MIG–ESP®

ACTIVE COATING SYSTEM:
THE WHATS, HOWS & WHYS

MIG–ESP® ACTIVE COATING SYSTEM

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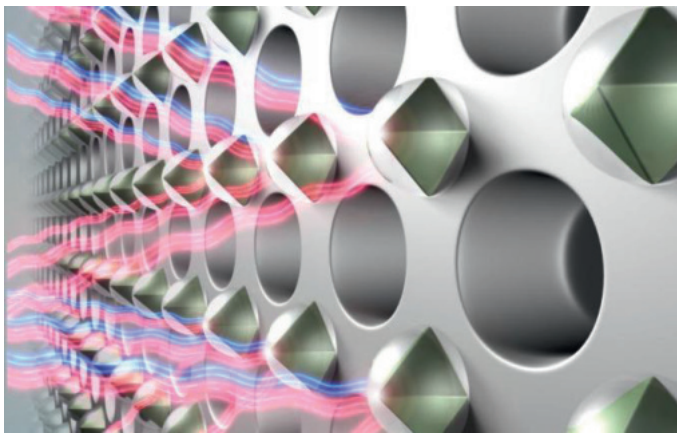


What is MIG-ESP® Active Coating System?

MIG-ESP® Active Coating System is not a conventional paint, but a breathable membrane system with excellent heat insulation properties that lead to significant energy savings and health benefits. It is odourless, VOC free and non-flammable.

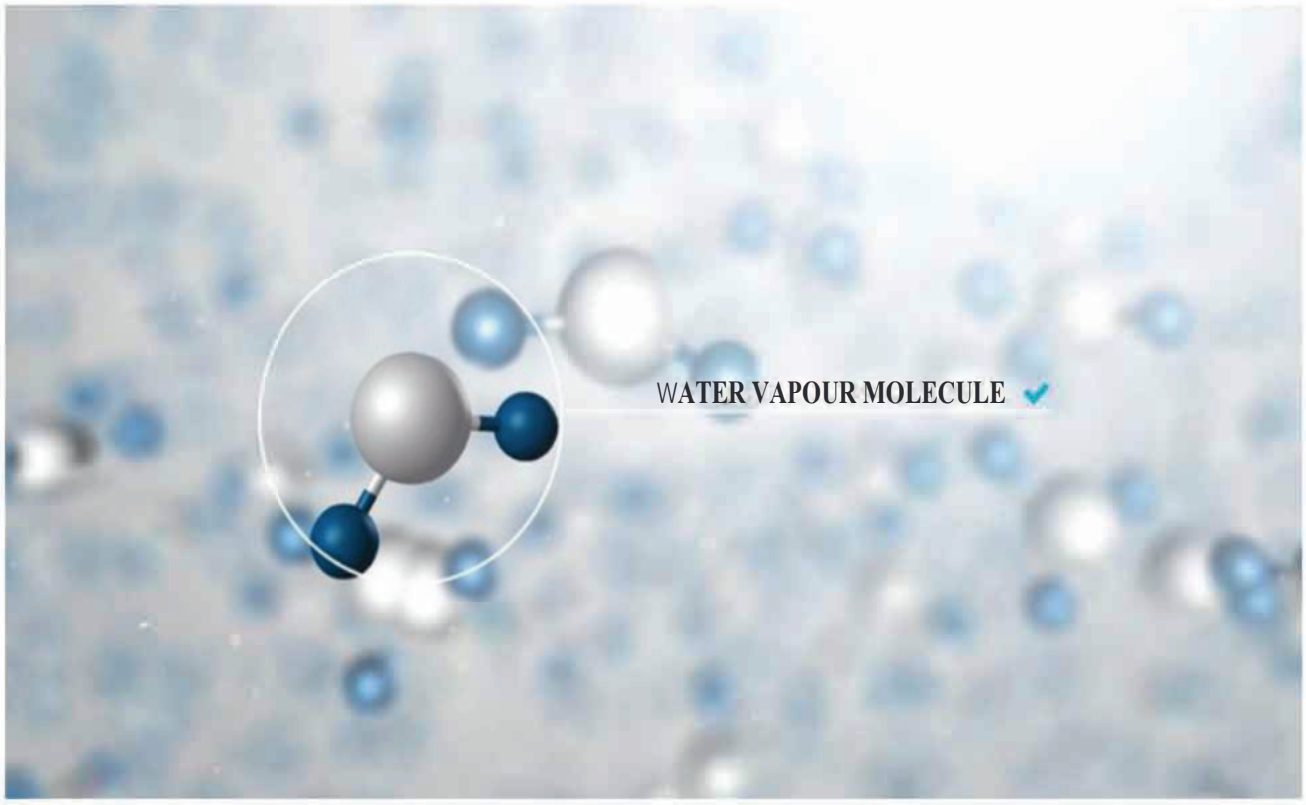
How Does it Work?

MIG-ESP® coating system is based on the patent pending DHMb® Double Hybrid Membrane technology, which features a micro-porous structure that controls heat and moisture.

The DHMb® technology is characterised by combining the reflection of thermal radiation (UV, visible and infrared rays) with moisture control to achieve energy savings.

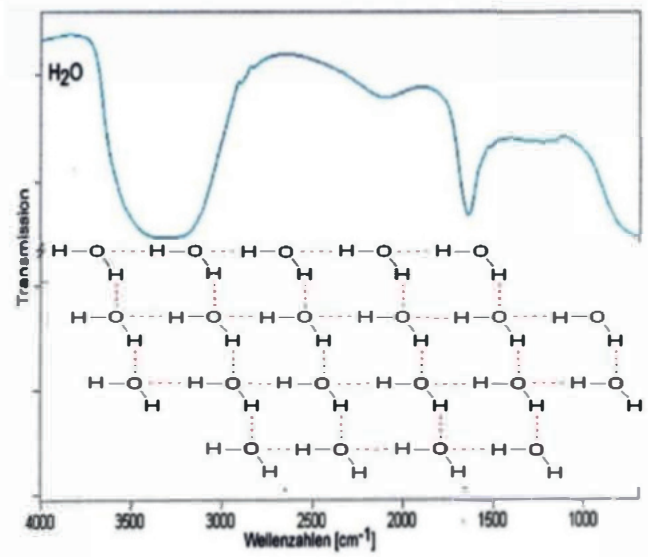
The innovation of this technology lies in treating moisture as the most important parameter for measuring the performance of insulation materials. The role of moisture in determining the insulation performance of building components or materials is often overlooked. Water has a high heat capacity, which means it is good at carrying and conducting heat. So an effective insulation must keep moisture away, otherwise its performance will be compromised. Moisture is also the culprit for many problems that affect our health indoors, like dampness, condensation, mould, bacterial growth, etc. So handling moisture is the main challenge that this technology must overcome.

Water in the gaseous form, i.e. water vapour, is generally more active, the faster it moves, the higher the energy it carries.



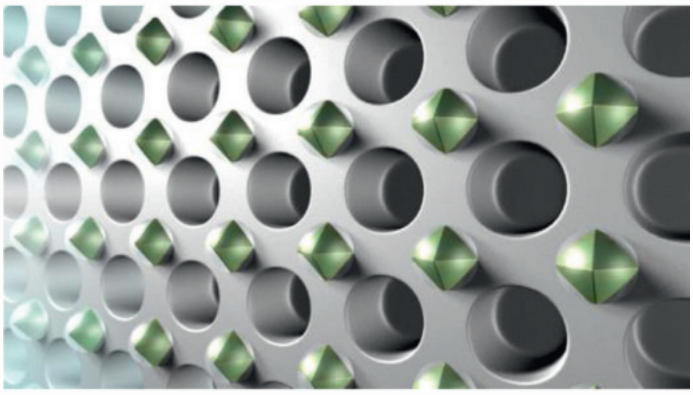
How Does it Work?

When water vapour encounters objects with low temperatures, the temperature of these surfaces is lower than the temperature of water vapour in the air. Heat transfer to the surface occurs, the internal energy of the water (vapour) molecules is reduced, the molecules slow down their movement and the water vapour changes from gas to liquid water. For the molecules to separate from one another and to become gas, a large amount of energy must be added to the water, usually by heating, so that the water molecules have enough energy to overcome the strong force of the hydrogen bonds and break down. The fundamental task of MIG Double Hybrid Membrane is to speed up the movement of water molecules so that they remain active and do not condense.

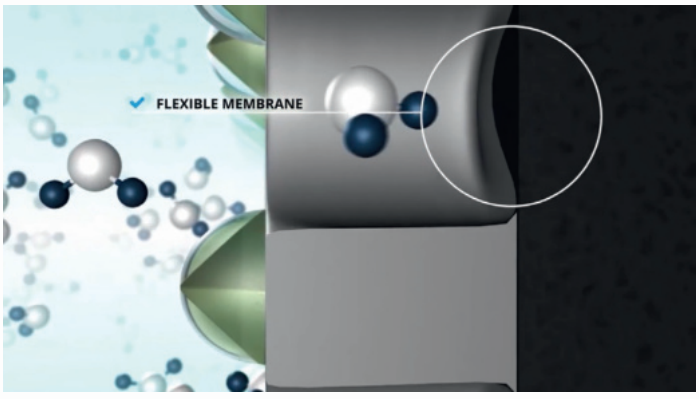


IR-Absorptionsspektren von flüssigem H_2O und D_2O (Quelle: www.chemgapedia.de)

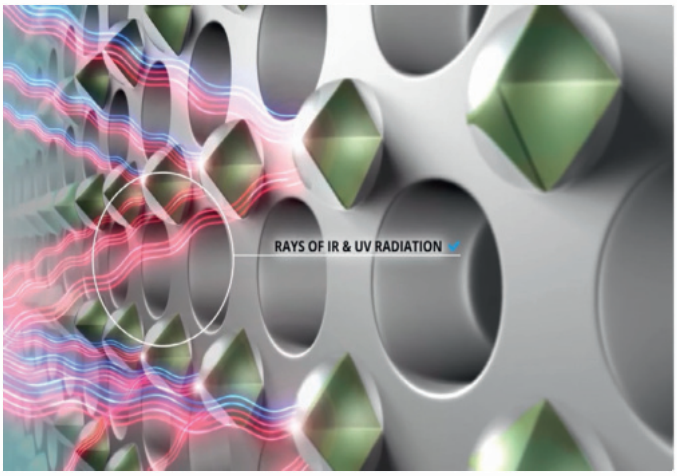
Once the MIG-ESP® active coating is applied, a double-hybrid membrane will form on the wall with a uniform distribution of double-hybrid particles that reflect thermal radiation. At the bottom of the membrane, there is a matrix of well-arranged, molecular pump-like pores that serve to bounce back water molecules that have entered the wall.

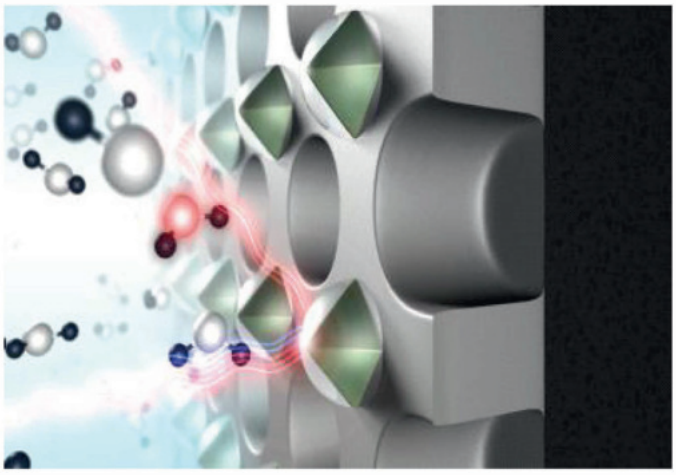


Once water molecules fly into the membrane system, the pores at the bottom of the membrane eject them.

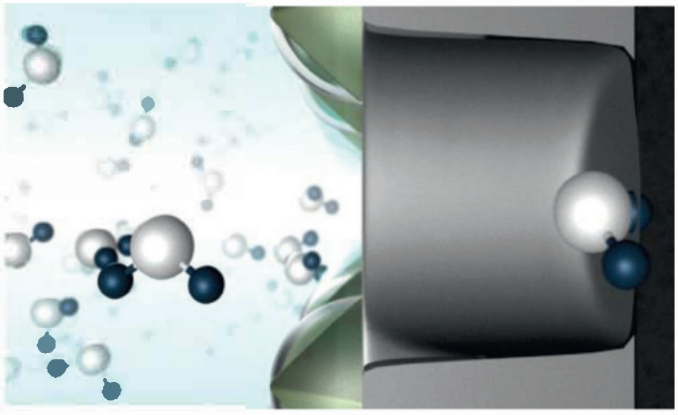


At the same time, the double-hybrid particles distributed on the surface of the membrane reflect the thermal radiation within the room and channel them into the rejected water molecules, whose movement is accelerated through gaining heat energy. As a result, moisture cannot accumulate on the wall, which can cause condensation and other moisture-related problems. On the other hand, without water as a good conductor, heat loss is minimised.





In addition, since the water vapour trapped in the wall is also ejected by the membrane system, heat energy can be retained indoors without water as a thermal conductor, so that the wall itself becomes a natural thermal insulation barrier.



Scan this QR code to watch a video on the MIG DHMb® technology

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What are the Harmful Effects of Moisture Accumulation?

Moisture can cause significant losses in insulation efficiency. For example, according to studies, once 4% of moisture penetrates into insulation materials based on mineral wool, their thermal insulation performance drops by half, leading to serious heat loss as well as causing the following issues concerning our buildings and occupant health:

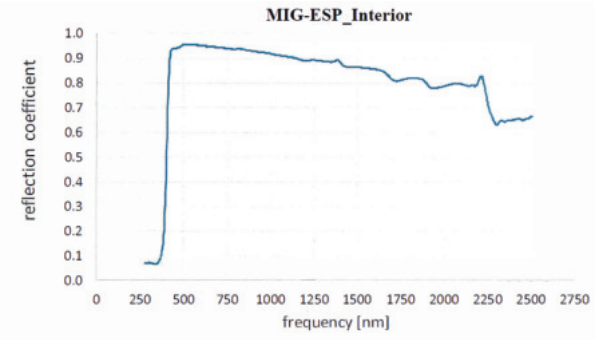
- Breeding of mould and mildew, which are detrimental to human health
- Water and vapour build-up, which can corrode the entire building structure from the inside over time.
- Increased water content adds weight to the insulation and causes structural damage
- Increased energy consumption in order to maintain proper temperature and humidity levels, which means additional heating and cooling costs

Why is Moisture Control Important?

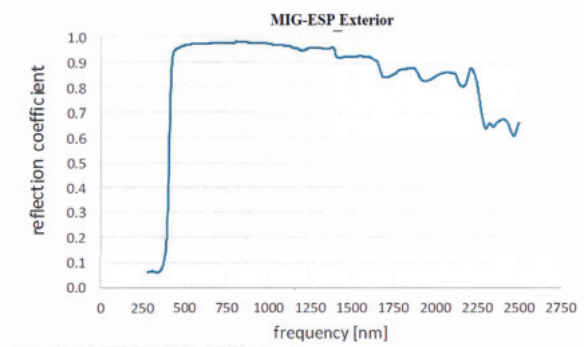
- Reducing heat conduction
- Retaining thermal energy
- Improving thermal insulation performance
- Promoting energy savings and CO_2 emissions reduction
- Maintaing a mould-free, germ-free indoor environment
- Improving occupant comfort
- Keeping façades clean and attractive, increasing property value

Apart from dealing with moisture, MIG-ESP® Coating performs another crucial task: heat reflection. Spectral analysis shows high reflectance of the MIG-ESP® Coating (both Interior and Exterior) in a broad range of radiation wavelengths in the ultraviolet, visible and infrared portions of the spectrum.

High Reflectance in a Broad Range of Wavelengths



Spectrum of the diffuse refelctance of the sample "ESP Innen"



Spectrum of the diffuse refelctance of the sample „ESP Außen".

Interactions between Heat Reflection and Moisture Transport Contribute Greatly to Indoor Thermal Comfort and Energy Efficiency

How is it Different from the Competition?

Regular Paint
Regular paint is mostly decorative with little protection.

MIG-ESP®
It's similar to regular paint in that it's easy to apply and available in a wide variety of colours. However, it differs from normal paint because it's predominantly a thin layer insulation that offers maximal protection to buildings.

Traditional Insulation
Insulation acts as a defensive barrier that regulates the way heat travels in and out of buildings. Traditional insulation is designed to slow down the transfer rate of heat energy. Heat energy will be absorbed and then, with a delay, released. In other words, standard insulation does not stop heat transfer from happening, it just creates a kind of buffer zone in between the indoor and outdoor environments. Sooner or later, heat gain or heat loss will occur no matter how efficient the insulation claims to be. Another important argument that speaks against traditional insulation is, it works only to the extent that moisture is left out of consideration. As soon as there is moisture the insulation performance will be diminished. For example, in mineral wool, just 4% of moisture will reduce the effectiveness of insulation by 50%. Worse still, sudden rises and drops in temperature will turn the moisture trapped inside the insulation into water, resulting in condensation and mould problems.

MIG–ESP® ACTIVE COATING SYSTEM

MIG-ESP®

It's superior to traditional insulation because it prevents absorption of heat through heat reflection on the one hand and reduces thermal mass (moisture) on the other. That's why it's an active system. Either used as a finish coat in concert with traditional forms of insulation underneath, or together with other MIG-ESP® products as a stand-alone system, it can optimise or replace traditional insulation without making structural change.

Normal Heat Reflective Paint

Heat reflective paint contains glass or ceramic spheres to reflect sunlight, minimising heat absorbed.
While heat reflective coating for e.g. external roof surfaces has been around for a while and is effective for reducing heat from direct sunlight, it has significant limits. Firstly, it reflects only a very limited range of the solar radiation spectrum – mostly direct energy from the sun, which means a wide range of the wavelengths is not reflected. Secondly, although it's true that surfaces coated white alone deliver high solar reflectance, they're only reflective under ideal circumstance: humidity is not taken into consideration. As with normal paints, as soon as moisture sets in, the insulation effort collapses. Thirdly, heat reflective paint doesn't block or prevent the heat from leaving the building.

MIG-ESP®

It reflects a much broader range of the electromagnetic spectrum if used outdoors. If used indoors, it also reflects thermal energy inside and prevents that energy from escaping, contributing to lower heating and cooling energy consumption.

Normal Antibacterial Paint

Extra biocide or other chemicals are added to the paint to inhibit the growth of microbes. It is effective only in killing a small range of bacteria.

MIG-ESP®

Based on a natural formula that is biocide free, our antimicrobial line not only provides protection against a broad spectrum of pathogenic bacteria and microorganisms but is also proven capable of killing 99.99% of them.

Why Does it Stand Out?

MIG-ESP® is unique because it is a breathable thin layer insulation in the disguise of a coating that perfectly combines heat reflection and moisture management to maximise a space's potential to retain thermal energy. It truly tackles the challenge of moisture that can greatly affect an insulation's performance if not treated properly. In a nutshell, MIG-ESP delivers the following key benefits:

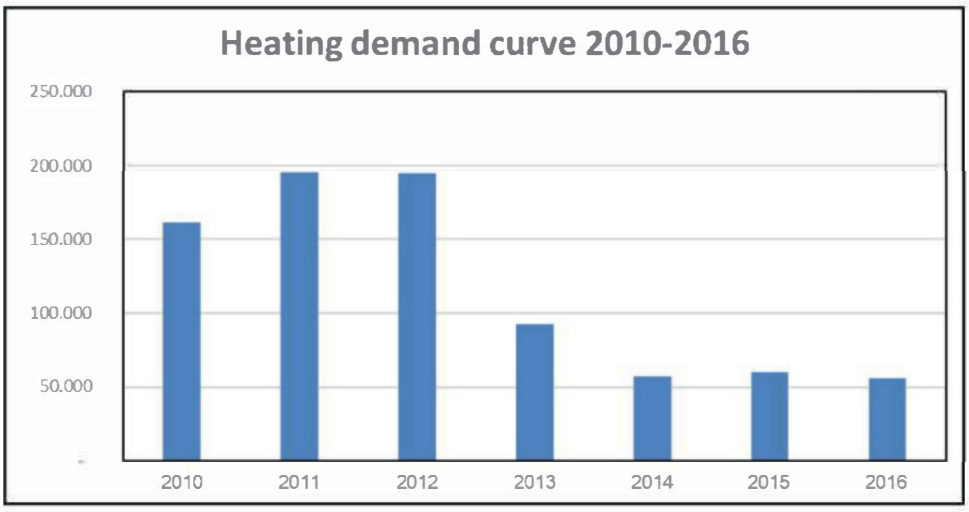
- **Highly heat reflective, both indoors and outdoors**
- **Minimising heat losses through moisture regulation**
- **High thermal efficiency - great alternative to traditional insulation**
- **Creating a healthy indoor climate**
- **Eco-friendly, antimicrobial**
- **Excellent fire resistance**
- **Optimal façade protection**
- **Ensuring healthy and energy efficient buildings**

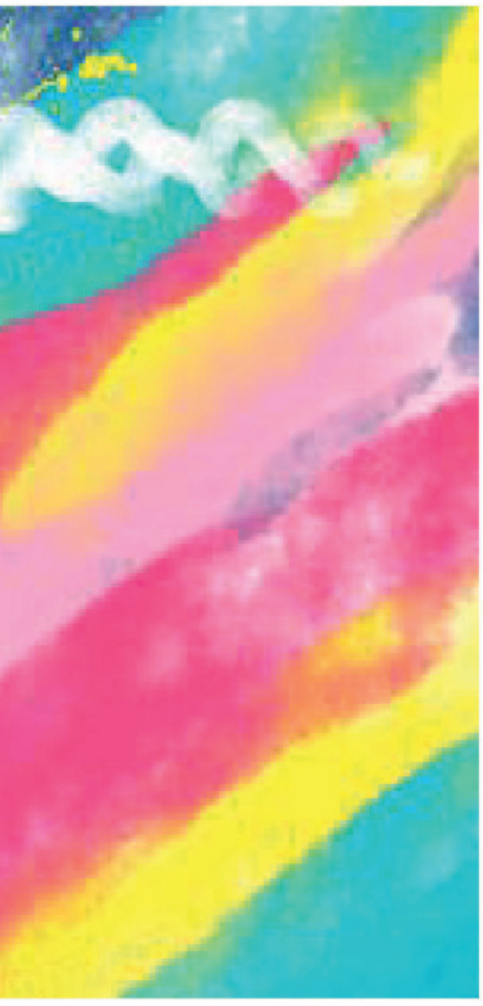
Methodology for Measuring Effectiveness

Comparison of electricity consumption before and after application

Between 2010 and 2016, MIG kept track of the energy use of a multi-family house in Salzkotten, Germany, with a living area of 585 m².

Energy consumption has fallen steadily in the six years since the MIG coating was applied, from 161,316 kWh in 2010 to 56,000 kWh in 2016. Only 75% of the interior wall area was painted with MIG-ESP®, resulting in 35% energy savings (climatically adjusted).





7 multi-family house. D-33154 Salzkotten, Westring 4 - 585 m²

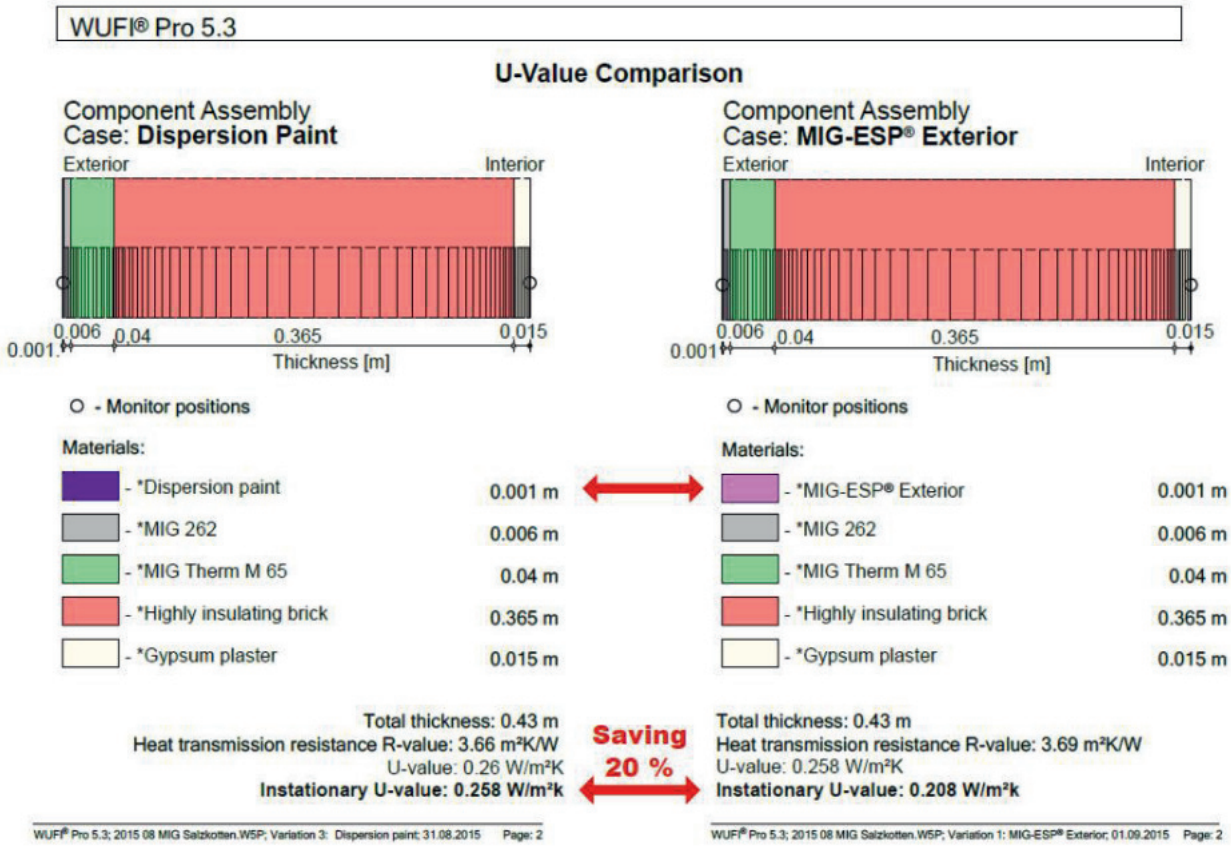
Year	kWh
2010	161.316
2011	194.555
2012	193.982
2013	92.000
2014	57.000
2015	60.000
2016	56.000

Energy supplier: E.ON Westfalen Weser

Hygrothermal Calculations by WUFI Pro®

WUFI Pro® is a simulation software developed by the Fraunhofer Institute for Building Physics, Germany for determining the simultaneous heat and moisture transport of multi-layer building components under real climate conditions. WUFI Pro® produces dynamic data through computation of the coupled heat and moisture transfer in building envelops with predefined boundary conditions, giving a more realistic picture of the heat-moisture interaction between building elements.

WUFI Pro® 5.3 was used to compute the heat transfer coefficient (U-value) of two building component assemblies in Germany, with one treated with MIG's plastering mortars 262 and Therm 65 but topped with emulsion paint, and the other treated with MIG 262 and Therm M 65 but topped with MIG-ESP® Exterior. The U-values of both assemblies have improved over wall structures without MIG products at all, with the U-value for the structure topped with MIG-ESP® as finish coat showing an additional 20% improvement.

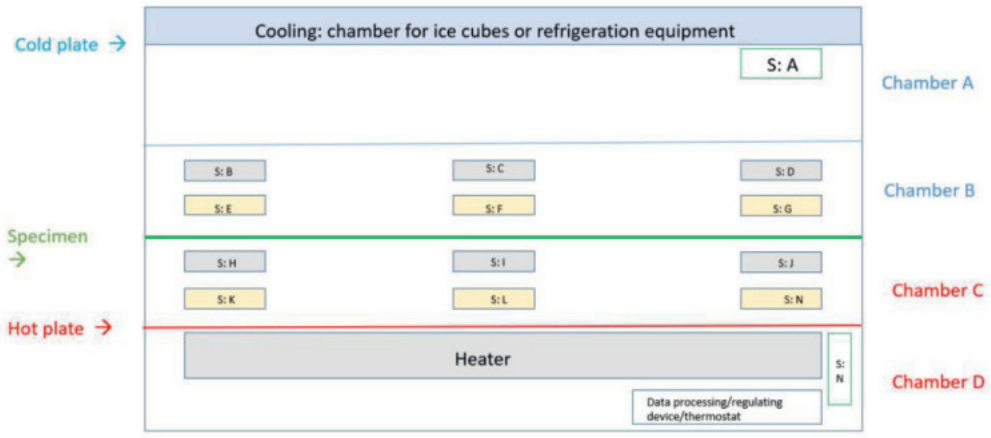


MIG Test Method for Thin Layer Insulation Performance

WUFI Pro® is a great tool to calculate the U-value of building components in unsteady state (instationary U-value, taking into account climate data, moisture, solar radiation and other factors). However, it is a simulation program which is theoretical in principle. It needs to be validated by constant comparison with test results.

Conventional calculation of U-value is dependent on material thickness. For thin layer insulation, however, a direct U-value cannot be obtained using conventional methods, as a heat-flow path through the material is required. Such a path through material is absent with MIG coating at approx. 400 µm. Therefore, MIG has designed a simple and effective method to calculate the U-value equivalent to thin layer insulation.

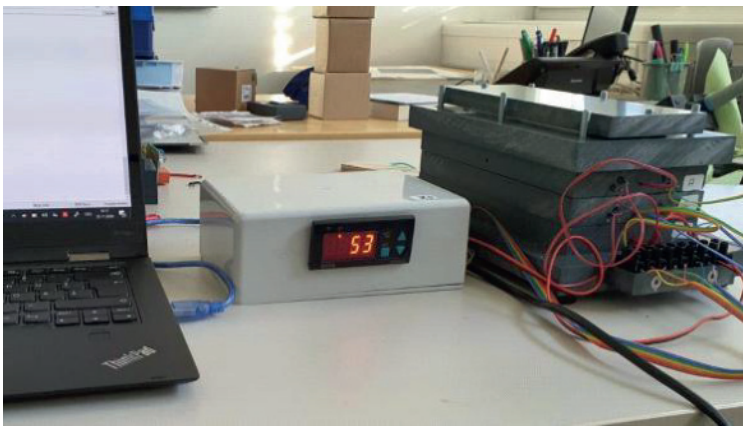
Diagram: Measuring instrument for mapping the heat flow 'Q



Principle: Chamber A, Chamber B = **cold compartment**, Chamber C, Chamber D = **hot compartment**
Specimen: Between Chamber B and Chamber C Thermal sensors: S: A to S:N

A test specimen is fixed as a border between the hot and cold chambers. The heat flow from the hot to the cold compartment is recorded using thermal sensors suspended evenly in both chambers. Factors affecting the heat transfer through the test specimen like air movement, moisture, etc., are accounted for in the calculations. Temperatures are measured at specific time intervals and their readings are communicated via a suitable data acquisition system that store the information for later analysis.

This picture shows a prototype of the MIG test apparatus nearing completion with the test box, thermocouple and data processing device. MIG is currently in collaboration with prestigious universities and testing institutes, both in Germany and China, to push forward the certification of MIG's test method for thin layer insulation.



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