houses not at all or hardly insulated, especially close to exterior walls, there will be comfort restrictions. Do we really want to accept this?

Low-energy or passive houses are state of the art, no matter if it is a new or renovated building and the trend towards energy-efficient houses plus is continuing. Technical solutions for the energetic renovation of buildings are ready at hand, have been proved in construction practice and are now fully developed. In keeping with a holistic energy balance of buildings, sustainable and environmentally compatible heat insulation materials are crucial. The development of new, matching facade concepts and efficient energy-supply models for buildings are the logical outcome and further necessary step for the future of the construction industry.

This can be considered as the major challenge for all parties involved, no matter if this refers to science, economy or politics. It has to be made very clear that energy saving construction and renovation work not only makes sense but that it's absolutely worth it in the long term. Ideal thermal insulation is more effective. It increases the value of a building, the outfit is extremely gratifying and the comfort inside the home improves.

Not only environmental reasons make it imperative for us to create a chain reaction: Turn the thermal change into a building insulation change, turn this into an energy change and let this ultimately become the climate change. Energy saving and climate protection are the superordinated topics that are being discussed all the time, but the cosiness gained by thermal insulation is the most important issue that we should talk about much more!



Prof. Dr.-Ing. Andreas H. Holm
Managing Director

4 FIW Munich at a glance

The foundation is exclusively and directly non-profit making in the sense of the German revenue code section entitled “tax-privileged purposes”.
The purpose of the association is the promotion of scientific research in the sector of thermal insulation.

The purpose of statutes is realized by the following in particular:

- Researching the thermal and mass transfer laws, especially the scientific principles concerning insulation against heat and cold
- The dissemination of this knowledge
- The technical thermal testing of construction and thermal insulation materials and the constructions made from them (practical designs)
- The cooperation with heat-economy associations, technical associations and scientific institutes

The structure and organization of FIW Munich is oriented to the business areas as well as to the classic core competencies. FIW Munich core competencies and business areas cover a wide spectrum. They cover, amongst other things, laboratory tests, open-air tests, in-situ demonstrations, studies, further education and standardization.

Institute management
Managing institute director:
Prof. Dr.-Ing. Andreas Holm

Deputy director:
Wolfgang Albrecht

Technical Insulation
Roland Schreiner

Certification
Wolfgang Albrecht

Insulation products for buildings
Claus Karrer

Building physics & components
Christoph Sprengard

Administration and HR management: Rolf Opp

Equipment building and infrastructure: Michael Guess

Quality management: Ralph Alberti

Core competencies and business areas

Testing, monitoring and certification

Holistic evaluation of the building shell

In all questions pertaining to
- thermal insulation
- moisture protection
- fire protection
- stability
- material composition

Development of testing standards, material standards, guidelines and worksheets

Research and development

Basics of thermal insulation and moisture protection as well as construction chemistry

Testing of technologies and new materials for improving energy efficiency

Effect of determining factors

Durability of materials and systems

Initial research into construction material and construction system development

Energetic optimization of the complete building system

Transfer of knowledge and technology

National and international standardization

Member of various expert committees

Publications and lectures

Realization of training sessions and symposia

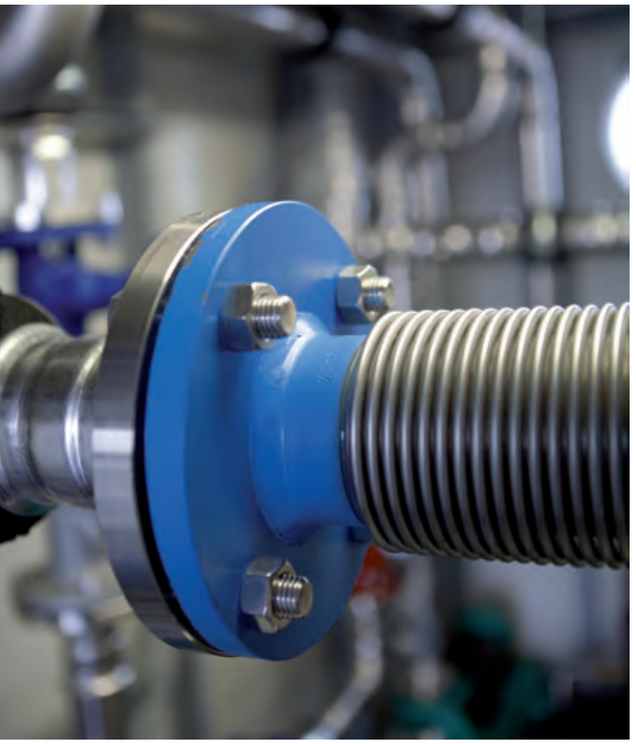
Development of measurement devices and testing equipment (scientific system and equipment building)

Building industry

Insulation of industrial systems and in industrial construction

Transport and logistics

Core competencies and business fields



1. Technical Insulation Systems

↑ *Holistic approach of a "Technical Insulation" system*

As in previous years, the department "Technical Insulation" was strongly involved in the field of know-how transfer of thermal and refrigeration. The fundamental documents of "energy efficiency of operational installations" are due to be finished in the VDI 4610 guideline committee. The guideline committee for the Revision of VDI 2055 Part 1 "Thermal and refrigeration insulation of operational installations in industry and building equipment- calculation base" has been transformed into an expert committee "thermal and refrigeration insulation" by VDI to open up further fields of activity.

The revision of the guideline is making good progress. Robert Hofmockel, expert on nanostructure technology, joined the team of engineers of "Technical Insulation" in June 2014.

The cooperation with EiiF "European Industrial Insulation Foundation", a European foundation, engaged in the application of sustainable insulation systems in industrial facilities has been continued successfully. Concerning the training as certified TIPCHECK-engineer, an energy consultant for technical insulation systems, the EiiF can count on the cooperation with FIW Munich.

An operational technical insulation system consists of qualified insulation material and optimized insulation components as well as system-related thermal bridges. When designing operational equipment by focusing on energy efficiency and safety, the confident handling with all physical technical influences is essential. The field of insulation of operational equipment, widely unregulated by legal requirements European and national, depends on a well-functioning network of partners from industry, federations, research bodies and testing institutes. This makes FIW's department "Technical Insulation" the central platform, closing the gap between theoretical regulations and practical applications, ever since the foundation of the institute in 1918. The main operating fields of the "Technical Insulation" department are derived from this. Quality assurance and performance testing of technical insulation materials are on the focus, comprehensive knowledge and transfer of knowledge of physical-technical interrelations as well as comprehensive assessment of insulation systems. The confirmation of expert execution and the declaration of damages and causes of defects of technical insulations in expert opinions complement the service range. The insulation and mechanical test can be executed in a wide temperature range from -180 °C to +1000 °C.

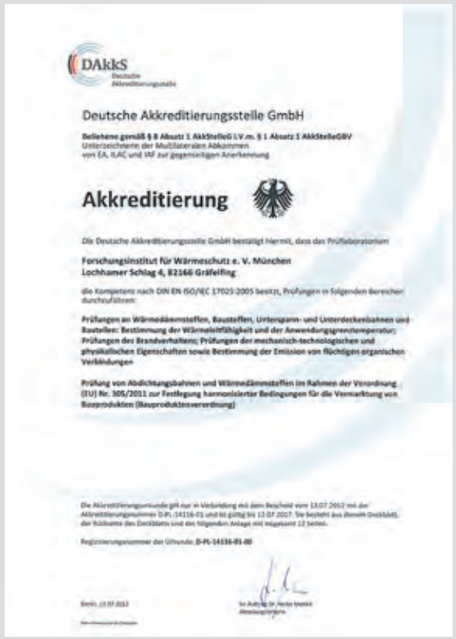
Contact: Roland Schreiner
T +49 89 85800-42 | schreiner@fiw-muenchen.de

The laboratory tests, conducted according to European standards, are complemented by identifying influencing factors with application-oriented insulation materials, for example boiler walls, pipes or under vibration load. Besides contract testing for all technical insulation materials, the active shaping of the European voluntary quality control (VDI/Keymark) is an important service for our customer. Taking part in European round robin tests is a firm component of the activities performed by accredited Laboratories. We are particularly proud to have found comparative insulation material to protect the European level of thermal conductivity at higher temperatures. The mathematical-physical model of all mechanisms involved in heat transfer is available for this material for the very first time. The results were presented to a highly interested audience at the "32nd International Thermal Conductivity Conference" Purdue University, West Lafayette, Indiana, USA.

Competent auditing of in-house production control at manufacturers of insulation material in the field of voluntary quality assurance and statutory CE label is our given stipulation. The already existing notifications concerning product certification and testing body for all technical insulation material are to be continued according to the new European construction products regulation. Active transfer of know-how is our commitment. This is reflected in our participation in national and European standardization committees and panels and the organization of information events and trainings.

An energetic examination of technical insulation systems through detailed recording with three dimensional finite element modeling and the opportunity to evaluate thermal and refrigeration insulation according to VDI 2055 Part 1 calculation base leads to statements and classification of energy efficiency technical plants in industry and technical building equipment.

System checks, conducted simultaneously, also provide parameters which are essential for the evaluation of technical insulation systems.



↑ *Accreditation certificate according to EN 17065*

Contact: Wolfgang Albrecht
T +49 89 85800-39 | albrecht@fiw-muenchen.de

2. Certification

The certification department, founded in 2012, covers the certification body (BAY 08), according to national building regulations (LBO) and the Construction Products notified certification Body for thermal insulating products, code nr. 0751.

In 2014, the LBO certification body mostly stayed within its accustomed territory, certification of all sorts of thermal insulation material, according to general technical approval series Z-23.11, Z-23.15 and for special applications, such as insulation material for thermal insulation systems (ETICS), inverted roof, perimeter insulation or load-bearing thermal insulation below foundation slabs.

Furthermore, FIW Munich offers certification of conversion factors for moisture content, deviating from DIN 4108-4.

There have been far more changes for the certification body according to the European Building Products Act.

After being accredited as a certification body according to DIN EN 45011 on 7th May 2013, just in time for the introduction of the European Building Regulation, the yearly DAkkS audit was due. The focus of this audit was on the transition to the more extensive DIN EN ISO/IEC 17065 for the certification of product. Another focus was on the analysis of impartiality, to guarantee that the certification body is able to make decisions on certification independently, not only from the inspection and testing body, but also from FIW's management and executive board.

The certification body is supported by the expert committee in terms of safeguarding the impartiality. It consists of 4 external persons from the fields of science, testing institute, consumers, users and producers. The DAkks audit was passed without significant problems and in October 2014 we received the new accreditation certificate. Included in the accreditation are, besides the well-known thermal insulation materials, factory made and produced at the application site, expanded perlite and expanded Vermiculit.

In future, the certification body will, besides statutory "constancy of performance" according to system 1 of EN 13172 for thermal insulation material for buildings and technical insulation material, expand its activities. These activities are strongly related.

3. Insulation products for buildings

The key task of the „Insulation products for buildings" department is the auditing and testing of insulation material. In this case auditing not only means the formal auditing of production processes but professional supervision and support of the implementation of normative requirements and the realization of in-house production control. With its comprehensive, standardized monitoring of the majority of manufacturing factories of insulation material, FIW provides high-end building material for end users and fair market conditions for the producers. Currently FIW is auditing 230 national and international plants for the building industry. The target of FIW's inspection body is to offer all the tests, relevant for insulation material, or, in exceptional cases, to transmit cooperation with other inspection bodies. The decade-long experience of Europe's biggest inspection body for insulation material is brought into the relevant standards by collaborating with national and international committees.

In return, new test methods are being implemented at FIW Munich, timely and competent, to offer a certificate of suitability for the manufacturer's products.

FIW Munich is a national (PÜZ-Center) and European (notified body) testing laboratory, acknowledged and accredited according to EN 17025. The special competency is demonstrated by its leading collaboration at the Lambda Expert Group (TC88/SDG 5), where the most highly renowned laboratories for the determination of thermal conductivity of insulation material audit each other and define the measurement accuracy by round robin tests. The "Insulation products for buildings" department is available for all questions concerning the monitoring and auditing of insulation material.

This shall apply with regard to the European requirements, in terms of European product or test standards and European technical approvals as well as for national requirements, such as general building approvals.

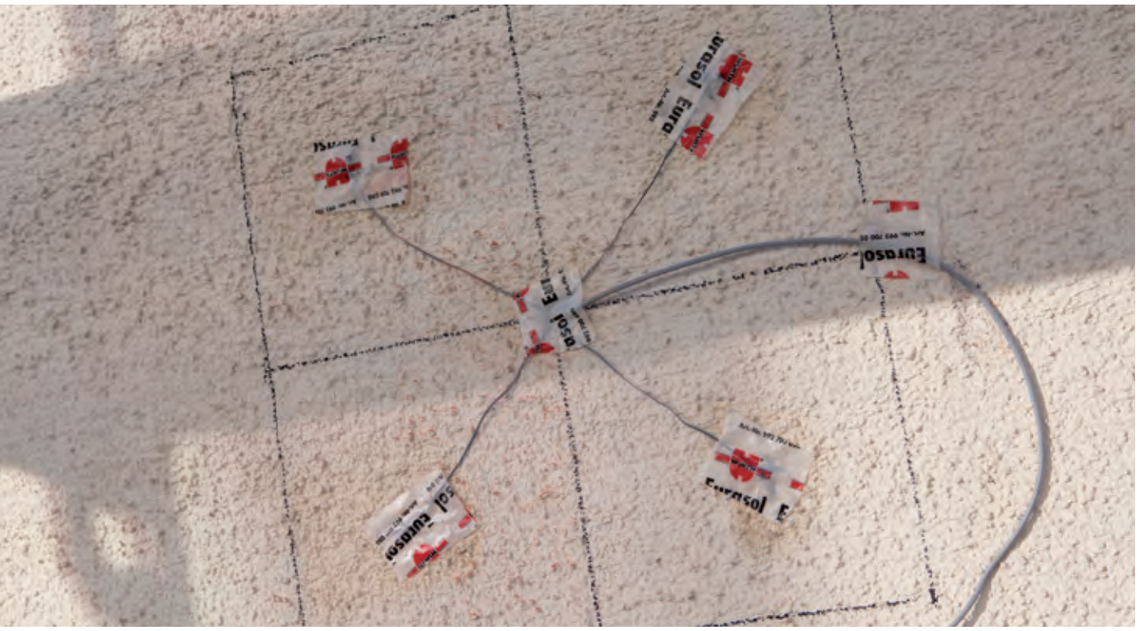
In 2014, the "Insulation products for buildings" department consequently fulfilled its commitments, resulting from surveillance contracts with producers or distributors of various insulation materials. Particularly challenging were initial and approval tests for EPS and XPS, produced with new flame retardants as an alternative to HBCD.

Since April 2014, the team has been reinforced by Mr. Gerald Coy B. Eng who is responsible for the operative audit of insulation material and Mr. Felix Basel M. Eng. who, since November 2014, has been supporting FIW's testing coordination and implementation. Our new colleagues in the testing laboratories are Regina Reif, who started in February 2014, and Maximilian Obermeir, who started work in September 2014.

Contact: Claus Karrer
T +49 89 85800-42 | karrer@fiw-muenchen.de

A newly planned laboratory for fire testing with a small burner was retarded by an unscheduled, but necessary asbestos reorganization. The ignitability, according to EN11925-2 (required for European fire classification E) and building material class B2 according to DIN 4102 is being tested there.

A new, adjacent air-conditioned room for storing test samples for fire testing enables shorter working routes.



4. Building Physics and Components

In 2014, the research aspect of the “Building Physics and Components” department became even stronger than the years before. This development deepened the separation of research activities from building approval tasks of the institute testing, monitoring and certification. The research project “Improving Energy Efficiency through Interior Insulation Systems” by order of BMWi (through the Jülich project management) and the start up cooperation in the IEA Annex65 „Long Term Performance of Superinsulating Materials SIM“, also supported by PTJ. These two big projects have been successfully claimed by the “Building Physics and Components” department, both of them supported with public funds (project description see Section “current projects”). Furthermore, in 2014, a whole range of projects, large and small ones, were carried out on the customer’s behalf. Several outstanding examples are presented in Chapter 5. With the planning and implementation of energy-related renovation measures, economic viability is increasingly becoming a key issue brought to the attention of the public. This was proved by the massive media campaign against thermal insulation in general and ETICS in particular. This is why the “Building Physics and Components” department has built up specific know-how for the evaluation of energetic measurements from an economic point of view to support manufacturers and associations with arguments from an impartial scientific viewpoint. Dipl.-Ing. (FH) Christine Mayer, another young female scientist, was hired for this huge number of projects and new fields of activity. Mr. Gerhard Treiber and Mr Winfried Eiche, who had worked for the FIW laboratory for nearly 40 years, retired.

The department’s core competency is the hygrothermal optimization of insulation and construction materials and of building components and insulation structures. The Continued development activities is increasingly being carried out through calculations and simulations by means of modern computer software. The quality of these calculations depends very much on the degree of accuracy and reliability of the material data, determined in measuring setups. The “Building Physics and Components” department has access to high quality testing equipment and the most modern test methods to determine thermal transition and moisture content. The simulations with components and construction units can be verified true to scale by tests on whole structural components, like facade elements, windows, doors and walls.

A particular strength of the “Building Physics and Components” department lies in the flexible combination of calculation, simulation and laboratory testing. Especially for new building products, like vacuum insulation panels (VIP), thermal material based on aerogel and microporous materials (APM „advanced porous materials“), moisture adaptive vapour barriers, low emissive coated insulation foils or masonry blocks filled with insulation material, there is often no reliable material data available to be used as a basis for the calculation. The “Building Physics and Components” department defines the material values as a basis for calculative investigations of the product and accompanies the producers on their way to the market. The department’s hygrothermal know-how is also available for branches outside the construction sector. Manufacturers of fridges and freezers, freight container and automobiles make use of our experts, in order to optimize the thermal behavior of their products.

Increasing or sinking temperatures often make it necessary to carry out transient calculation or using dynamic simulations to analyze the energy demand of systems. In many cases, tests under realistic moisture conditions are necessary to analyze moisture distribution in systems and to evaluate the extent of the damage. These laboratory tests complement, for example, studies on on-site building constructions within the framework of a monitoring of already existing and newly constructed buildings.

In research, the classical questions about characteristics of the building shell, concerning heat and moisture transfer, are being supported in the same way as the further development of products and components and the application-oriented testing of individual components. Increasing energy efficiency of the existing building stock and energy-efficient new construction are the key elements for a successful energy revolution. Without reducing the heat loss of existing buildings, the ambitious energy saving targets of the federal government cannot be achieved.

The “Building Physics and Components” department accompanies the entire value added chain in the construction sector from raw material to component, to the complete thermal insulation building shell. A holistic view takes into account the location, the climate and even the user behavior of the residents to gain reliable results for a long-lasting functionality of constructions and restoration measures.

Contact: Christoph Sprengard
T +49 89 85800-58 | sprengard@fiw-muenchen.de

Personal Development

The number of employees has increased from 58 to 61 (core stafft). Together with temporary employees, 63 persons worked for FIW Munich at the end of 2014.

Anniversary with FIW Munich

10 Years of Service
Thomas Winterling, Calibration laboratory

15 Years of Service
Martin Mayer, Insulation products for buildings

20 Years of Service
Annett Stratz, Insulation products for buildings
Wolfgang Moosburger, Technical Insulation Systems

25 Years of Service
Roland Kümmel, Insulation products for buildings
Andrea Bergler, Insulation products for buildings

30 Years of Service
Rolf Opp, Business accounting

Staff changes at FIW Munich

Entries

Felix Basel
(Insulation products for buildings) 01 November 2014

Gerald Coy
(Insulation products for buildings) 01 April 2014

Christine Mayer
(Building Physics and Components) 01 September 2014

Maximilian Obermaier
(Insulation products for buildings) 01 September 2014

Regina Reif
(Insulation products for buildings) 01 February 2014

Daniela Vetter
(Insulation products for buildings) 01 April 2014

Dirk Wiegang
(Device constructions) 01 April 2014

Robert Hofmockel
(Technical Insulation Systems) 18 June 2014

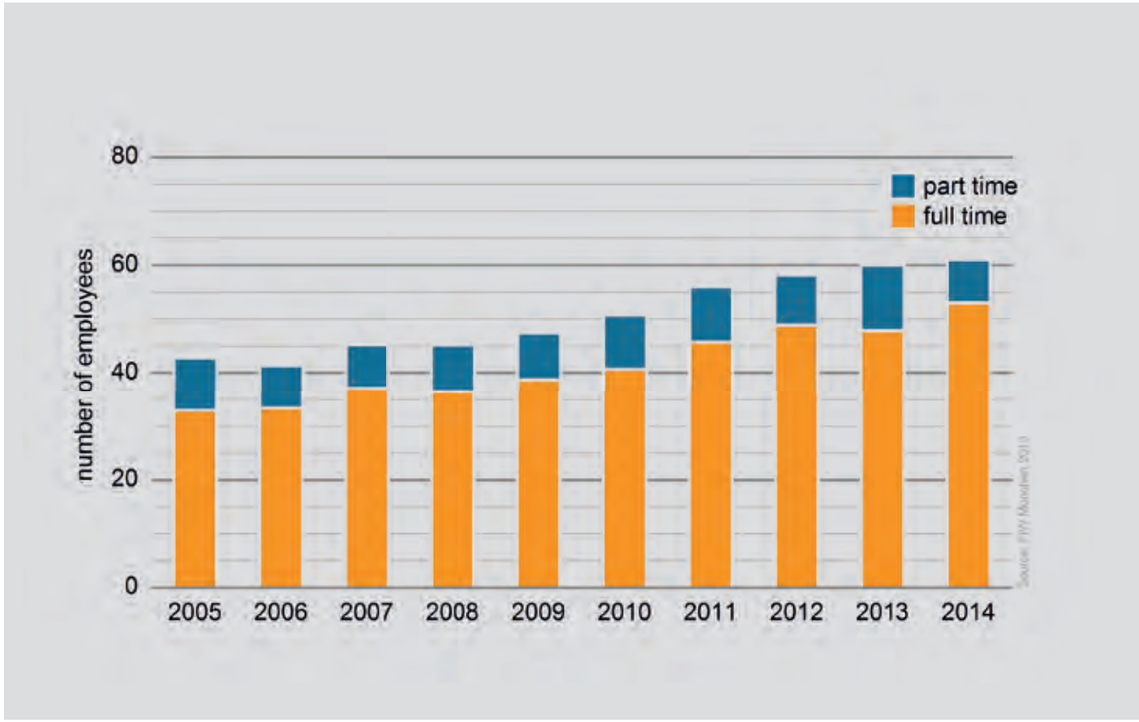
Retirements

Julia Kleiner
(Insulation products for buildings) 31 July 2014

Stefan Koppold
(Insulation products for buildings) 30 September 2014

Carsten Zacharias
(Insulation products for buildings) 31 August 2014

Gerhard Treiber
(Building Physics and Components) 31 October 2014



↑ *Financial Development*

Financial Development

The growth in the HR department is also reflected in the institute's overall performance. Revenues increased to 8.04 million Euro in 2013. The sales volume has increased by more than 111 % since 2000. Positive results with simultaneous revenue increases have been constantly achieved since 2008. This is primarily based on the fact that the testing and monitoring function was significantly enlarged. There were multiple committees with manufacturing plants domestically and abroad for a variety of new monitoring contracts. This trend is strengthened by increasing product variety, lower heat conductivities and greater insulating material thicknesses. Revenues also positively developed as a result of voluntary monitoring systems. Revenues from the field of research increased to reach a record high last year. Compared to the previous year, investments decreased to a total of almost 0.6 million Euro.
Our customers largely come from the German-speaking market. However, the trend is gradually moving towards an international customer structure. In the last 20 years, the percentage of revenues from abroad has almost doubled: Of the revenues from certificates and tests for 2013, 67 % were domestic, 33 % were from abroad. The reason for this is that many customers are monitored by FIW Munich not just from their national factories, but also in their international factories. Furthermore, FIW Munich was able to establish its own monitoring system in several countries, together with partners from industry. In addition, there are also increasing requests for research and development from abroad.

Memberships and cooperations

FIW Munich is a member of the following institutions:

- Allianz für Gebäude-Energie-Effizienz, geea, Berlin
- American Society for Testing and Materials (ASTM), Philadelphia
- BDI – Initiative “Energieeffiziente Gebäude”
- DIN Deutsches Institut für Normung e. V., Berlin
- DKV Deutscher Kälte- und Klimatechnischer Verein, Stuttgart
- DVM DEUTSCHER VERBAND FÜR MATERIALFORSCHUNG UND -PRÜFUNG e. V., Berlin
- Energy Efficient Buildings Association E2BA, Brussels
- FACHINSTITUT GEBÄUDE-KLIMA e. V., Bietigheim-Bissingen
- Fachverband Luftdichtheit im Bauwesen e. V., Kassel
- Fachverband Innendämmung e. V., Frankfurt am Main
- Forschungsgesellschaft für Straßen- und Verkehrswesen, Cologne
- GRE, Gesellschaft für Rationelle Energieverwendung e. V., Kassel
- Industrie-Förderung GmbH, Berlin
- L’Institut International du Froid, Paris
- Technischer Überwachungsverein Bayern, Munich
- Vereinigung der bayerischen Wirtschaft e. V. vbw, Munich; sustaining member
- VMPA Verband der Materialprüfungsämter e. V., Berlin
- Verein zur Förderung der Normung im Bereich Bauwesen e. V. VFBau, Berlin

There are cooperation agreements with the Deutsche Energie-Agentur GmbH (dena), Berlin, and the University of Applied Sciences, Munich

Opportunities for recycling components from thermal insulation systems after they are returned to the production cycle of insulation material, respectively down cycling in the production of inferior goods up to thermal application.
Wolfgang Albrecht

Background and definition of objectives
Considering that many ETICS from the seventies are in line for a revision, the following questions are to be examined. FIW cooperates with its scientific project partner, Fraunhofer-Institute für Bauphysik, Holzkirchen (IBP):

- Dismantling
- Recycling possibilities
- Forecast of the future amount of waste

The research project has been sponsored by the Federal Institute for Building, Urban Affairs and Spatial Research and was accompanied with financial and expert support by the professional body WDVS and Rigid Foam Industrial Association.

Amount of waste
According to the industry association WDVS, from 1960 until 2012, 900,000,000 m^2 ETICS were been installed nationwide. Nearly 720,000,000 m^2 (80 %) are rated on EPS systems. Depending on thickness of the EPS layers, this results in a total mass between 646 und 1570 kt. Added to this are further installed EITIC components like 2822 kt adhesive, 2880 kt basecoat mortar, 130 kt fabric, 2160 kt final coat and nearly 2.6 billion. dowels. Regarding the amount of waste, there was a total amount of 4,400 kt of plastic waste. The share of EPS and XPS (not only ETICS) from the construction sector was 42 kt / year, which means less than 1 % of the amount of plastic waste.

Dismantling and retrofitting
From the current dismantling methods, four options have been looked into closely. Mainly the manual decoating with a scraper and mechanical decoating with excavators are being used. Thermal decoating and milling play a subordinate role in practice.

When after 30–50 years the ETIC needs retrofitting, such as a new plaster layer for example, or doesn't correspond to the current technical state of the art, these systems are not being dismantled but doubled, newly dowelled and plastered. With these measurements, the potential service life of the systems is significantly prolonged and can be spread from 40 up to 120 years, according to current estimations.

Recovery of EPS-Waste
Three options to recycle EPS waste from ETICS can be used at the moment. As an example for material recycling EPS-recycling plates with a recycling rate up to 100 % are looked at. Because of the HBCD-interdiction, this waste disposal won't be possible in the coming years, only with HBCS-free EPS construction and production waste.

The CreaSolv® Process for a "selective extract" of polystyrol, with the help of organic solvents is an example if feedstock recycling advantages. The main advantage of this process is the separation of flame retardant HBCD and other pollutions. This makes it possible to produce polystyrol with the characteristics of new polystyrol. However, this process is not being used commercially at the moment.

This gives thermal recycling of EPS, that has served its time, a very important role. For this, the incineration plants, distributed through Germany, can be used. They are on a very high level. The advantage of this process is that parts of the energy, used during the production, can be recovered when the material is being burned.

A large-scale test in the incineration plant in Wuerzburg has proved that, for technical reasons, a maximum of two percent EPS or XPS should be added to the residual waste. The measured contaminant concentration remains significantly under the permitted limits.

Forecasts and conclusions
The consensus opinion of disposers, associations, but also the conclusion drawn from this is, that the current quantity of waste is still at a very low level because of the lifetime, which is significantly higher, contrary to earlier assumptions. Still, the dismantling volume will increase considerably in the next decades until it reaches a quantity of waste of 50 kt a year. This corresponds approximately to the expected annual production of EPS for ETICs and can easily be handled with the existing capacities of incineration plants. This makes the energetic recovery ecologically and economically an appropriate recycling method for the next 10 to 20 years.

As the energetic recovery of existing ETICS through doubling can only delay but not prevent the dismantling process, the authors of the study recommend positive labelling of HBCD-free EPS and the development of rapid tests for the reliable application on construction sites and in terms of disposal.

Just as useful is the development of advanced techniques, machines and tools for a selective deconstruction of single-layered or doubled ETICs. Alternative joining techniques could also simplify dismantling.

In the medium term, recycling procedures for raw material, like selective extraction, should be further developed to save EPS raw material and protect natural resources in the long-term on a commercial scale.

Development of a Measuring System for demonstrating Energy Savings through Insulation Measures on the Building Shell
Max Engelhardt, Michael Guess

In the public perception the efficiency of insulation measures are strongly questioned. In terms of energy-saving potential, from a building physics point of view, untenable statements from the media and public opinion are pretty customary nowadays. Even numerous myths, like mold problems and "suffocating walls", are unnecessarily hindering our climate protection goals, the continuing criticism concerning functionality and efficiency of insulation is still the major problem. The lack of trust in profitability means an insurmountable obstacle for capital investors on the free market. Therefore we welcome the idea of measuring the actual reduction of transmission heat loss of an insulated outer wall after renovation, on an ongoing basis. This is a real chance for energetic renovation to be noticed as a more realistic measurement in future.

In another industrial research project a feasibility study for the development of such measurement devices has been carried out and the first prototypes have been tested. Requested was the reliability of the measurement concept as an affordable and user-friendly terminal device for private house and apartment owners, invisible integration of measurement technology into the building, which should guarantee sufficient measurement accuracy. The positive results of the study lead in a short period to the development of a product, ready for series production. FIW Munich scientifically accompanied the product development and market launch. In 2015, tests for validation of the measuring device will be carried out at FIW Munich.

↑ *First prototype of the measuring device*

The measuring device is able to determine the U-value of the original construction. The heat flows, which would occur on an uninsulated construction under identical thermal conditions, are being realistically calculated. This makes it possible to determine continuously increasing energy saving, which can be followed on a display. The figure below shows the first prototype.

Annex 65 – Long-Term Performance of Super-Insulating Materials in Building Components & Systems
Christoph Sprengard, Andreas Holm, Christine Mayer

The "Energy in Buildings and Communities Programme (EBC)" of the International Energy Agency, IEA research projects, initiates wide-ranging research projects (Annex) in the field of energy-efficient building. The goal of the Annex 65 is a growing use of high-performance thermal insulation materials and, as a consequence, an increase

of energy-efficiency in the building sector. This should be achieved by gathering, comparing and further developing existing know-how, testing and handling current products. In addition to this, clearly labelling hygrothermal attributes, as well as long-term behavior of high-performance thermal insulation materials, should enhance the acceptability of these products. High-performance thermal insulation materials like vacuum insulation panels or aerogels, are innovative materials and products, which offer a significant improvement to thermal-insulation properties compared to conventional insulation materials. However, there is hardly any existing long-term experience with these materials in the building sector.

In addition to this, there are currently no standards to define test procedures for material aging. This should be achieved in the framework of Annex 65, with the help of a current market survey and validation of the current state of the art. Round robin tests and other methods should be used to define marginal conditions and aging methods to determine reliable and reproducible parameters of various high-performance thermal insulation materials. In cooperation with different stakeholders from industry and research, basics to describe characteristics, as well as test methods, respectively procedures for standardized testing and evaluation of highly efficient insulation material should be applied. The results should be coordinated internationally, on a scientific basis. In the ideal case, they will be included in the normative directions. The tasks of FIW include, besides the management and coordination of the component project to determine high-performance thermal insulation materials, the analysis of reasonable aging methods. Also essential is the derivation of appropriate testing and calculation methods of these high-end materials concerning their area of application under boundary conditions.

The kick-off meeting for the research project took place in Grenoble in September 2014. Numerous international enterprises and institutes met for the planning and implementation of projects. In future project participants will organize semi-annual meetings for all members. FIW Munich will take over management and control of the first working session in February 2015.

The studies are being sponsored by the Jülich Project Management Organization.

Increase of Energy Efficiency through Interior Insulation – Application Ranges, Chances and Limits

Christoph Sprengard, Holger Simon, Christine Mayer, Andreas Holm

The reduction of heat requirements in existing buildings is essential as well as economical measurements towards the energy-saving targets of the Federal Government. This can mainly be achieved by improving the thermal properties of the building shell. Under certain circumstances, such as facades worth protecting, or adjoining neighboring buildings, proven measures like for example ETICs, can't be used. In these cases the aspired energy savings could alternatively be achieved by barely tested interior insulation systems.

Currently, the potential of interior insulation is far from being exploited because of the building physics risks, like mould formation and condensation and the non-existing empirical values of the construction planners. To achieve the same savings with an interior insulation that you can get with the exterior insulation system, a thicker insulation layer is necessary, which leads to a further risk increase.

Given the above, a project to study hygrothermal properties of interior insulation systems was launched, in cooperation with the Fraunhofer- Institute für Bauphysik in Holzkirchen. During the three years runtime of the project, a reliable evaluation system for inside insulation constructions was to be developed, with the emphasis on the permanent reduction of transmission heat loss and building physics boundary conditions.

An extensive market research should serve to group and characterize currently available interior insulation materials and systems. FIW Munich will carry out different tests and measurements on selected products to specify thermal characteristics. This study includes the relationship between thermal conductivity and moisture content. The results of these tests and series of measurements will be implemented, together with hygric parameters, determined by Fraunhofer IBP, into the material database of the hygrothermal simulation software WUFI®.

In the following simulation calculations, the hygrothermal behavior will be tested in different cross-sections with deviating boundary conditions. To obtain reliable data and measurements of thermal 3-D bridges in future, parameter studies are being carried out with different standard details. Besides steady state calculations, transient simulations concerning heat loss and surface temperature are being performed.

These calculations shall be verified and validated via laboratory tests and field trials by FIW Munich and Fraunhofer IBP. Besides the physical and energetical evaluation, an ecological balance sheet for interior insulation systems is to be carried out. Here, the life cycle of a product system in its entirety is being looked at and evaluated.

The aspects to be considered are the production phase, supply of resources, transport and production, as well as other selected phases, like for example the disposal phase life cycle analysis. The compilation of these life cycle analyses and the resulting environmental impacts should deliver comparable environmental declarations.

The results and experiences from the research project "Increasing Energy Efficiency through Interior Insulation" should be available for construction planners and users and should provide a reliable validation of building physics risks of internal insulation systems. This should lead to an increasing application of interior insulation systems and optimally exploit the energetic potential.

This project is sponsored by Fraunhofer-Institute für Bauphysik and Jülich Project Management Organization

Efficiency of Thermal Insulation Methods

Andreas Holm, Christine Mayer

The climate-neutral building stock that the Federal Government wants to achieve by 2050 at the latest, requires extensive energy-oriented refurbishment. The general economical meaningfulness of renovation measurements like, for example, retrofit insulation of the building shell is being questioned in the media. FIW Munich has been entrusted with the question as to whether insulation measures of the building envelope are economically viable respectively if there could be an accurate statement concerning this matter.

The solution to these questions initially require finding out the range of expected costs. This was calculated for "Insulation of an exterior wall with a thermal insulation system". The business-as-usual costs are being subtracted from the full renovation costs (costs for repair and measurement, which would be necessary anyway, like rendering, scaffolding and so on. The resulting costs show the energy-related additional costs, which includes the costs for insulation material, its assembly and necessary extra work.

To evaluate the relationship between necessary investments and realizable energy saving, the examination of the relationship between additional costs and usage is helpful. This relationship demonstrates energy-related cost versus the annually saved kWh heating energy Therefore it can be said: The smaller the relationship between additional costs and usage, the more effective and economical the insulation measurement is.

To evaluate the validity of the results and possible uncertainties of feasibility studies, the various influencing parameters like energy price, rise in energy prices, interest rate, actual heat energy savings and its possible fluctuation margin, have to be taken into consideration.

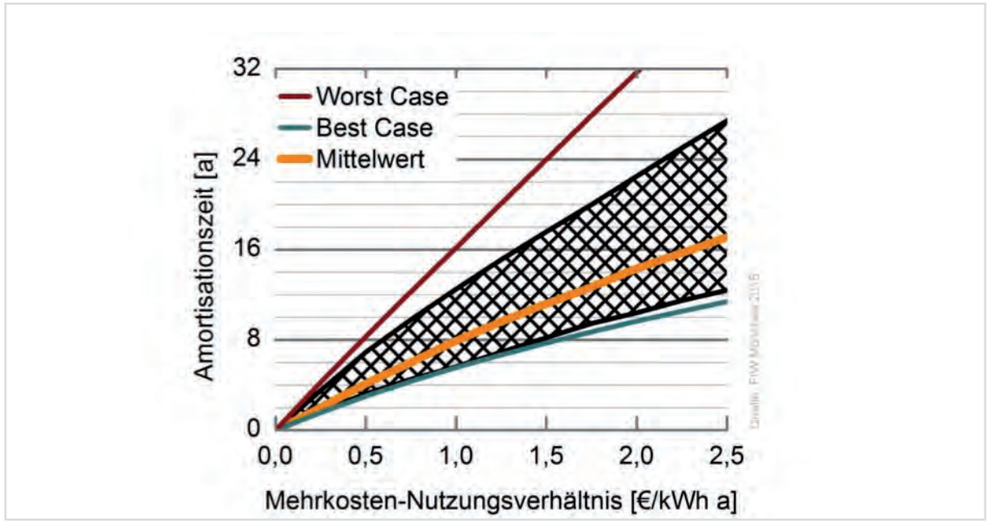
To consider these uncertainties of the economic assessment, the calculation of the amortization period was carried out with the help of a probability supported analysis. Possible combinations of parameter values are being generated through artificial random experiments. The reliability of the analysis increases with the number of repeated calculation runs.

Figure 1 shows the course of the payback period, subject to the relationship between additional costs and usage of refurbishing measurements.

The highlighted area is the confidence interval of the analysis. This means, 95% of the results, calculated through simulations, are in this segment. Obvious outliers can be excluded. Furthermore, a best-case and worst-case scenario is shown.

When we look at this chart, it becomes clear, that the choice of the parameters, even within realistically estimated fluctuation margins, can significantly influence the result and therefore the evaluation of a feasibility calculation.

Therefore, the difference of the determined amortization



↑ *Figure 1 – Parameter influence on the amortization period concerning the relationship between additional costs and usage in €/kWh.*

periods between best-case and worst-case scenario, but also within the confidence interval, grows with an increasing relation between additional costs and usage relation.

This analysis, and various others in this study, leads to the conclusion, that there is quite a number of uncertainties when it comes to a general statement for profitability of renovation measures. These uncertainties could have a significant influence on the total result.

This means that a statement, concerning profitability and feasibility of renovation measures of an energetic refurbishment, is only valid if input data and marginal conditions are sufficiently known, like an actual planned measure. With an exemplary application to a stochastic approach, the influence of parameters, mostly afflicted with great uncertainty on the economic assessment, could be represented and quantified. The necessity of such a procedure for general evaluations of renovation measures became clear.

The research was carried out on behalf of the industry.

Characterisation work and comparative testing of expanded glass granulate as round robin material for thermal conductivity at higher temperatures ITCC/ITES 2014

32nd International Thermal Conductivity Conference/20th Annual Thermal Expansion Symposium, Purdue University, West Lafayette, Indiana, April 27th – May 1st 2014

Roland Schreiner

To being registered as a testing laboratory within the system of voluntary monitoring for technical insulation material in Europe (VDI/Keymark), the laboratory has to prove its competence. The initial selection procedure of suitable insulation material to be used as comparative material to define temperature-dependent thermal conductivity, leads to a characterization of expanded glass granulate. Provided the suitability test was passed, registered laboratories are authorized to carry out measurements which confirm the thermal conductivity curve of technical insulation material. After passing this quality test, the producer of the insulation material is authorized to use the quality seal VDI/Keymark. At the same time, the results of the suitability tests with expanded glass granulate, conducted by five European testing laboratories, enabled the definition of thermal conductivity, at high temperatures (50 °C to 500 °C), on a reliable European level.

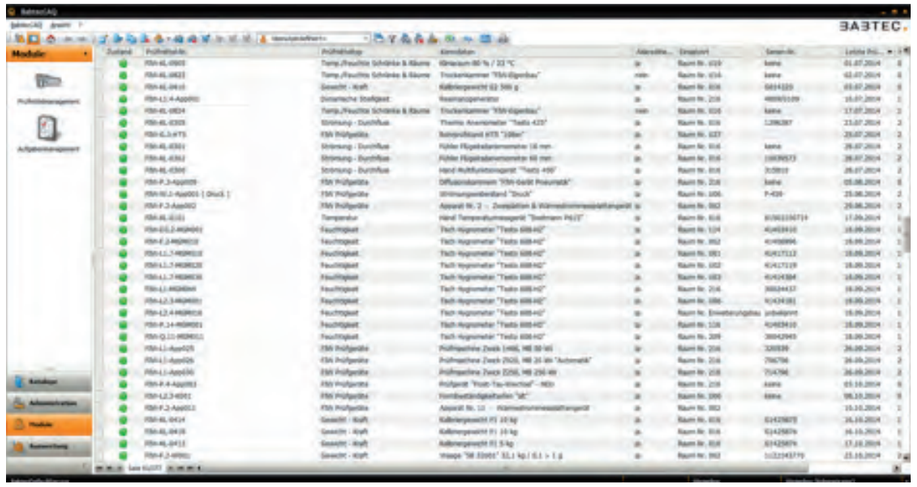
In 2012, the task force “Thermophysics, society for thermal analysis e. V.” (GEFTA) initiated another round robin test for temperature-dependent thermal conductivity.

By using the expanded glass granulate as comparative material, more know-how considering other testing methods (especially transient ones) was gained.

Expanded glass granulate once more has been qualified as comparative material for an extended temperature range of thermal conductivity, up to -160 °C. Compared with reference curve of VDI/Keymark, it shows excellent compliance.

Beginning in August 2012, CE-labelling for technical insulation material became obligational. The declared, temperature-dependent thermal conductivity curve has to be guaranteed as a limit value by the manufacturer. Against this backdrop, a European level of thermal conductivity, ensured by comparative tests, is of really great significance.

The use of various testing methods and different testing facilities to define temperature dependent thermal conductivity of an insulation material, is an important step to accelerate the evaluation of the “real thermal conductivity”.



The certification body of FIW Muchich has been newly accredited by DAkks (Deutsche Akkreditierungsstelle) on the basis of DIN EN ISO/IEC 17065 “Conformity evaluation – requirements for bodies operating product certification systems for products, processes, services. This created the basis for a further recognition as notified body within the Construction Product’s Regulations. Besides the accreditation as a certification body, the testing laboratory is still accredited on the basis of DIN EN ISO/IEC 17025.

FIW’s in-house calibration laboratory ensures the highest level of measurement accuracy according to the norm requirements. To guarantee the returnability on national and international normal ones FIW Munich spared no effort. FIW Munich is working closely with leading external calibration laboratories (DAkkS). Additionally, FIW is constantly working to reduce the uncertainty of measurements. This includes, on the one hand, a consistent development of the institute’s own testing equipment but also by investments in modern and future-oriented calibration equipment.

It is aimed at securing and safeguarding quality, reliability, operational capability and readiness of FIW test equipment.

Equipment management

A simple traffic light system (red = calibration, green = ok) helps to manage the nearly 400 testing devices of FIW Munich.

Hardware side: Purchasing another reference measuring instrument is planned and this investment will help to significantly improve the measurement uncertainty in the range of low temperature.

Besides the high-quality technical equipment, in particular the employees, with their many years of experience and high competency who are the guarantee for the accuracy and reliability of our testing results.

7 Testing equipment and devices

In the framework of the energy efficiency of building and technical facilities, material testing, certification and quality control acquire increasing importance. In addition to our research and development work, we operate testing laboratories according to the highest quality standards. We have decades of experience and enjoy an excellent reputation. We have the latest examination possibilities as well as various analytical techniques. Given the increased demand of relevant studies, our testing laboratories are being continuously equipped at a high level, instrumentally as well as in terms of the staff. Currently, FIW offers the following test equipments:

Product conductivity of thermal insulation according to test regulation

Thermal conductivity of thermal insulation according to regulations von DIN EN 12664, DIN EN 12667, ISO 8301, ISO 8302, ASTM C 177 and the regulations of DIBt, Berlin

- within a temperature range between -180 °C and +900 °C
- 10 °C average temperature
- 40 °C average temperature

Product Type Determination (PTD)
- according to EN 14303–14309
- according to EN 14313
- according to EN 14314

Thermal conductivity of pipe insulations and pipe jacketing, according to regulations DIN 52613, DIN EN ISO 8497
- within a temperature range between -70 °C and +300 °C average temperature
- 10 °C average temperature for cold insulation
- 40 °C average temperature for insulation for thermal insulation of heating systems
- 50 °C average temperature average temperatures for district heating pipelines

Dimensional stability / Shape stability
- Dimensional stability according to DIN EN 1603 in standard atmosphere
- Dimensional stability according to DIN EN 1604 in temperature and humidity/moisture conditions

Behaviour at higher temperatures
- Upper application limit temperature according to DIN EN 14706 and DIN EN 14707
- Upper application limit temperature with and without oscillations

Measurement of the thermal transfer and temperature field with specially adapted standardized or individually designed testing devices on:
- Insulation systems
- Building physics and components

Requirements of fire protection respectively fire behavior
- Non-combustibility according to DIN EN ISO 1182
- Combustion heat according to DIN EN ISO 1716
- Ignitability at direct impingement of flame according to DIN EN ISO 11925-2

Mechanical properties
- Conditions, dimensions, gross density according to DIN EN 1602 and DIN EN 13470
- Tensile strength according to DIN EN 1607, abrasion resistance, transverse tensile strength
- Deformation under defined conditions of compression or temperature, according to DIN EN 1605
- Pressure test according to DIN EN 826
- Shear stress according to DIN EN 12090
- Bending strength according to DIN EN 12089
- Point load according to DIN EN 12430
- Expansion and contraction coefficient according to DIN EN 13471
- Long-term compression behavior, long-term creep behavior according to DIN EN 1606

Hygric properties and behavior at freezing temperatures
- Water absorption according to DIN EN 12087 at complete immersion
- Water absorption at temperature change 20 °C / 40 °C
- Diffusion test 50 °C / 1 °C DIN EN 12088

- Water absorption at partial immersion according to DIN EN 1609
- Water content according to DIN EN 322
- Vapour diffusion according to DIN EN ISO 12572
- DIN EN 12086, DIN EN 13469

Further Properties

- Closed-cell nature according to ISO 4590
- Cell gas structure with a gas chromatograph
- Chloride content and determination of pH values according to DIN EN 13468
- Thermal stability
- Long-specific flow resistance according to DIN EN 29053
- Non-fibrous component parts (welding beads)
- Ignition loss according to DIN EN 13820
- Fiber diameter
- Determination of the total lack of silicone in thermal insulating material

Acceptance measurements

- On-site measurements using heat flow meter and/or infrared camera

Test facilities for insulation material in building construction

Product Type Determination (PTD) according to EN 13162–EN 13171

Approval tests for new insulation materials according to test plans of DIBt or European Technical Approval Guidelines (ETAG)

Testing of construction material class DIN 4102-B2 (normally inflammable)

Classifying of fire behavior according to DIN EN 13501-1, Class E and determination of inflammability according to DIN EN ISO 11925-2

Measurement and testing of thermal conductivity according to the standards DIN EN 12664, DIN EN 12667, DIN EN 12939, ISO 8301, ISO 8302, ASTM C 177 and testing regulations DIBt, Berlin

- In the temperature range of -30 °C to 80 °C mean temperature
- At 10 °C mean temperature

Mechanical characteristics

- Condition, measurements, thickness, bulk density
- Thickness under load according to DIN EN 12431
- Tensile strength, abrasive resistance, transverse tensile strength (DIN EN 1607/1608)
- Compression test according to DIN EN 826
- Shear stress according to DIN EN 12090
- Bending strength according DIN EN 12089
- Point load according to DIN EN 12430
- Dynamic stiffness according to DIN EN 29052-1
- Expansion and contraction coefficient according to DIN EN 13471
- Slump after vibration
- Slump after climate testing according to 40 °C/90 % r. F.
- Long-time creep behavior with compressive stress according to DIN EN 1606 up to a thickness of 300 mm
- Dowel pull-through strength according to ETAG 004

Hygric properties and behavior at freezing temperatures

- Water absorption according to DIN EN 12087 at complete immersion
- Water absorption at temperature change 20 °C/40 °C
- Diffusion test 50 °C/1 °C DIN EN 12088
- Frost-thaw and compression test according to DIN EN 12091
- Water vapour diffusion according to DIN EN ISO 12572, DIN EN 12086, DIN EN 13469
- Moisture balance according to DIN EN 12429
- Sorption moisture for construction material according to 12571 (DIN 52620)
- Water absorption at partial immersion according to DIN EN 1609
- Moisture content according to DIN EN 322

- Dimensional stability/Shape stability
- Dimensional stability according to DIN EN 1603 in standard climate
- Dimensional stability under a defined temperature and moisture conditions according to DIN EN 1604
- Deformation under defined pressure and temperature conditions according to DIN EN 1605

Other characteristics

- Closed-cell nature according to ISO 4590
- Cell gas structure with a gas chromatograph
- Chloride content of HWL-panels according to DIN EN 13168
- Flow resistance specific to length according to DIN EN 29053

Special Testing Equipment

1. Quick test for alternating load tests on bonds.

In the NA 005-56-93 AA “airtightness” test, methods are being developed that are suitable for the evaluation of durability of the adhesive bindings of the path of airtightness among each other and the contiguous ones.

Adhesive tapes and adhesive cement are being used for the bonds. One of the methods is the “peeling test”, which is generally used to determine the strength of bonds. Its disadvantage is that a peeling strain hardly ever occurs in practice. To test the often occurring shearing strain, FIW developed, together with Prof. Dr. Thomas Ackermann from Technical College Bielefeld, a new test application. For this purpose, an already existing device from FIW, originally designed for testing settlement behavior of loose insulating materials, has been modified to allow testing of shear airtightness bonds. Currently, tests on bonds with different adhesives are being conducted to analyze if this testing method could be suitable for standard testing.

Contact: S. Treml

2. Rotatable heat flux measuring slab

Since August 2012, a new heat flux measuring slab, which enables measuring of big samples up to approx. 1.2 m x 1.6 m, is available at FIW Munich. The device was planned in only a few weeks and has mainly been built by FIW staff. After an extensive test phase, it is now already being used for the testing of the research project on the impact of brick shapes, mortar joints and stamped out handles of highly insulating thermal masonry. This is where the device can reach its full potential, through its varying orientation of its cooling plates. Its unique feature is its rotatability up to 360°, while its cooling plates are embedded in a stable construction of aluminium sections. This allows the determination of equivalent heat conductivity under different directions of heat transfer. Every possible orientation is conceivable here: Thermal flow downwards, upwards or horizontally and any angle in between. Highly insulating thermal masonry normally means a horizontal thermal flow. Up to now, the measurement of half bricks, using the plate method, has only been possible in a horizontal mounting position, according to DIBt directives. This gap is now closed by the new device.

The direction of heat transfer during measurement could also prove to be interesting for further possible areas of application, materials and samples, for example highly-insulating glazing, multi-layered foil insulation materials, membranes and insulation layers with a low density, for which the orientation of the component (and therefore of the thermal flow) is important. The huge sample area is especially interesting for the monitoring of vacuum insulation panels (VIPs), which cannot be cut to size.

Control and data logging has been designed in such a way that long-term recordings of varying temperatures are possible to test transient effects on thermal flow, such as, for example, heat inputs and outputs or moisture transfer in drenched samples. This means that FIW Munich can now make use of a valuable new and very flexible instrument for research and testing purposes.

Contact: C. Sprengard

3. Testing facilities for the determination of water absorption after complete immersion

For testing “Water absorption after complete immersion” according to EN 12087, testing facilities for thermal insulation material, up to a thickness of 400 mm, are available

Contact: S. Sieber

4. Testing facilities for the determination of freeze / thaw cycling

In 2012, another device for the “determination of freeze / thaw cycling” according to EN 12091 was purchased. Thermal insulation material, exposed to moisture (inverted roof, perimeter insulation) is being tested (after 300 cycles of one hour storage each, at -20 °C and sub-water storage at + 20 °C) with regard to change under compressive stress and water absorption. To moisten the

Testing device to determine behavior during freeze / thaw cycle

samples, normally the „Determination of water absorption through diffusion” according to EN 12088 is preceded to freeze / thaw cycling test. These audit capacities were also extended in the recent years.

Contact: S. Sieber

5. Measurement of cryogenic temperatures

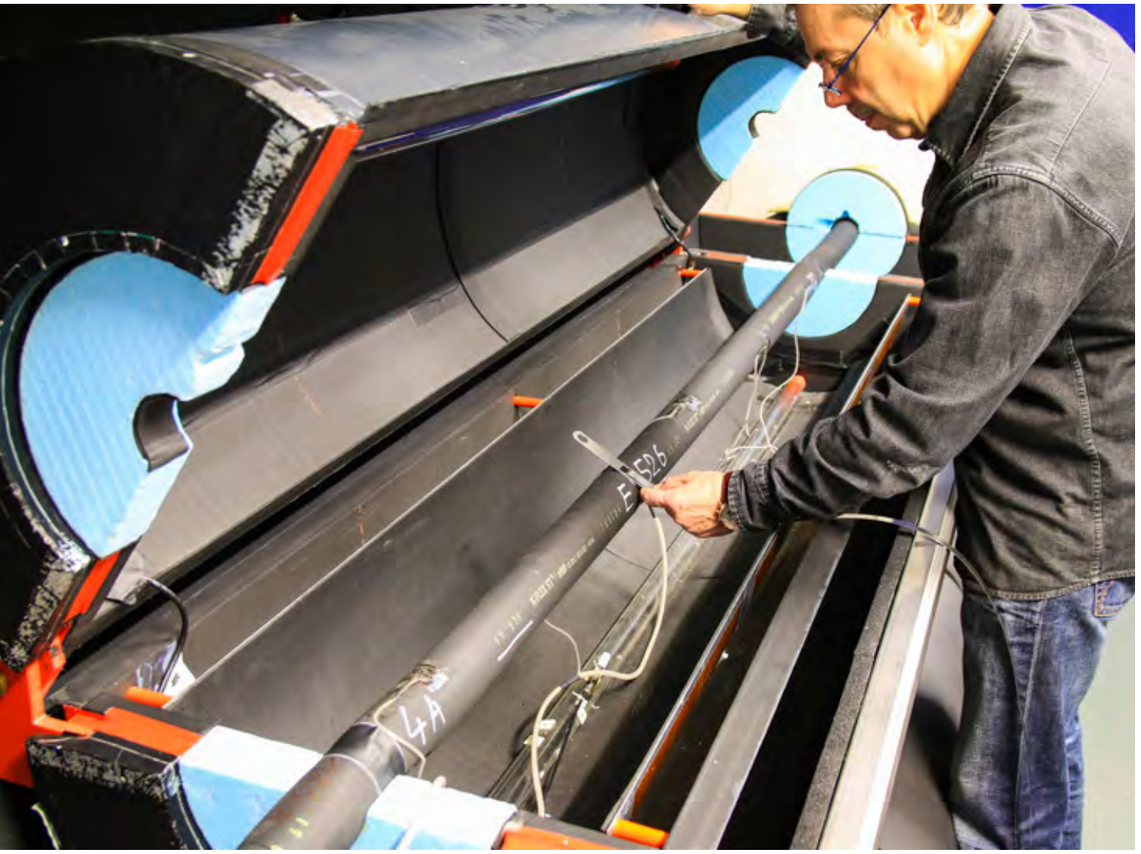
The definition of insulation material for cryogenic temperatures (up to -190 °C) is being widened for the expansion coefficient. For the design and planning of insulation systems, such as, for example, liquid gas facilities, the knowledge of the expansion coefficient is essential to consider the different length expansions between the building wall and insulation material, to minimize the number of thermal bridges. The new testing device, which will fulfill the requirements according to DIN EN 13471 “Thermal insulation material for building services and operating facilities – determination of thermal expansion coefficient”, has been optimized concerning samples for insulation material.

Contact: R. Alberti

6. Autoclave for the conditioning of mineral wool in ETICs

In 2013, we started operating an autoclave for moisture conditioning of samples of mineral wool for ETICS. This means FIW now offers, besides EOTA steam test and nordtest, conditioning in autoclaves.

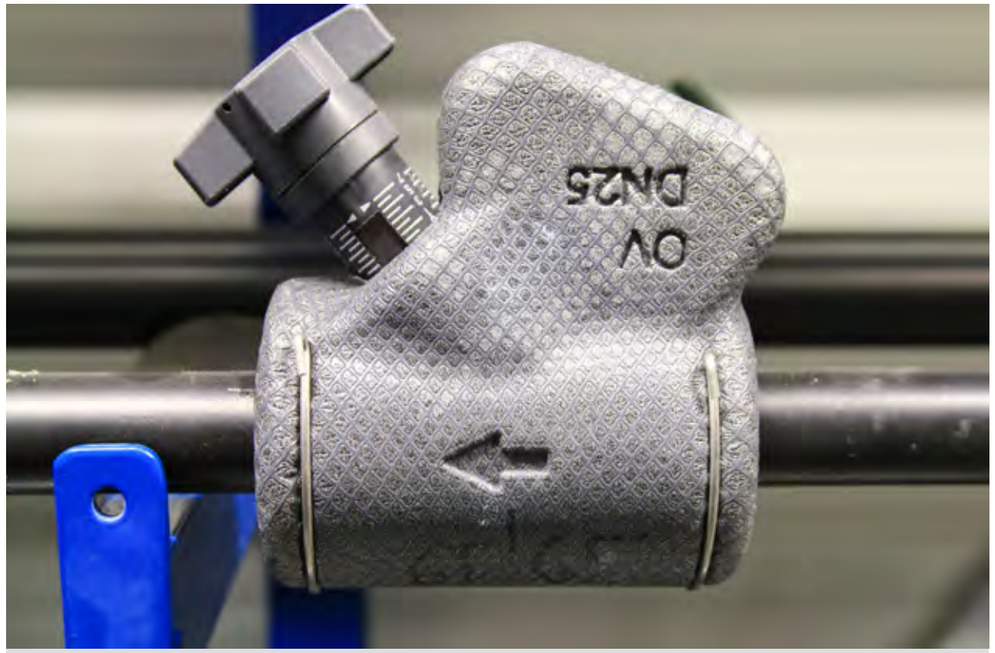
Contact: C. Karrer



↑ *Tubular test chamber according to hot box method*

7. Tubular test using the hot-box-method for insulation systems to define flow resistance specific heat loss in extreme low temperature run – an expansion of the test offer by the technical insulation department

Today, the increasing cooling requirements enhance the energy demand and pollute the environment. For the generating, storage, and transport of coldness, energy efficient technologies are needed.
To demonstrate the energy-saving potential through loss of heat, but most of all loss of coolness, in operating facilities, all specific energy losses of all components have to be defined. Primarily for insulated pipelines, flanges, fittings and valves which are the parts that cause additional energy loss. Therefore, the tubular test chamber, according to hot box method, offers the ideal solution to register metrologically the specific length heat loss of insulated (figure YY) or uninsulated construction parts. The testing procedures have been further developed for cooling requirements down to -50 °C. Figure xx shows the test chamber of the tubular test devices. The test pipe is being flowed through by a liquid, cold medium. The inner test chamber is sensitive to temperature and humidity. During



↑ *Pipeline with insulated valve, component testing*

this procedure, the outer chamber is regulated on a zero temperature difference to the inner chamber by a thermopile. Due to the low mean temperature, there is a heat flow from the inner chamber into the insulation system. The medium warms up and this cools the inner chamber. With an electric heating system in the inner chamber, energy is being added to keep the temperature of the inner chamber constant. The electric performance of the heating system is being measured and corresponds to the heat loss through the insulation and the installed thermal bridges in the measuring zone under operating conditions. The control loop of the testing device has been examined in detail with regard to the conditions under low temperature and optimally coordinated. With the extensions of the test bench for low temperature, the specific energy losses, occurring far below ambient temperature of insulation systems for technical facilities, can be calculated reliably. Accelerated by the collaboration with FIW Munich to establish the guidelines committee VDI 4610 section 1 and section 2 “Energy efficiency of operating facilities, for thermal and refrigeration insulation /catalogue of thermal bridges” the specific energy loss of standardized construction parts of refrigerant piping can be made available to a broad public.

Contact: R. Alberti

New measuring and test equipment

Bituminous sheeting – Sample preparation

1. Sample preparation bitumen coating

At the beginning of 2014, for the first time, a bituminous sheeting for sample preparation for compression tests was put into operation according to EN 826 for foam glass. In the course of the same year, a specific work environment with a controlled ventilation system was installed. The equipment is being used for the preparation of rule checks and in the framework of a research project.

Contact: S. Sieber

2. Reorganization in the fields of fire test and sample conditioning

By the turn of the year, the long-planned modernization of the fire test and sample storage premises under a temperature of 23°C / 50% r.F was carried out. Now the chamber for sample conditioning is next to the fire room and can also be used for further tests, like dimensional stability in standard atmosphere. Not only shorter walking distances between storage and testing, but also a few technical innovations, like a shading system or a dimmable light, will make the daily workflow easier.

Contact: S. Sieber

Sample Conditioning

Fire Room

New test benches for long-term creep behavior

3. Innovative, state of the art test bench for Long-term creep behavior under Compression

For the production of insulation material, the use of the flame retardant HBCD is no longer allowed, according to 57d REACH-regulation from August 21 2015 onwards. All manufacturers of insulation material of EPS und XPS also produce material containing alternative flame retardants, which have been tested at FIW Munich, respectively will be tested with procedures for long runtimes. The German Institute for Building Technology, DIBt, considers the change-over as a change in formulation which demands preliminary checks before approval. For general approvals by the building authorities for the application load-bearing thermal insulation under foundation slabs, test results concerning long-term creep behavior under compression, according to DIN EN 1606, are required. As new preliminary checks are required for all approved insulation materials, and with the long runtime of 1.67 years, a high demand of testing capacities for long-term creep behavior arose, which was not available in the whole of Germany at that time. That's why FIW planned and constructed innovative and state of the art test benches from the end of 2014 onwards until the beginning of 2015. This should help each member to get the necessary test results as promptly as possible (if 1.67 years of testing can be called promptly at all).

Each test bench is fitted with a high-precision extensometer, which delivers the necessary long-term stability. These inflexible and heavy test benches have been installed in a new, fully air-conditioned chamber in the basement of construction unit 3.

↑ *eGecko Lims application*

4. Introduction of ERP and LIMS-Software

The “Alpha-based”, all-in-one software program, grown over decades, had been discontinued and is being replaced by an ultra flexible and configurable software. The need for the change had two reasons:

Updating the old system platform would have been immensely cost-intensive. With the retirement of the long-time software expert, Mr. Vieregg, maintenance and updating became more and more complicated.

This is why, nearly two years ago, we started looking for a replacement with the help of external consultants. The new software will, as usual, deliver excellent support for the business processes. On top, it guarantees a huge flexibility for the increasingly dynamic processes in the laboratory and will include processes, which have up to now been less integrated. By the end of 2013, by signing the contract, the final decision was made in favour of eGecko from CSS. Since Q4/2014, it is being actively implemented at FIW. The accounting department was the first one to work with the new software. Step by step, the other departments will follow.

↑ *Contract closing from left to right: Michael Friemel (CEO CSS), Renè Baudzus (CSS Distribution), Prof. Dr. Andreas Holm (FIW), Stefan Klasche (FIW), Wolfgang Albrecht (FIW)*

The most important area for the institute will always be the laboratory sector. In the preliminary stage, a lot of basic discussions took place concerning the business processes and could be deepened by the CSS Software. It also meant that internal processes of different departments were able to find a common basis and were optimized. The new system architecture allows various kinds of adaptation. Especially in the laboratory sector there will be a lot of simplifications, faster transitions of information and more transparency up to a higher level of automation.

Voluntary Monitoring System

A voluntary monitoring system for thermal insulation material for use in external thermal insulation systems (ETICS)

→ Thermal insulation material for external thermal insulation systems (ETICS) has to meet extremely high requirements to guarantee not only thermal protection, but also the stability of the system. These requirements are defined in the national general building approval for thermal insulation material Z-33.4-xxx or for the system) or European fundamental standard (standards or European technical approvals – ETAs)

To demonstrate these properties of a high product quality, numerous producers of insulation material from expanded polystyrene (EPS) contractually agreed on a monitoring system. This voluntary monitoring system, defined in collaboration with the Rigid Foam Industrial Association, Heidelberg, was successfully propagated and conducted in 2013.

A notified body, (FIW Munich) performs an audit of the factory production control system in the monitored plants at least twice a year. The audit is based on the European product and conformity standards and ETAG 004 (Directive for European technical approvals for external thermal insulation systems) and a verification of labelling of the products. In addition, product extractions, together with a review of all declared and application relevant features, are being conducted on two charges on a yearly basis.

The leading manufacturers of expanded polystyrene (EPS) for use in thermal insulation systems (ETICS), who joined the monitoring system, finally possess, after a successful audit in 2013, valid certifications (not UE or CE certificates) which confirms compliance with the declared nominal values, levels and classes, and the requirements of EN and ETAG 004. These voluntary certificates not only enjoy a high level of acceptance among the manufacturers of ETICS but also among the recognized inspection and certification authorities.

Forschungsinstitut für Wärmeschutz e.V.
München

ZERTIFIKAT

Reg.-Nr.: FZ-xxx.0-01/13

über die Durchführung der werkseigenen Produktionskontrolle und der freiwilligen Fremdüberwachung aller relevanten Produkteigenschaften auf Grundlage der Anforderungen der ETAG 004:2000

Produkt: **"xxx - Fassadendämmplatte"**
Wärmedämmplatten aus expandiertem Polystyrol (EPS) nach DIN EN 13163
Stoßkante aus grauem Rohstoff mit IR – strahlungsabsorbierenden Eigenschaften
für die Anwendung in Wärmedämmverbundsystemen (WDVS) nach ETAG 004:2000
EPS-EN 13163-T2-L2-W2-S2-P4-BS100/150-DS(N)2-DS(70,-)2-TR100/150
Brandverhalten nach EN 13501-1: Klasse E

der Hersteller **xxx-Dämmstoffe GmbH**, PLZ+Ort
hat mit dem **FIW München**, Forschungsinstitut für Wärmeschutz e.V., 82166 Gräfelfing
für das Herstellwerk **PLZ+Ort**
einen Vertrag über die freiwillige Fremdüberwachung des oben genannten Produktes geschlossen.

Die Überwachung umfasst die regelmäßige Überprüfung der werkseigenen Produktionskontrolle (WPK) auf Grundlage der EN 13163 und EN 13172 Abschnitt 5, sowie die regelmäßige Produktprüfung an zufällig im Herstellwerk entnommen Proben. Dadurch soll die Eignung des Wärmedämmstoffes für die Anwendung in Wärmedämmverbundsystemen nachgewiesen werden, die nach europäisch technischen Zulassungen (ETA) auf Grundlage der ETAG 004, sowie nach nationalen allgemeinen bauaufsichtlichen Zulassungen (aBZ) genegelt ist.

Folgende Eigenschaften wurden im abgeschlossenen Überwachungsjahr bei Produktprüfungen nachgewiesen:

Produkteigenschaften vom FIW München überwacht	xxx-Fassadendämmplatte		Anzahl der erbrachten positiven Nachweise
	EPS 035 WDV kd IR	EPS 032 WDV kp IR	
Wärmeleitfähigkeit (EN 12667): Bemessungswert λ (Z-33.15-xxxx) / übersteigender Grenzwert λ_{grenz} nach DIN 4108-4 (Kategorie II)	0,035 W/(m·K) / 0,0378 W/(m·K)	0,032 W/(m·K) / 0,0336 W/(m·K)	1x pro Produkt
Nennwert λ_D / λ_{grenz} * A_1 in der WPK	0,035 W/(m·K) erfüllt	0,032 W/(m·K) erfüllt	2x WPK-Kontrolle
Dicke (EN 823):	T2 (± 1 mm)	T2 (± 1 mm)	1x pro Produkt
Zugfestigkeit senkrecht (EN 1607):	≥ 100 kPa	≥ 150 kPa	2x pro Produkt
Biegefestigkeit (EN 12089):	≥ 100 kPa	≥ 150 kPa	2x pro Produkt
Scherfestigkeit (60 mm Dicke) und Schermodul (EN 12090):	≥ 50 kPa ≥ 1000 kPa	≥ 50 kPa ≥ 1000 kPa	2x pro Produkt 2x pro Produkt
Wasseraufnahme bei kurzzeitigem teilweisem Eintauchen (EN 1609):	≤ 0,2 kg/m²	≤ 0,2 kg/m²	1x pro Produkt
Wasserdampfdiffusionswiderstandszahl μ (EN12086):	≤ 50	≤ 60	1x pro Produkt
Dimensionsstabilität bei Normklima 23°C/50% F (EN 1603) 70 °C über 48 h (EN 1604):	DS(N)2 (≤ 0,2 %) DS(70,-)2 (≤ 2 %)	DS(N)2 (≤ 0,2 %) DS(70,-)2 (≤ 1 %)	ø 2x pro Produktgruppe
Länge und Breite (EN 822): Rechtwinkligkeit (EN 824): Ebenheit (EN 825): Rohdichte (EN 1602):	L2, W2 (± 2 mm) S2 (± 2 mm/1000 mm) P4 (5 mm) ≤ 25 kg/m³	L2,W2 (± 2 mm) S2 (± 2 mm/1000 mm) P4 (5 mm) ≤ 25 kg/m³	ø 2x pro Produktgruppe

Das Zertifikat ist gültig bis zum Datum

Leiter der Überwachungsstelle

Gräfelfing, Datum

Dipl.-Ing. (FH) Claus Kamrer

Dieses Zertifikat wurde nach Abschluss der jährlichen Überwachungsprüfungen ausgestellt, ist 15 Monate gültig und wird nach positiven Produktprüfungen im folgenden Überwachungsjahr erneuert.

Forschungsinstitut für Wärmeschutz e. V. München
Lochhamer Schlag 4 · 82166 Gräfelfing

Telefon +49 89 854000 · Telefax +49 89 8540010
info@fiw-muenchen.de · www.fiw-muenchen.de

↑ *Sample of a certificate to confirm the compliance of all declared and application relevant features of EPS-thermal insulation material for use in external thermal insulation systems (ETICS)*

Research and development possibilities in the field of insulation material

Research

- Processing of research projects, concerning all fields of thermal and moisture protection of building physics, facilities and buildings.
- Research for energy saving of buildings and for energy efficiency
- Applied research and technology development of insulation material, building material and construction products,
- Research of fundamental hygric material properties or the impact of moisture on thermal conductivity of building and insulation parts
- Application for subsidies for research projects in Germany and Europe

Energy requirement of buildings

- Determination of the energy requirement of systems or buildings
- Holistic view of heat loss, taking into account location, climate and user's consumption patterns
- Estimates of potential for renovations

Development of products and materials

- Optimization of hygric characteristics of insulation and building materials and of construction parts and insulation systems
- Accompaniment of further developments of materials, products, components and building parts through calculation and simulation up-to-date computer programs
- Measurement of input data for thermotechnical simulations
- Determination of heat transition and moisture contend of components and builtind parts on a scale of 1 : 1 up to a 3.5 x 3.5 m component size
- A combination of numerical calculations, simulations and laboratory testing for new building parts (for example like vacuum insulation panels (VIP)), moisture adaptive vapour barriers, low emissive coated insulation foils or masonry blocks filled with insulation material, scientific support up to the market launch of the product.
- Calculations, simulations an testing of hygrothermical characteristics for other sectors, for example cooling and freezing equipment, transport container and cooling trucks, accompaniment of the complete value chain at a construction site, from raw material to construction component, from construction component up to the complete insulation system – the building shell.

Other research and simulations

- Calculations in a transient state, with rising or sinking temperatures
- Simulations for moving in liquids or gases (CFD)
- Measurements of building components or materials with a realistic moisture content, to analyse moisture distribution in systems and better assess damages
- On-site investigations and monitoring of existing or newly constructed buildings
- Testing and simulation of long-lasting functionality of construction and restoration measures
- Surveys and assessments of potentials
- Catalogues of thermal bridges
- Support concerning technical manuals and product documents

National committees and boards

AGI (Arbeitsgemeinschaft Industriebau)

- AGI Arbeitsblätter der Reihe Q
  R. Alberti

GSH (Güteschutzgemeinschaft Hartschaum e. V.)

- PUR on-site foam (casting foam) (RAL-RG 710/7)
  R. Alberti
- GFA-PUR – Joint expert committee PUR roof spray foam and PUR spray foam
  S. Kutschera
- Polystyrene task force (AAPS)
  S. Sieber
- Quality Committee
  S. Sieber
- Steering Committee
  S. Sieber

DIBt (Deutsches Institut für Bautechnik)

- SVA-A materials for insulation against heat and sound
  W. Albrecht
- SVA-B1 thermal conductivity
  W. Albrecht
- SVA-B3 exterior thermal insulation
  W. Albrecht
- Ad hoc committee: Load-bearing thermal insulation of greater thickness under foundation slab
  W. Albrecht
- ABM colloquium of the fire protection laboratories
  W. Albrecht
- Experience exchange thermal insulation-related measurement (EWM)
  W. Albrecht
- Experience exchange testing, surveillance and certification centers, foam plastics and wood woo
  W. Albrecht
- Experience exchange testing, monitoring and certification centers, mineral wool
  W. Albrecht

DIN CERTCO (Gesellschaft für Konformitätsbewertung mbH)

- ZA-UDB certification committee underlay and sarking for roof coverings (chairman)
  J. Cammerer

Hauptverband deutsche Bauindustrie (HDB) – Federal division for heat, cold, sound and fire insulation

- Technical committee (TA)
  Dr.-Ing. M. Zeitler, R. Schreiner

IVH (Industrieverband Hartschaum e. V.)

- Expert committee (monitoring processes on results and certification center)
  W. Albrecht
- TAA (technical task force)
  C. Karrer
- Task Force Etics
  S. Sieber

IVPU (Industrieverband Polyurethan-Hartschaum e. V.)

- Technical committee of the Industrieverband Polyurethan-Hartschaum
  W. Albrecht

ÜGPU (Überwachungsgemeinschaft Polyurethan-Hartschaum e. V.)

- Expert committee (analysis of third-party monitoring results of the ÜGPU
  W. Albrecht

VDI (Verein Deutscher Ingenieure e. V.)

- Guidelines committee VDI 2055
  Dr.-Ing. M. Zeitler (chairman)
- Guidelines committee VDI 4610
  Dr.-Ing. M. Zeitler (chairman), K. Wiesemeyer
- Expert committee “Energy use”
  Dr.-Ing. M. Zeitler
- VDI- Gesellschaft Energie und Umwelt (VDI-GEU), division 3
  R. Schreiner

Zentralverband des Deutschen Baugewerbes (ZDB)

- Association for the promotion of insulating technology: advisory and internet group
  R. Schreiner

- **Fachverband Wärmedämmverbundsysteme**
  AK2 - EPS
  S. Sieber

DIN NABau (Deutsches Institut für Normung e. V.)

- NA 005-56 FBR “KOA 06 Energy savings and thermal insulation”
  Prof. A. Holm (deputy chairman) (coordination committee)
- NA 005-56-10 AA “Insulation work on industrial systems in buildings and in the industry”
  R. Schreiner
- NA 005-56-20 GA Energetic assessment of buildings (amongst others DIN V 18599)
  Prof. A. Holm
- NA 005-56-60 AA thermal insulating materials (SpA for CEN/TC 88, ISO/TC 163 and ISO/TC 61)
  Prof. A. Holm (chairman)
- NA 005-56-60 AA Thermal insulating materials
  W. Albrecht
- NA 005-56-60, Ad hoc 04 EPS
  S. Sieber
- NA 005-56-60 AA, Ad hoc 09 Wood wool lightweight boards,
  S. Sieber
- NA 005-56-65 AA “Vacuum insulation panels (VIP)”
  C. Sprengard
- NA 005-56-69 AA “Insulating materials for industrial systems in buildings and in the industry”
  R. Schreiner
- NA 005-56-90 HA Thermal insulation and energy savings in buildings (SpA for CEN/TC 89 and ISO/TC 163) (amongst other, standard series DIN 4108)
  Prof. A. Holm (chairman)
- NA 005-56-2 AA Specific values and requirements of heat transition. Rated values of thermal conductivity (DIN V 4108-4) and minimum requirement of thermal insulation material (DIN 4108-10)
  W. Albrecht
- NA 005-56-93 AA Airtightness
  S. Treml
- NA 005-56-97 AA Transparent components (Sp ISO/ TC 163/ SC 1/ WG 14)
  C. Sprengard
- NA 005-56-98 AA Thermal insulating measurement
  W. Albrecht
- NA 005-56-99 AA Moisture (Sp CEN/TC 89/WG 10)
  Prof. A. Holm
- NA 005-02-07 AA pre-fabricated accessory parts for roofing (Sp CEN/TC 128/SC 9)
  S. Treml
- NA 005-02-09 AA Sealing sheets (Sp CEN/TC 254)
  S. Treml
- NA 005-02-10 AA Roof and sealing sheets (Sp CEN/TC 254/SC 1)
  S. Treml
- NA 005-02-91 AA Flexible layers under roof coverings (Sp CEN/TC 254/WG 9
  S. Treml
- NA 005-02-92 AA Overlay sheets (Sp CEN/TC 128/SC 9/WG 5)
  S. Treml
- NA 005-02 FBR Steering committee FB 02 – Sealing, moisture proofing
  S. Treml
- AA DIN 18530 Solid ceiling structures for roofs
  S. Treml
- Ad hoc 16 conformity procedure,
  S. Treml

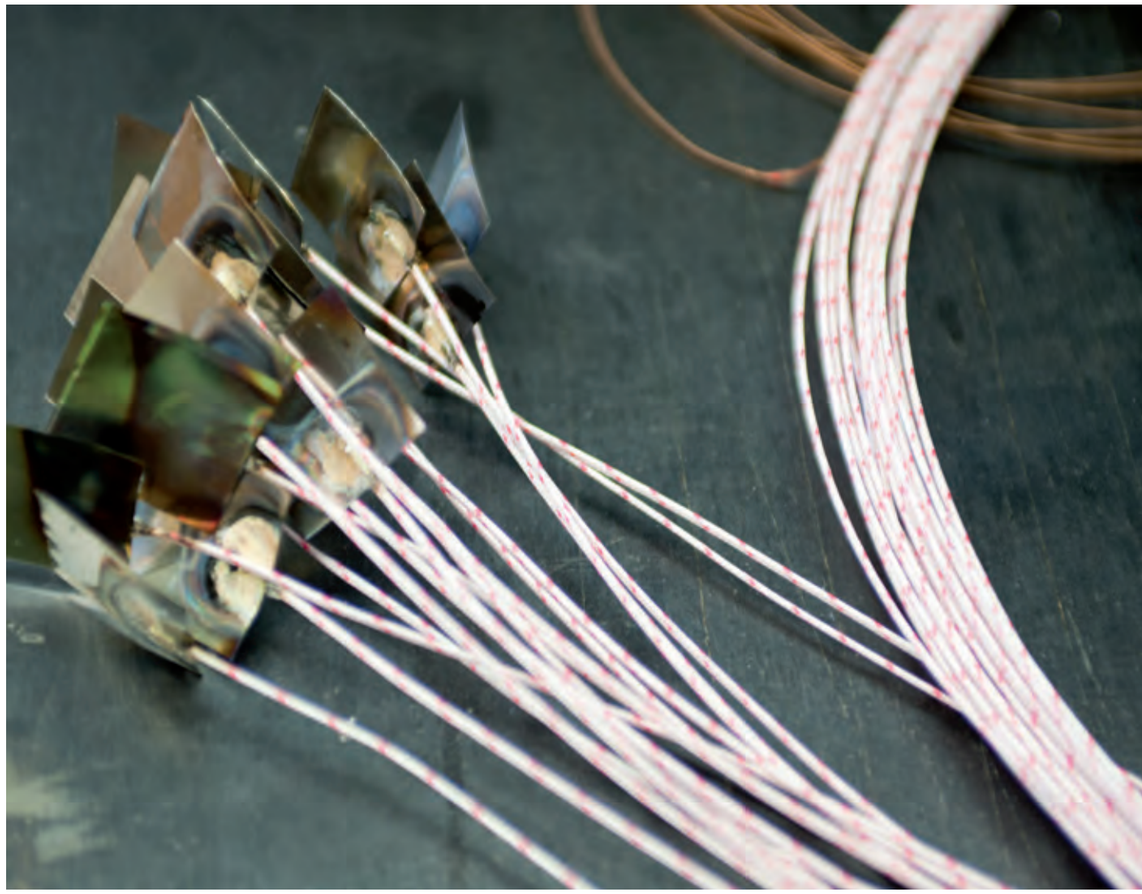
International committees and boards

ASHRAE (American Society of Thermaling, Refrigerating and Air-Conditioning Engineers)

- TC 1.12 Moisture Management in Buildings
  Prof. Andreas H. Holm
- TC 4.4 Building Envelope Performance and Building Materials
  Prof. Andreas H. Holm
- SPC 62.2 Ventilation and Acceptable IAQ in Low-Rise Residential Buildings
  Prof. Andreas H. Holm
- SPC 160 Criteria for Moisture Control Design Analysis
  Prof. Andreas H. Holm

CEN (Comité Européen de Normalisation)

- TC 88 Thermal Insulating Materials and Products
  Prof. Andreas H. Holm (Chairman)
- TC 88/WG 1 General test methods
  C. Karrer
- TC 88/WG 1 General test methods – ad hoc group ageing (Schnellalterungsverfahren für XPS, PUR, PF)
  W. Albrecht
- TC 88/WG 4 Expanded Polystyrene Foam (EPS)
  S. Sieber
- TC 88/WG 4 / Drafting Panel
  S. Sieber
- TC 88/WG 4 / TG ETICS
  S. Sieber
- TC 88/WG 4/TG Test Methods and Test Result
  S. Sieber
- TC 88/WG 7 Phenolic Foam (Phenolharz-Hartschaum)
  W. Albrecht
- TC 88/WG8 Cellular Glas (CG)
  S. Sieber
- TC 88/WG 9 Woodwool (WW)
  S. Sieber
- TC 88/WG 10 Building equipment and industrial installation (Convenor)
- TC 88/WG 11 Vacuum-Insulation-Panels (VIP)
  C. Sprengard
- Liaison officer with CENN/TC 166 Chimneys
  R. Schreiner
- TC 88/WG 10 Building equipment and industrial installation – Task group Test methods TGTM (TG – Leader)
  R. Schreiner
- TC 88/WG 12 Expanded Perlite Boards
  W. Albrecht
- TC 88/WG 16 Evaluation of Conformity
  R. Gellert
- TC 88/TG Liaison to TC 350/351
  R. Gellert (Convenor)
- TC 89 Thermal performance of buildings and building components.
  Prof. Andreas H. Holm
- TC 89/WG 3 Calculation of thermal insulation of equipment in buildings
  R. Schreiner
- TC 89/WG 11 Thermal performance of buildings and building equipment – Task group 1
  R. Schreiner
- TC 89/WG 12 Reflective Insulation Materials
  R. Schreiner
- TC 107/WG 10 “Flexible pipe systems for district heating”
  R. Schreiner
- TC 254 Flexible sheets for waterproofing
  S. Treml
- TC 254/WG 9 Underlays for discontinuous roof coverings
  S. Treml (Convenor)
- TC 254/TG WG 9 and 10 Artificial Ageing
  S. Treml (Convenor)
- TC 371 Project Committee on Energy Performance of Buildings
- Notified Bodies-CPD/SG 19 Thermal Insulation Products
  W. Albrecht, R. Schreiner



CEN Certification

- SDG 5 Thermal Insulation Products TG λ - Expert Group (Schaffung eines einheitlichen Wärmeleitfähigkeitsniveaus für Dämmstoffe in Europa)
  W. Albrecht

ISO (International Organization for Standardization)

- TC 163 Thermal performance and energy use in the built environment SC1
  Prof. Andreas H. Holm (Chairman)
- TC 163/ WG 5 Vacuum-Isolation-Panels (VIP)
  C. Sprengard, S. Koppold

QAC (Quality Assurance Committee)

- VDI-Keymark scheme for thermal insulation products for building equipment and industrial installations, the voluntary product certification scheme
  R. Schreiner (chairman)
- Laboratory group
  R. Schreiner

Thermal Insulation Day – a clear appeal towards policy, economy and science

Munich – More than 150 participants from business, industry and politics accepted the invitation by the Forschungsinstitut für Waermeschutz e. V. (FIW) for this year's Thermal Insulation Day in the house of Bavarian Economy in Munich, under the heading "Energy Revolution – today's challenge". Besides the welcoming speeches and specialist presentations, the main focus of FIW-members, industry insiders and guests was on the current development in the area of energy efficiency as the main tool for successfully coping with the energy revolution. In his keynote, FIW's chairman, Klaus-W. Koerner, spoke out clearly: "We cannot deny the sobering observation that the targets, formulated in the Black/Red Coalition Agreement for an increase in the energy efficiency of buildings, which was meant to be the main key of the energy turnaround, were not followed by decisive political action. So far, the master plan of the future energy and environmental policy is still missing. Up to now, there is no answer to the question regarding which strategies should be used to approach the energy efficiency in the industrial, public and private sector. On the positive side, Koerner noticed that the prominent role of energy efficiency as the second supporting pillar of the energy revolution and the naming of the building as an important starting point for energy efficiency measurements, has been acknowledged. Koerner's credo towards policy and population turned out rather unmistakably: "Unconsumed energy is the most cost effective way to save our energy and is always available". FIW's chairman claimed the development of a master plan "Energy efficiency" which should be used for the nationwide renovation of existing buildings in Germany. For Koerner, there is no other way to increase the energy efficiency of buildings than to implement a tax incentive system of at least two billion EUR for energetic renovation measurements. Klaus-W. Koerner closed his presentation with an urgent appeal: "The energy turnaround has to be saved and must become supply safe, affordable and socially acceptable!

From the very beginning, dena (Deutsche Energie-Agentur GmbH) has been the co-organizer and partner of the Thermal Insulation Day. Stephan Kohler, chairman of its executive management, spoke on behalf of dena. His presentation was under the heading of "Pushing the change of buildings". Kohler introduced the first Germany-wide, multidiscipline campaign, which started in March 2014, by dena and geea (Die Allianz für Gebaude-Energie-Effizienz). The triad of this campaign is "consulted, sponsored, refurbished". Information about this concept can be found on www.die-hauswende.de. The most important keywords are, according to Kohler, the demand for tax-deductibility, market-transparency and information, for example through energy consultants, energy certificates and an increasing openness to technological ideas by the public, but not in the sense of a forced renovation.

The state secretary Gerhard Eck, member of Parliament, made his welcoming speech as the representative of the Bavarian Ministry of the Interior, Housing and Traffic.

Eck formulated three key measurements in terms of which policy has to be carried out for a successful energy revolution: First of all: Improvement in public relation work. The public has to clearly understand the advantages of thermal insulation. Secondly, there have to be attractive subsidies to achieve a wide acceptance. Thirdly, legal requirements have to be realizable. According to the state secretary, innovative solutions have to be put to the test. In this context and in the name of the Bavarian Government he thanked the FIW for its "excellent work" in research. Eck assured the auditorium:"Bavaria promotes the energy revolution and will support increased promotion - provided buildings are designed to save energy.

In 2014, Bavaria provided an amount borrowed of EUR 130 Million. We, the government, have to set an example. Therefore, the Free State will renovate all government buildings according to a very high energetic standard. For this purpose, EUR 20 Million for nearly 120 construction measures were spent.

The voice coming from Berlin on this year's Thermal Insulation Day, was the one of Günther Hoffmann, head of construction department in the federal ministry for the environment, building and nuclear safety. Hoffman reported on the great success of the KfW programs. From 2006 to 2013, 3.4 Million apartment renovations have been supported with this money. This corresponds to 18 percent of all apartments in Germany. Hoffmann criticized the still existing, respectively increasing and obviously wrong press coverage, at least by some of the media. Like dena-head Kohler before, Hoffmann wooed the public for more openness towards technological innovations, without overstraining it. "We have to create a sexy image for renovation and compare, in a comprehensible way, costs versus savings" says the chief of the government building office. Like state secretary Eck, he emphasized that the

Government serves as a role model when it comes to the governmental building stock. According to Hofmann, the future main focus should lie on non-residential buildings – it is there he sees enormous energy efficiency potentials.

A particular highlight of the Thermal Insulation Day 2014 was the presentation by Ulrich Wickert, TV-journalist, author and former ARD-Tagesthemen-Presenter, who spoke on a more general basis about “Our responsibility for the environment”. Wicker is active in the new image campaign for thermal insulation, called “Insulation is worth it”. (www.daemmen-lohnt-sich.de). His message: Proper insulation doesn’t only mean we increase the coziness of our houses but also means we reduce our energy consumption. This campaign was initiated by the association Qualitätsgedämmt e. V. newly founded by four family-run companies, Baumit GmbH, Brillux GmbH & Co. KG, DAW SE und Sto SE & Co. KGaA and was introduced by its chairman, Mr. Bomboes. It is being scientifically advised by the association Gesellschaft für Rationelle Energieverwendung (GRE) and FIW Munich.

More specialist presentations were given, for example by Prof. Stefan Rahmstorf, head of earth system analysis at the climate impact research of the University of Potsdam. His topic was ”The climate crisis – how dangerous is the global warming”. Dr. Franz-Georg Rips, Managing Director of the German Tenants’ Association presented his

essential reform ideas in terms of who should, in future, bear the costs of heating.

The board member of the German Annington Immobilien SE, Klaus Freiberg, spoke about the topic “How to successfully structure the energy revolution – a solution approach for residential trade”. Friedrich Seefeldt, vice-director and head of the department energy efficiency and renewable energy at Prognos AG talked about” Energy turnaround of buildings - investments in the future”.

Markus Ferber, MdEP represented the Brussels viewpoint, his topic was “Effects and implementations of the European climate policy”.

Prof. Dr.-Ing. Andreas Holm, head of FIW, summarized the Thermal Insulation Day 2014 with this equation: Energy revolution = energy reversal + thermal energy reversal. Only a successful turnabout in electricity and heat energy allows the energy revolution, says Holm. He is definitely not satisfied with the current German one percent rate of energetic restoration but claims at least two percent by 2050. He doesn’t consider this as over- ambitious, provided that policy promptly fulfills the two main demands of the Thermal Insulation Day, concerning building renovation. Again, he emphasized the responsibility of press and media in this matter.

Most of the presentations of the Thermal Insulation Day 2014 can be downloaded free of charge under www.waermeschutztag.de.

The next Thermal Insulation Day will presumably take place in June 2016 in Munich.

more information:
www.waermeschutztag.de

Selected chapters of the Meta Study "Themal Insulation Materials, news from technical insulation up to basic research" – on 4 June 2014. FIW Munich staff presented the institute's research results. The event was aimed at the members of the association – in future, it will be open to all interested sectors.

"Sustainability of Energetic Restoration"

Christoph Sprengard presented tests measures of sustainability of energetic renovation. These will become obligatory in the course of sustainability of energetic measures in the framework of construction products regulation. For this, the interdependencies between systems, which benefit from production – usage – disposal or suffering harm and the environment and climate on the one hand, but also the population, the economy, business economics on the other hand, are being modelled. A holistic view includes efficient production and transport of raw resources, manufacturing the product over the total lifetime and necessary dismantling, recycling or disposal. Special emphasis with insulation material is being placed on the consideration of additives like, for example, biocides and flame retardants. Thus, sustainability becomes a further key criteria for product comparison, one that goes beyond technical observation. Technical performance of physical parameters is relatively simply to determine, if thermal conductivity, bulk density, mechanical properties and heat transfer resistance are measured or calculated.

An additional benefit of thermal insulation material is less tangible. Living under completely hygienic conditions, and feeling cozy in winter and summer is not objectively measurable.

It is the same with sustainability. Energy saving and benefit have to be compared with manufacturing costs (energetically and materially. System boundaries and observation periods are determinant. For the producers, often only the balance up to the factory gate, „Cradle to gate" is important, for the end user the „cradle to grave" or even the next life cycle, "cradle to cradle", is most important.

For energetic modernization measures, besides profitability, the amortization period is most important. That's the period in which the insulation material saves more energy than the energy used for its production. The initial U-value of the existing constructions and the target value

after renovation are crucial. If a "bad" exterior wall is being refurbished, the energetic amortization will normally be achieved in the first or second heating period. Refurbishment with ambitious targets, including insulation material with high primary energy, is might last up to three years until production energy is economized.

Energy efficient construction parts, with a "higher U-value" normally takes longer. Three years are common, in particular cases it can last up to seven years.

Even if, given unfavorable conditions, the energetic amortization lasts longer, all periods are well below the lifecycle of insulation material. Therefore, energetic renovation measurements are particularly sustainable.

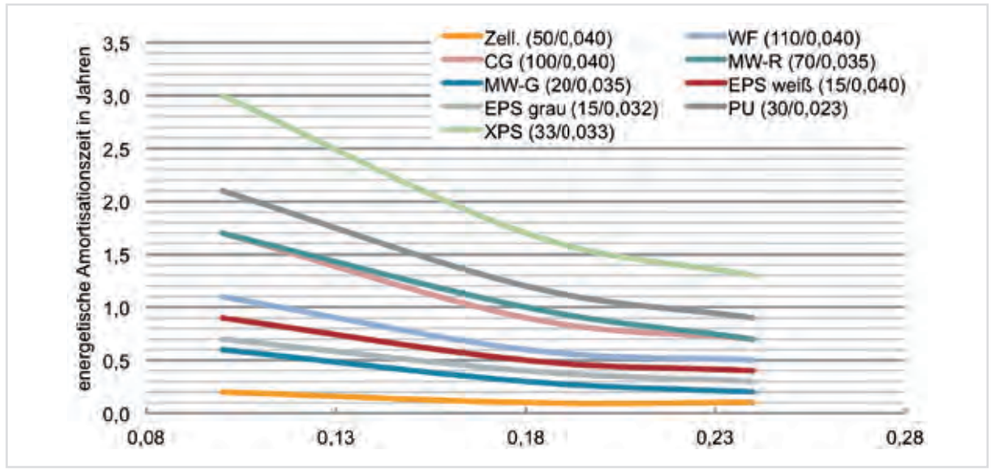


Figure 1: Diagram of time period up to the energetic amortization with renovation measurements of various insulation material, with a start U- level of 1.4 W/(m²·K) ("bad" wall) and the target U-value, presented on the x-axis, after renovation

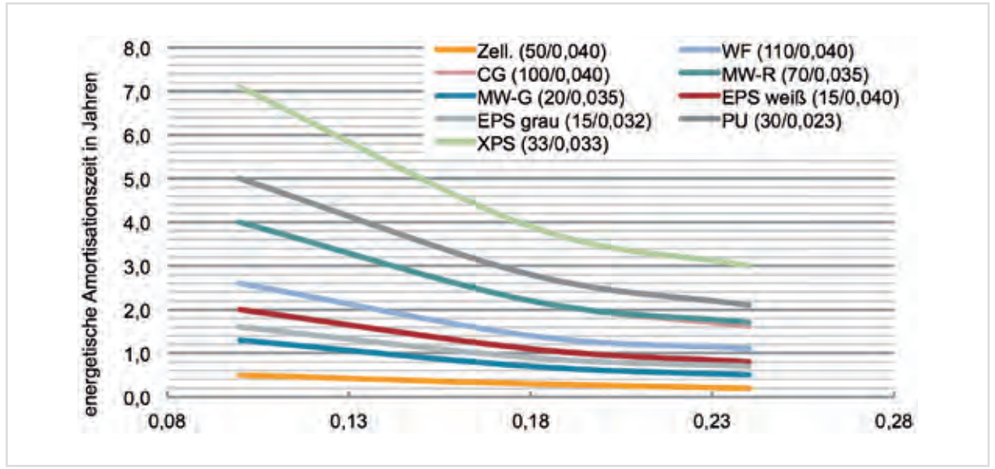


Figure 2: Diagram of time period up to the energetic amortization with renovation measurements of various insulation material, with a start U- level of 1.4 W/(m²·K) ("better" U-value) and the target U-value, presented on the x-axis, after renovation.

“The Building Envelope in the context of Energy Revolution”

In his presentation, Christoph Sprengard shows the role of the building envelope concerning the energy revolution. In Germany, the energy consumption was 2500 TWh. 1000 TWh, 40 % were primarily related to existing buildings. Residential buildings held a 60 to 65 % percent interest.

Assuming warm water energy requirements (17 %), efficiency of the heating system (85 % degree of efficiency, on the average of installed systems, this is a reasonable value) and heat loss through windows and ventilation – after discounting these data, another 260 to 270 TWh / per year is left for the energy of the building envelope. This amount of energy serves as a basic to employ insulation material and could easily be decreased by 50% by carrying out renovation measurements. With consistent implementation of reasonable measurements, a reduction of ⅔ still is economically feasible. Existing buildings have a potential of 130 to 180 TWh energy saving, which could be increased by using insulation material. Even if one should avoid comparing heating energy with electricity, the comparison with a total performance of all German nuclear power plants of 99 TWh in 2012 is still impressive.

“Innovations from the insulating-material sector – more innovative than one might think”

Claus Karrer shows innovations concerning insulation materials can be seen in the improvement of traditional properties on the one hand and market introduction of new materials on the other hand.

The lowest physical value of thermal conductivity, of insulation material, containing air, both cell or fiber structure is 0.025 W / (m · K), which corresponds to stationary air. Due to unavoidable influences of radiation and thermal conduction of solids, the technically feasible limit can be assumed to be approximately at 0.028 W / (m · K). Through perfecting the production process, insulation material could be manufactured from mineral wool, whose thermal conductivity values, when FIW tested them, came close to a technical lower limit of 1 mW / (m · K). Since reflective, respectively radio absorbent components in raw materials are being used, comparable values of thermal conductivity can be achieved with expanded polystyrol (EPS).

In closed cell rigid polyurethane foams (PU), gases, released during the production process are locked into the foam matrix with a significantly lower thermal conductivity than air.

When using diffusion resistant surfaces and the propellant Pentan, a normal design value of thermal conductivity of 0. 023 W/(m·K), with regard to the utilization time, will be achieved.

By using new propellants (for example HFC 1234) or additives to improve cell structure, significantly improved values concerning thermal conductivity, have been achieved. For open-celled PU “Nanoschaum” with cell sizes, significantly less than 1 µm, values in a measuring range of 0.016 W / (m · K) were reported. However, it is still in the development stage.

Aerogels are especially innovative thermal insulation materials. Their porous structure shows cavity diameters less than 1 µm. This means a strong limitation of the thermal conductivity by air molecules. Aerogels, based on silicate, show a pore size of approximately 20nm (Nanometer = 0.001 µm). An insulation material cube with a side length of only 1 mm has more than 100 trillion single cavities. Even so they were already discovered in 1931, large-scale industrial production facilities for silicate based aerogel granules were only built in the last decade. The first building approval was issued in 2010, as powdery material in double-shell masonry, certified for a rated value of 0.021 W / (m · K) (Z-23.15-1844).

In 2013, two general building approvals for insulation material with aerogels were adopted: For an interior insulation panel based on pyrogen silicic acid for a rated value of 0.017 W / (m · K) (Z-23.11-1945) and for a fleece containing Aerogel particles for a rated value of 0.018 W / (m · K) (Z-23.15-1939).

The innovation of vacuum insulated panels (VIP) was not the invention of the insulation material but the technological conversion of a well-known principle. VIPs consist of a support core elements with minor heat conduction of the framework, coated with barrier foils with a high permeation resistance and minor transverse heat conduction. While pyrogen silicic acid for support core element has qualified itself, tolerance values concerning diffusing water vapor and its minor thermal conductivity, even in ventilated state, metal vaporize compound foils for coating have been continuously improved. Through optimized production plants, especially for sealed seams and because of a growing experience with applications, the rated value of thermal conductivity of VIPs, could be reduced from 0.011 W / (m · K) in 2007 (year of the very first building approval) to currently 0.007 W / (m · K), in some approvals.

The application of vacuum isolation panels is expensive because the isolation panels have to be produced to fit precisely to the measured size and cannot be changed once they were delivered to the construction site. A considerable simplification for insulation layers on floors is offered by a package of certified VIPs with 4 different formats, with which a mostly square space can nearly be covered completely. The remaining space can be isolated with PU panels. An innovative application of vacuum isolation panels in thermal insulation composite system (ETICS) is the double-layer, overlapping application of VIPs, foamed into EPS-mouldings. Even with only a few standard sizes, the customizable EPS overlap allows the display of the entire façade.

“Characteristics of Technical Insulation in the low Temperature Range –FIW Munich as Competence Center”

Roland Schreiner outlines the area of extreme cold conditions, media temperatures below -30°C, which, through a number of important applications, becomes more and more important. Especially liquid gases for energy supply and for technical application are in the focus. The transport and storing of cold liquids are enormous challenges for technical insulation technology. For cryogenic applications, the installation of an insulation system without moisture on the surface and the insulation material imposes highest demands. This is why mainly closed-cell insulation materials with a high resistance against vapor diffusion are being used. The compensation of temperature-related length extension as well as the tolerance, concerning changing temperatures while operating, are of high priority for a functional insulation system. All the important characteristics of insulation material can be defined at FIW Munich. These are, for the cryogenic temperature insulation, the lower application limit temperature, mechanical pressure and tensile stability and temperature related thermal conductivity. The know-how of cell gas composition of plastic foam material, which directly influences thermal conductivity through cell gas exchange, is standardized practice in the FIW laboratories.

In this context, FIW Munich, could, together with other European testing institutes for the European reference material, “IRMM 440“, complete as a reference the certified temperature range from -10 °C to 50 °C for an expanded range of -170 °C to -10 °C thermal conductivity values.

Measurements to define the resistance against vapor diffusion and closed cell content, complete the testing services of cryogenic temperature insulation. All characteristics have to be guaranteed during the 20 year period of the technical refrigeration system.

Measurements of specific heat losses of insulation systems with mounted components like flanges, valves and pipe supports are possible. To simulate thermohygric marginal conditions of refrigeration applications over a longer period, climate chambers are provided for this purpose. The determination of specific energy loss of thermal bridges through measurement procedures opens the possibility to even define total heat loss of facilities. The

calculation and analysis of insulation systems for refrigeration are carried out according to VDI 2055 heat and cold protection of facilities in industry and technical building equipment – basis of calculation”.

Condensation on the surface of the insulation system or the humidity in the insulation material itself could be accompanied theoretically. Unresolved damages show that there is further demand for research in the area of long period vapor diffusion with temperature-dependent parameters

The motivation of FIW Munich for defining the characteristics of insulation material in the area of ultra-low temperatures, lies in the obligatory CE-labelling of technical insulation material and the issue of energy efficiency of industrial facilities. Especially there, optimized insulation materials and insulation systems, whose quality, in an ideal case, can be proved through a voluntary quality assurance system, is of utmost importance. Against this background, the “Technical Insulation” department could demonstrate the competence center “Extremely low temperatures“

“Round Robin Test - Long Term Creep Behavior of EPS- and XPS Insulation Materials”
Wolfgang Albrecht

For 15 years, FIW Munich has been engaged with testing of long term creep behavior under compressive stress of insulation material. The background here is that more and more building are insulated with load-bearing thermal insulation below foundation slabs, to minimize energy consumption in this part of the building shell as well. Insulation material in this application is exposed to high levels of stress, for example:

- High compressive stress, over decades
- Continuous moisture stress, caused by soil moisture and groundwater

The insulation materials being used have to withstand these strains over the life span of a building, 50 to 100 years module life, because it is not possible to change them, like one could do with other construction parts. That’s why for this application the rated values for compressive stress have to be absolutely correct.

Due to he experience oft the last few years, FIW gained various insights. To get reasonable and reproducible long-term creep curves over time periods, the following criteria have to be fulfilled.

- Deposited samples aged > 45 days, so that the insulation material is sufficiently stabilized
- The compressive strength over the width of the insulation panel has to be known
- Sample taking from a row lengthwise with average of the compressive strength milling off or sanding down surfaces, to achieve a sufficiently even surface for an optimum force application
- The testing standard EN 1606 gives only very general information of these important criteria.

Furthermore, the testing standard doesn’t contain any details concerning measurement inaccuracy and reproducibility. Following this demand, the idea of an international round robin test was developed, to collect the already existing know-how and to define measuring uncertainty as well as the range of measurement variations. DIBt supports this round robin test in the framework of a research contract. The participating testing institutes and manufacturer’s laboratories bear the main expenses themselves.

Summary

The results of the round robin test and the accompanying investigations successfully proved that the testing method according to EN 1606 provided sufficient care in the selecting of samples, test execution stable room climate leads to comparable and reproducible values. The testing results deliver necessary security to responsible persons in construction authorities concerning practical planning and calculation of buildings.

The knowledge, acquired during this industrial research project, shall be included in the norms, to enable a simpler handling and more reliability regarding testing results. Furthermore, the scientific insight from the research project should be included in process instructions.Thus the state of the art will be available for the user of this standard.

Thermal Conductivity Testing of Damp Sample Material.

Professor Andreas Holm closes the afternoon with a basic research presentation.

As soon as temperature gradient occurs in humid material, a stationary process of heat and water will start. This also applies to moisture samples, used for various measurement procedures for thermal conductivity. The moisture transfer is the cause of a so called “dampness factor” which influences thermal conductivity. This moisture influence factor could be defined through post-test calculation with WUFI analysis methods. The thermal conductivity analyzer enables theoretical simulation during measurement of migratory processes.

Moisture transfer does not only depend on moisture characteristics of the material, but on hygric boundary conditions, occurring during thermal conductivity testing. Installation into an apparatus or on a device of measurement of thermal conductivity is similar to sided moisture-proof end piece. Using the hot-box method means both sample surfaces are open and therefore evaporationable. In this case, not only temperature boundary conditions become most relevant but also the atmospheric humidity of the heating and cooling chamber. These boundary conditions also influence moisture. Even if moisture exchange is prevented, for example by foil wrapping samples, humidity influence cannot completely be avoided, because during measurement humidity relocates within the sample. Not to forget the importance of the output moisture, uprising during sample preparation.

At the beginning of the thermal conductivity measurement, stationary coupled heat and moisture transport processes are built up in the sample, but the building up of the temperature field happens faster than that of the moisture field. Both transfers – thermal and hygrig – asymptotically try to reach a final state which (theoretically) could be reached after an infinitely long time. It is obvious that thermal conductivity measurements should not last “forever” but have to be finished within a “manageable period”. An experience measurement engineer would interrupt the test if the measurement value does not change. The time change is significant, not the thermal conductivity. Therefore, the termination of the measuring time will be t1 % respectively. t1 ‰, when measuring duration at what point the time gradient below a specified level of 1 % respectively 1 ‰.

To explain the not easy understandable thermohygric coupling processes of heat and humidity, a 20 cm cellular concrete panel with a 20 K temperature gradient was chosen. The initial moisture is 20 Vol.-%, constantly spread over a sample cross section with moisture proof end pieces on the warmer side. The moisture content, panel thickness, temperature gradient, and moisture-proof end pieces will be varied at a later time. The building up time of temperature and humidity fields vary strongly. The heat source of a humid sample are more than a day behind the dry sample. Because of the enthalpy of phase changes the humid sample cools out, even an undercooling compared to the ambient temperature could occur. Later, the humid sample can easily deduct more heat from the heating box. In the beginning, the influence of dampness becomes negative ($\lambda f < \lambda tr$), but after a zero transit point shows positive values ($\lambda f > \lambda tr$). The zero transit point of the influence factor curve shows a significant result of the present study. It demonstrates that thermal conductivity measurements of humid materials could - by chance – show negative or positive deviations, depending if the measuring time is on the left, the right or more distant from the zero transit point there could be wider scattering of measured values, due to humidity. The values in the center of the zero transit point are close to zero.

After a nonterminating test time, a moist sample would completely dry out if its fitting in the measuring apparatus would allow this and the boundary conditions would match the dry form (for example. 105 °C). But this won’t be the case. Therefore, only the moisture final value of the sample will occur, which corresponds with the hygroscopic balance. After equilibrium is attained there are no more moisture relocations. The moisture influence, still detectable, is based solely on water molecule in quiescent condition in the pore structure. It is equivalent to the “true” thermal conductivity of damp material. Even so the standards committee is aware of the relatively complex interrelationships of transient-coupled transport processes, it was considered as hardly “treatable”. Instead, standard rules which define experimentally determined values that have to be added to thermal conductivity values, measured under dry conditions, have been developed. These additional values now could be put on a theoretical basic, using WUFI verification calculations. For this purpose, the preciseness of these verification calculations have to be reviewed. This review has to be aimed at material parameters and boundary conditions, which have been taken as base for the WUFI-calculation. The latent enthalpy is a significant factor in this because of its 2 different values: The evaporation heat during the phase change of water is already well known. Values for sorptive latent heat (important for low humidity near drying up) are missing for nearly all construction materials: Binding enthalpy has been neglected with WUFI-calculation method up to now. Further research is necessary to achieve this. Other construction and insulation materials, besides aerated concrete materials, which were used as a basis here, have to be tested. Furthermore, a more precise verification of double sided moisture-proof end pieces, like it is indicated when measuring with plate-base instruments.

Events, seminars, exhibitions

Exhibition stand at the 9th. international construction fair (ISO'14) in Cologne, March 8 and 9 2014

Energy efficiency of industrial installations – everything concerning this subject was presented by FIW Munich on ISO '14. The determination of the saving potential of heat and cooling loss, effective insulation, protection of fossil energy resources and reduction of CO_2 emissions, are key issues.

The German industry could save up to 80 percent energy every year. This is the result of a research currently being carried out by the consultancy company Ecofys, presented at ISO '14 in Cologne. The total amount of saving potential through technical insulation is up to a yearly CO_2 emission of 106 petajoul and 8.7 megatons. This corresponds to an energy consumption of approx.1.5 million private households. Against the backdrop of uncertain raw material, energy prices and Europe's high dependence on energy imports, like oil and gas, an increase in energy efficiency becomes the key question in international competition. Holger Elter, chairman of the federal division for heat, cold, acoustic and fire insulation, refers to this as well. "For many companies, it is high time to update their insulation systems". At constant energy costs, plant operators could still save 750 Million EUR a year only by thermal insulation. A one-time investment of 180 Million would be necessary for this, says Elter. A huge part of the possible energy-saving potential could be realized within a payback period less than a year.

This is also emphasized by Deutsche Energieagentur (dena), represented by Steffen Joest, deputy department head of energy systems and services: The target is a 20 % decrease in primary energy consumption by 2020, compared to 2008. (Iso-Messe)

Successful transfer of know-how "Thermal and cold protection of operational systems"

On 14 October 2014, the practical seminar " Thermal and cold protection of operational systems - calculation bases for constructing thermal insulation" took place at FIW. This event was organized in cooperation with WKSB of HDB.

Thermal insulation is an important parameter of operational systems. It influences the efficiency level, operational safety and helps saving energy. The calculation basis can be found in VDI 2055 page 1. With its physical basic equations and many individual solutions for certain system components, it provides an important set of rules for thermal and cold protection of operational systems in industry and technical building equipment. Its comprehensive descriptions of parameter and underlying algorithms to calculate their impacts makes it an indispensable set of rules for professional constructions of insulation. The seminar topics imparted the necessary know-how to the participants from technical insulation and showed them how to plan thermal and cold protection of operational systems in a more economical and efficient way. The series of seminars is to be continued in 2015.

Teaching and lectures

Prof. Andreas H. Holm
„Building physics – Basics".
University of Applied Sciences Munich, 2013

Presentations

Christoph Sprengard

- „Hygrothermical Material Properties as Decision Criteria" on WTA expert conference of WTA Germany 28 November 2013, Weimar
- "The main Key for the Energy Revolution – Requirements and Potentials of the Building Envelope" Panel Future Building / Old Building, deubaukom 17 January 2014, Essen
- "Energy Saving Regulations 2014/2016 Zero Energy Building 2021" expert forum Statics and Thermal Insulation, KLB 4+5 and 11+12 February 2014
- "Moisture Management with Upper Planking – Calculation-Measurement – Monitoring" Technical Congress Association German Prefabricated Buildings, 3 April 2014 Posen, Poland
- "The Building Shell as a Component of the Energy Revolution" Association for Rational Energy Use" 8 May 2014, Kassel
- "The Building Shell in the Context of the Energy Revolution" Research Conference FIW 4 June 2014, Munich
- "Sustainability of Energetic Renovations" Research Conference FIW, 4 June 2014, Munich
- "EnEV 2014 – Impacts of Thermal Insulation and Constructions" 5. Symposium Energy Buildings Techniques, E.On Energy Research Centre 4 July 2014, Aachen
- "Lime Sandstone Planning Manual chapter ›Thermal Insulation and state of the art in standardization‹" KS South, Planning Manual Presentation 2 October, 2014, Nuremberg
- "The Basement – Climate Zone of the house – Energetic Integration, Comfort Gain and Building physics" Concrete Workshops 2014 Basement – Value – Utilization of Basements, 27 November 2014, Regensburg
- "Thermal Insulation – Products – Applications – Innovations" internal Workshop at Reisch Bau GmbH, 28. November 2014, Bad Saulgau

Wolfgang Albrecht

- "New Regulations for EPS- Insulating Materials "SKZ Symposium EPS – Particle Foam – Sustainabilty more important than ever before?", 13 February 2014, Würzburg
- "Round Robin Test – Long Time Creep Behavior" EPS and XPS, Research Conference FIW, 4 June 2014, Munich
- "Thermal Insulation and Recycling: Disposal of Thermal Insulation Systems", DAW Stakeholder-Dialogue: Future of Thermal Insulation 10 July 2014, Ober-Ramstadt

Andreas Holm

- “The Building Shell as a Component of the Energy Revolution“ Norddeutsche Wohnungsunternehmen, 6 February 2014, Hamburg
- “The Key for the Energy Revolution“, Bautec 19 February 2014, Berlin
- “The new EnEV – the Key for Energy Revolution“ Winter Symposium 18 and 20 March 2014, Eisenach
- “Thermal Conductivity Testing of Damp Sample Material”, Thermal Insulation Day, FIW, 4 June 2014, Munich
- „Thermal Energy Change – already arrived?” Research Conference FIW, 5 June 2014, Munich
- “Buildings as Components of the Energy Revoluti-on”, Plus Energy House, 24 July 2014, Deggendorf
- ”Energy Efficiency – Contribution of Building Physics for a Public Discourse” Sector Symposium, des September 29, Ludwigshafen
- “New and well-tried Thermal Insulation Materials and their Application - a critical Overview”, IBP-Thermal Insulation Symposiums, 10 October 2015, Stuttgart
- “How do Buildings contribute?“ VBW-event, Efficiency Potential in the Building Sector, 20 October 2014, Munich
- “Energy Revolution is not possible without Thermal Insulation” technical expertise event, Professional Body WDVS, 5 November 2015, Baden-Baden
- “Die Energiewende ist ohne Wärmedämmung nicht zu schaffen“ auf dem Technikertag des Fachverban-des WDVS am 5. November 2014, Baden-Baden
- “Lies and Legends – an Attack on Thermal Insulati-on“ political event of the Parliamentary Association 11 November 2014, Berlin

Publications

Holger, S.:
EnEv Novelle 2013 – Changes in building envelopes? EnEv edition IV/2014

Holm, A.; Sprengard, C.; Simon, H.; Treml, S.:
EnEv Novelle 2014 – Changes in building envelopes? Expert articles on behalf of GDI, available online: www.gdi-daemmstoffe.de/tl_files /pressemitteilungen

Sprengard, C.; Spitzner, M. H.:
Thermal protection – Planning Manual. Federal German Association for the Sand-Lime Brick Industry, Edition 6, Verlag Bau und Technik GmbH, Düsseldorf, 2014

Holm, A.; Sprengard, C.; Treml, S.; Engelhardt, M.:
Sound Insulation Requirements of thermal insulation systems. Rexroth, S.; May, F.; Zink, U. (Hrsg.): Thermal Insulations of Buildings – up to date and adaptable. VDE Verlag GmbH, Berlin 2014 ISBN 978-3-8007-3570-9

Holm, A.; Treml, S.; Sprengard, C.:
Requirements for fire safety measures. Rexroth, S.; May, F.; Zink, U. (Hrsg.): Wärmedämmung von Gebäuden – Zeitgemäß und wandlungsfähig; VDE Verlag GmbH, Berlin 2014 ISBN 978-3-8007-3570-9

Holm, A.; Sprengard, C.:
Numerical examination of thermal bridging effects at the edges of vacuum-insulation-panels (VIP) in various constructions, Energy and Buildings – IVIS 2013 special issue, Elsevier (2014)

Holm, A.:
Innovative and proven thermal insualtion material – Products – Applications – Innovations in ETICS – A critical overview. Dämmstoffe und Dämmsysteme neue Entwicklungen und Erkenntnisse Fachsymposium 10. Oktober Fraunhofer IBP

Holm, A.:
Meta-study insulation material – Products – Applications – Innovations in thermal insulation systems annual report 2013-2014 Fachverband Wärmedämm-Verbundsysteme e. V.

Holm, A.; Gertis K.:
Thermal Conductivity of humid Sample Material with double-sided moisture-proof End Pieces. Bauphysik 36. Edition 4. Ernst & Sohn

Holm, A.:
Thermal insulation – not sexy for media but ecologically and economically significant. Deutsches Ingenieurblatt 6-2014 Bundesingenieurkammer

Holm, A.:
Climate Change, Structural Alteration, Energy Transition Deutsches Ingenieurblatt 12-2014 Bundesingenieurkammer

Imprint

Forschungsinstitut für Wärmeschutz e. V. München
Lochhamer Schlag 4 | DE-82166 Gräfelfing
T + 49 89 85800-0 | F + 49 89 85800-40
info@fiw-muenchen.de | www.fiw-muenchen.de

Concept, design and realisation
Verenburg Kommunikation GmbH
Fürstenrieder Straße 279 | DE-81377 München
T + 49 89 5177775-0 | F + 49 89 5177775-20
kontakt@verenburg.com | www.verenburg.com

Photography and visual concept
Stephan Guess
Lochhamer Schlag 4 | DE-82166 Gräfelfing
T + 49 89 85800-0 | F + 49 89 85800-40
info@fiw-muenchen.de | www.fiw-muenchen.de

Thomas Dachs
Markranstädter Straße 2a | DE-04229 Leipzig
T + 49 179 4568518
info@thomasdachs.de | www.thomasdachs.de

Forschungsinstitut für Wärmeschutz e. V. München
Lochhamer Schlag 4 | DE-82166 Gräfelfing

T +49 89 85800-0 | F +49 89 85800-40
info@fiw-muenchen.de | www.fiw-muenchen.de