

WACKER

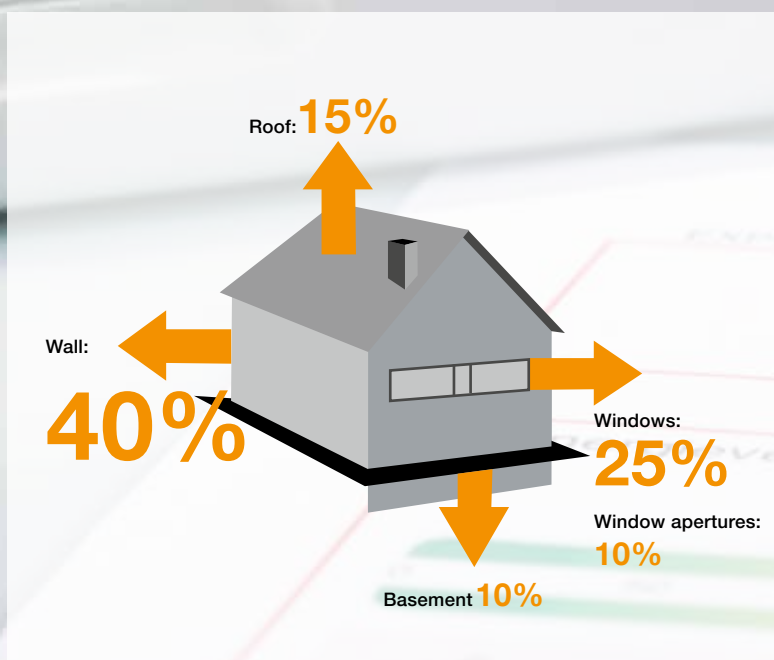
CREATING TOMORROW'S SOLUTIONS

VINNAPAS®

CONSTRUCTION | FACADE | INSULATION

ENERGY-EFFICIENT CONSTRUCTION
WITH EXTERNAL THERMAL INSULATION
COMPOSITE SYSTEMS

ALL AROUND THE WORLD, 40% OF PRIMARY ENERGY IS CONSUMED BY BUILDINGS¹ HERE'S HOW YOU CAN KEEP ENERGY COSTS IN CHECK



40% of all heat in a house escapes through the exterior walls. Heating costs can be reduced by as much as 55% just by installing efficient external insulation. (Calculation based on a typical one-family house in Germany)

EAUSWEIS

Ordnung (EnEV)

Erfasster Energieverbrauch des Gebäudes

Die Gebäude...



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1) Source:
Handelsblatt, April 14, 2010

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AS MUCH AS 70% OF ALL HEATING ENERGY CAN BE CONSERVED THROUGH THERMAL INSULATION¹

Buildings consume 40% of primary energy worldwide and generate 33% of CO₂ emissions. That is why politicians, the public and the building industry have made “energy-efficient construction” a top priority.

Thermal Insulation is Key

A great deal of attention is being paid to thermal insulation. After all, depending on the type of building, as much as 40% of heat escapes into the atmosphere through the building’s exterior walls. That is heat which could be gainfully employed in a properly insulated building.

Relevant for All Climates

The same holds true in warm climates, where thermal insulation reduces energy costs resulting from cooling.

Added Benefit: Building Fabric Protection

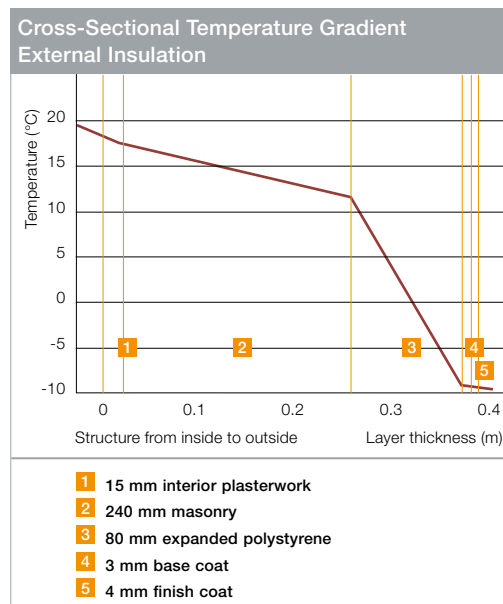
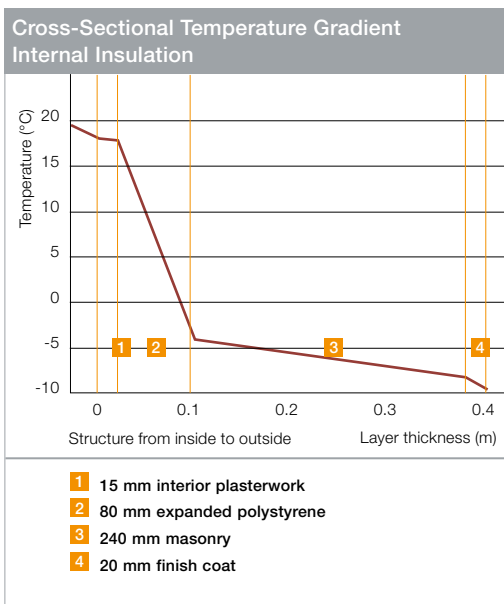
Good insulation of the exterior wall will not only reduce heating costs by as much as 55%, it will also improve the interior climate and help preserve the value of buildings because it prevents building damage related to fluctuating temperatures.

External Insulation is Most Efficient

While there are several methods for insulating exterior walls, the two most common are external and internal insulation. External insulation is preferred wherever possible because, among other things, it allows full use of a wall’s thermal storage capacity, prevents the occurrence of heat bridges and protects buildings from frost damage.

Externally Insulated Exterior Walls

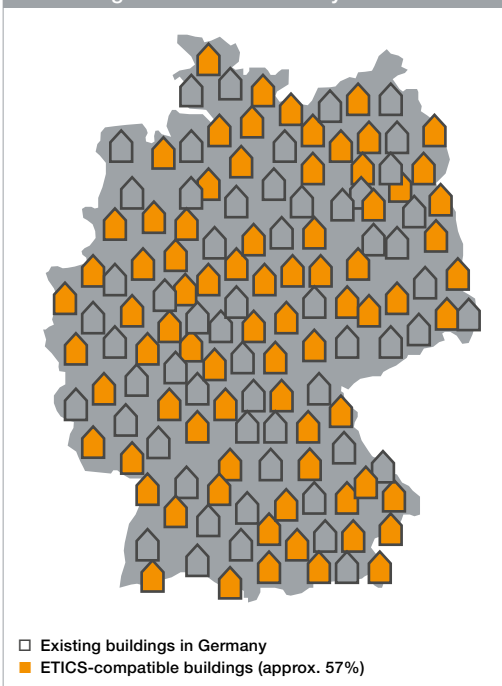
- Outstanding thermal insulation
- No pronounced heat bridges
- Optimum use of the wall’s thermal storage capacity
- Pleasant interior climate
- Thermal protection in summer
- Great design flexibility for facades



The biggest energy-conservation potential worldwide is in existing buildings.

THIS IS HOW YOU BENEFIT

Retrofitting Potential in Germany



Potential Market in Germany

63% of existing homes in Germany were built before 1977² and thus do not meet today's requirements. Some 57% of existing buildings could be insulated with an external thermal insulation composite system. That would reduce heating costs by approximately 55%. This pays for residents who have seen their heating costs double in the last 10 years. But the rest of us benefit as well: if all existing buildings were retrofitted for energy efficiency to achieve the technically possible 35% reduction in consumption, this would result in potential primary-energy conservation of 700 terawatt-hours. Accordingly, more and more governments are establishing programs with individual incentives to retrofit buildings with insulation.

All this has created one of the biggest growth markets for the construction industry.

An Enormous Market

The potential market for thermal insulation is not limited to new construction. An existing building requires about three times as much energy for heating as a newly constructed one.² The quantity of existing buildings represents a huge growth area.

¹ Source: dena (German Energy Agency)

² Source: BDEW (German Association of Energy and Water Industries)

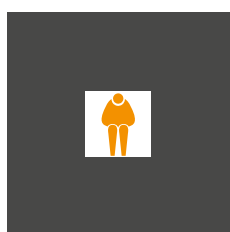
A woman with dark hair, wearing a blue tank top and blue jeans, is lying on her side on a thick, white, shaggy rug. She has her eyes closed and a slight smile, appearing to be resting or sleeping. Her hands are tucked near her face. The background is a plain, light-colored wall.

FOR SUFFICIENT THERMAL
INSULATION, A CONCRETE WALL
WOULD HAVE TO BE **8 METERS THICK**

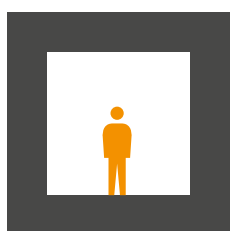
Why is it so hard for us to keep warm? We humans aren't naturally equipped to withstand extreme temperatures. We need clothing to protect us against heat and cold. The same goes for the buildings we erect. Commonly used construction materials need additional thermal insulation to efficiently protect us from extremes of temperature above and below zero.

DO MORE WITH LESS

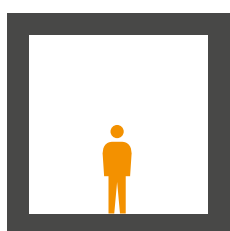
Minimum Thickness Needed for a U Value of $\leq 0.24 \text{ W/m}^2\text{K}^1$



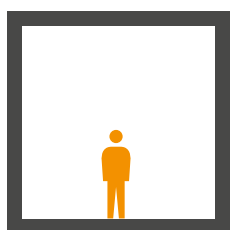
Concrete wall
800 cm



Brick wall (vertically
perforated brick)
160 cm



Insulation plaster
31 cm



WLG032 external
thermal insulation
composite system
(ETICS) with EPS
13 cm

External thermal insulation composite systems (ETICS) are among the most efficient, most commonly used solutions for insulation today. This is because they combine numerous advantages.

Suitable for Old and New Buildings

Brickwork, concrete, render and plaster, timber and just about all other substrates can easily be fitted with ETICS, which means the systems can be used for both retrofitting and new construction.

Suitable for All Climates

Externally insulated facades are heat shields. They keep out the cold and keep in the heat, or vice versa, thereby reducing energy costs.

Improved Interior Climate

Insulated facades also improve the interior climate. Among other things, ETICS reduce temperature differences between indoor air and wall surfaces. By doing so, they significantly improve the comfort level inside.

Architectural Freedom

With ETICS, architects have free rein to create their facade designs. Materials can include plasters, paints, skim coats or tiling.

¹Calculations by Wacker Chemie AG



THE PERFECT INSULATOR IS WHAT LIES BETWEEN THE FEATHERS

Air is the best thermal insulator. All insulation is based on trapped air in some form. The worst enemy is water, which displaces the air and eliminates all insulating capacity. A bird's plumage functions as an ideal insulation system: it traps air and allows the skin to breathe, while water beads off.

MAKE AIR WORK FOR YOU

Air is the ultimate insulator, but you can't build on it. Materials containing high levels of trapped air are seldom robust or able to bear loads. But they usually are also light, so even if they can't themselves bear loads, they are still perfect for cladding. This feature is utilized in external thermal insulation composite systems. The different components within these systems make it possible to use materials with high insulation values for durable, robust cladding.

External thermal insulation composite systems (ETICS) are made up of a combination of materials, each playing a specific role. The composition varies according to the building, the climate and other factors. But the following components are usually involved:

1 Adhesive Mortar

The insulation must be attached to the exterior wall. A polymer-modified cementitious dry-mix mortar is used for this purpose.

2 Thermal Insulation Panel

The most commonly used material for thermal insulation panels is expanded polystyrene. Other suitable materials include mineral wool boards, phenolic resol foam and wood fiber-board.

3 Glassfiber Mesh

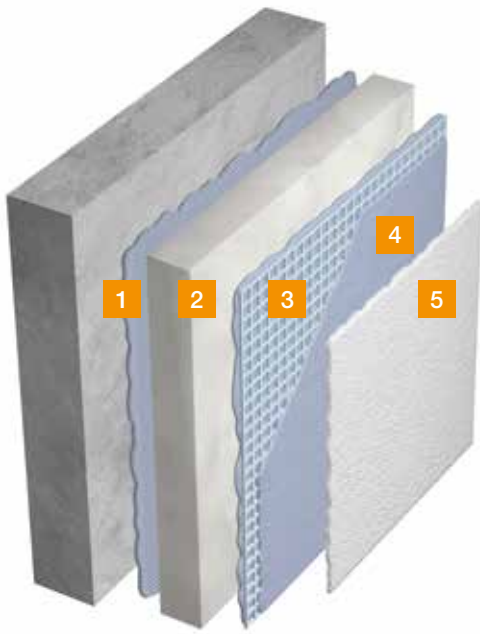
An alkali-resistant glassfiber mesh is embedded into the mortar. It provides high tensile strength and thus helps to increase the mechanical stability of the system.

4 Base Coat

To enhance the impact resistance of the system, a cementitious, polymer-modified dry-mix mortar containing an embedded mesh is applied to the panel. The polymer mortar ensures secure adhesion, improves mechanical stability and protects against the elements.

5 Renders and Paints

A finishing coat completes the external thermal insulation composite system. It consists primarily of renders and paints.



Typical Structure of an External Thermal Insulation Composite System (ETICS)

- 1 Adhesive Mortar
- 2 Thermal Insulation Panel
- 3 Glassfiber Mesh
- 4 Base Coat
- 5 Renders and Paints

IT'S THE MORTAR THAT MAKES OR BREAKS AN EXTERNAL THERMAL INSULATION COMPOSITE SYSTEM

The first component of an external thermal insulation composite system is the adhesive mortar. Its function is to bond the system to the wall and smooth out unevenness in the substrate.

Every Wall is Different

That's not as easy as it sounds. Firstly, most unmodified cementitious systems do not adhere to most insulation panels. And secondly, an exterior wall built in 1960 does not look like one built today, while conditions in Reykjavik are fundamentally different from those in Rome or Beijing. When working with plastered or unplastered brickwork, concrete or wood, or a combination of some or all of these, you require high-performance adhesive mortars.

Indispensable: VINNAPAS®

This is why adhesive mortars must be modified with polymeric binders. Specially developed VINNAPAS® polymer powders are the most commonly used binders worldwide. They enhance a mortar's adhesion and flexibility, and improve ease of workability.

Particularly Suitable: VINNAPAS® VAc-E Grades

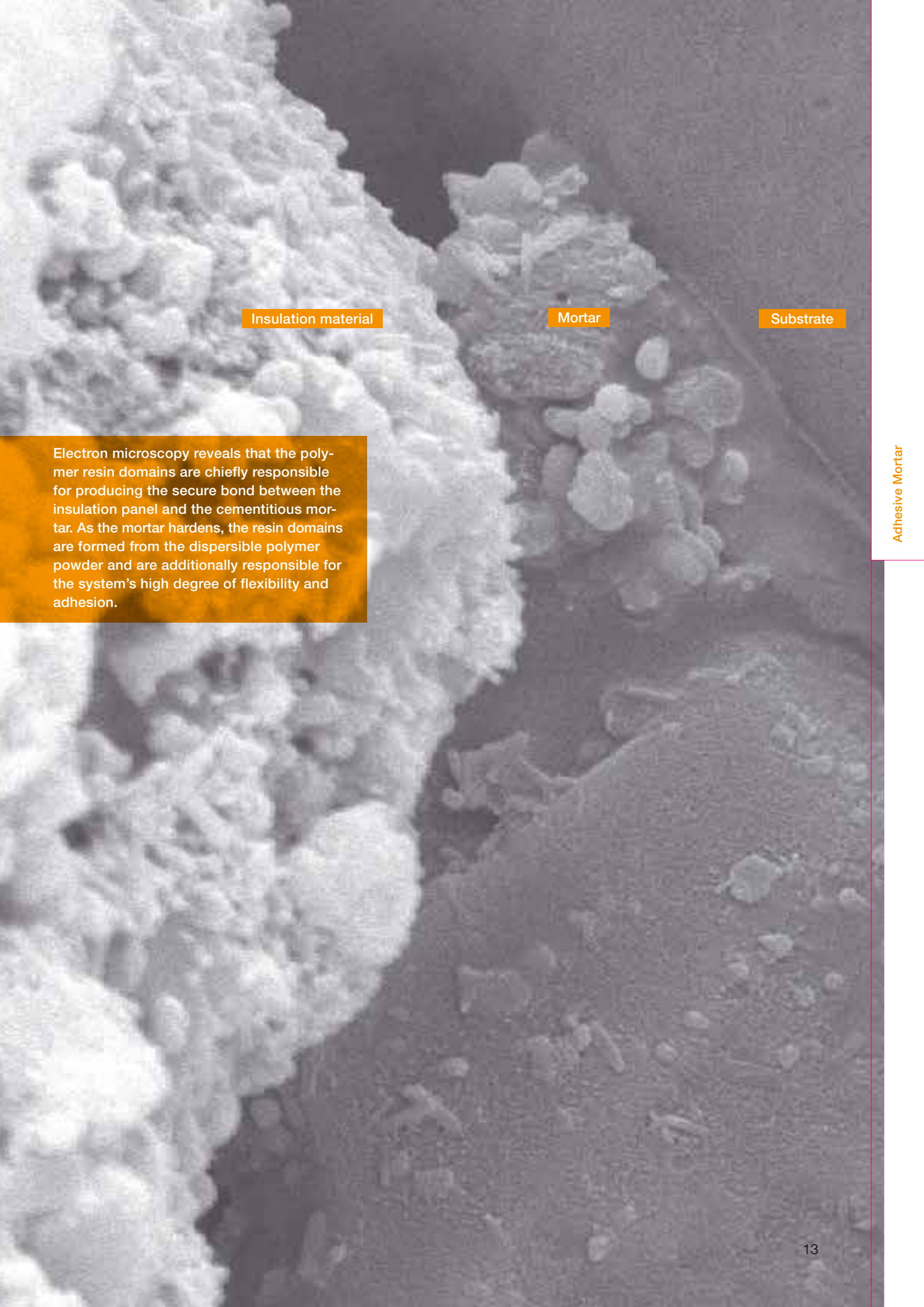
WACKER offers a number of vinyl acetate / ethylene-based products. They are particularly suitable for modifying ETICS adhesive mortars. Because of the strong physical affinity of ethylene to expanded polystyrene, VINNAPAS® VAc-E grades adhere especially well to EPS, the material most commonly used for insulation panels. Furthermore, their high ethylene content makes the polymers extremely flexible. That improves impact resistance and removes the need for plasticizers. VINNAPAS® 5044 N has proven itself as a particularly strong performer.

VINNAPAS® Dispersions and Polymer Powders

VINNAPAS® polymer powders and dispersions are the most successful polymer binders worldwide. Produced by WACKER for over 75 years, they are continually being optimized. In the 1950s, VINNAPAS® was the first-ever polymeric binder in powder form and paved the way for the success of dry-mix mortars. These systems additionally benefited from the development of special grades for use in external thermal insulation composite systems. Today's VINNAPAS® brand is a byword for innovative technology, and for specialists personally committed to supporting you in your market.

WACKER is a global partner to the construction industry, offering a portfolio of polymer and silicone construction chemicals that is second to none. Aside from VINNAPAS® polymer powders, this portfolio also includes VINNAPAS® dispersions, SILRES® silicone resins, ELASTOSIL® silicone sealants and adhesives, GENIOSIL® hybrid sealants and adhesives, and HDK® pyrogenic silica.

For more information, visit
www.wacker.com/construction



Insulation material

Mortar

Substrate

Electron microscopy reveals that the polymer resin domains are chiefly responsible for producing the secure bond between the insulation panel and the cementitious mortar. As the mortar hardens, the resin domains are formed from the dispersible polymer powder and are additionally responsible for the system's high degree of flexibility and adhesion.

THIS IS SUPERIOR BONDING



Every construction engineer knows: without flexibility, adhesion is irrelevant. That's because only elastic bonds are able to absorb the unavoidable stresses and displacements that occur between building materials. VINNAPAS® improves adhesive mortars in both respects, providing adhesion as well as flexibility.

Improved Adhesion

VINNAPAS® added to adhesive mortars in small percentages dramatically increases their adhesion to an extremely wide range of substrates, substantially improving the lifetime of the system as a whole. Other key properties of adhesive mortars can also be optimized individually through polymer modification.

VINNAPAS® polymer powders are so effective that the bond strength of adhesive mortar to the insulation panel still exceeds the cohesive strength of the panel itself even decades later.



Pull-Off Test

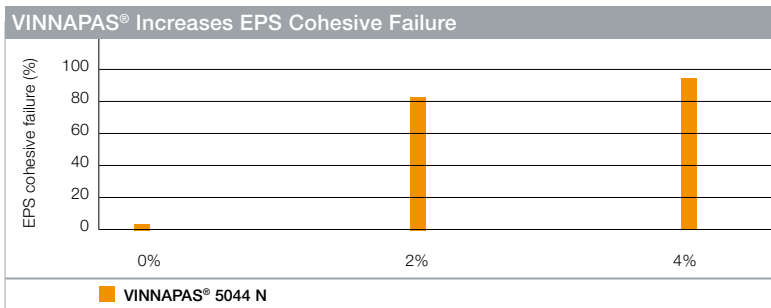
In a pull-off test, mortar is applied to an EPS panel in 5 cm x 5 cm test areas and conditioned. After metal plates are attached to the mortar surfaces with a special adhesive, pull-off tests are performed to measure the force required to separate the mortar from the EPS panel. The pull-off speed is 1-10 mm/min., as provided for by ETAG 004. In addition, the percentage of EPA torn away is assessed and determined.

Results of the Cohesive Failure Test

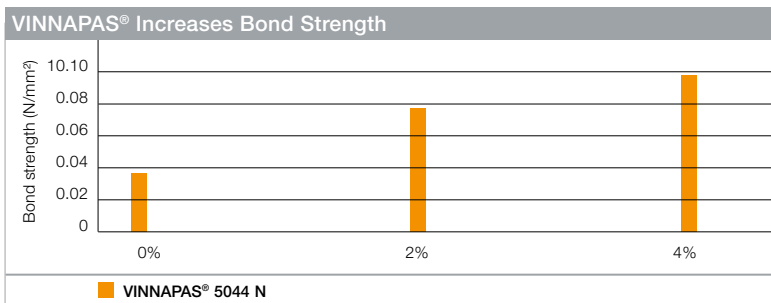
Polymer modification (VINNAPAS®) on the left, none on the right. It is evident that in mortars modified with VINNAPAS®, the adhesion of the mortar to the insulation panel is stronger than the cohesion of the insulation panel. Cohesive failure occurs in the insulation panel, not on the bonding face.



Cohesive failure in EPS panels (%), conditioning 12 days in sc (= standard climate: 23 °C, 50% relative humidity) + 2 days in water – “near market” formulation



Bond strength on EPS panels (N/mm²), conditioning 12 days in sc (= standard climate: 23 °C, 50% relative humidity) + 2 days in water – “near market” formulation



SMARTER SYSTEMS BEND, BUT DON'T BREAK **THAT'S FLEXIBILITY**

Day-to-Day Protection

The base coat protects the external thermal insulation composite system against impact and the elements. It is generally a layer of mortar containing embedded glassfiber mesh. For sustained protection, the mortar, the thermal insulation panel and the glassfiber mesh must be joined firmly but flexibly to each other.

Mechanical Stability

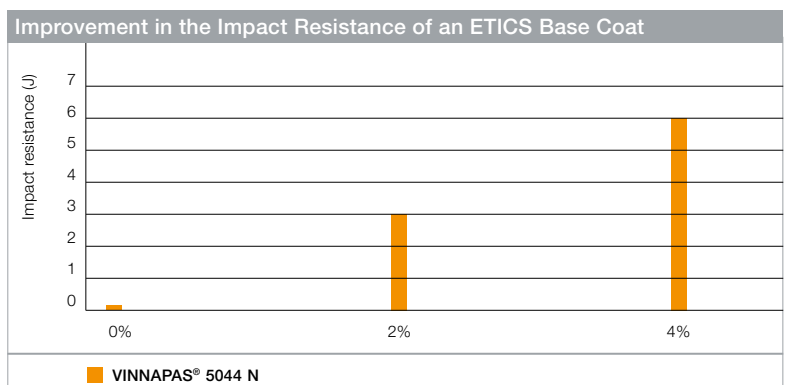
For example, a base coat must be able to withstand the impact of a ball hitting it, or that of a bicycle falling against it. The impact energy that a reinforced base coat can absorb without sustaining damage depends on:

- The insulating material
- The composition of the glassfiber mesh
- The flexibility of the mortar

That flexibility can be adjusted by altering the quantity and resin composition of the dispersible polymer powder used. VINNAPAS® polymer powders give mortars the right degree of adhesion and flexibility that they need for ensuring optimum mechanical stability.

Hard Body Impact Test

The hard body impact test involves impacting the surface of an external thermal insulation composite system with a series of steel balls of different weights at a defined force. The test shows that impact resistance increases as the content of VINNAPAS® in the mortar rises. Without polymer modification, the ETICS is subject to spalling, which impairs the functionality of the entire system. The test is performed in the WACKER technical centers.



Impact resistance (in joules) at 23 °C, conditioning 28 days in sc
(= standard climate: 23 °C, 50% relative humidity) – “near market” formulation



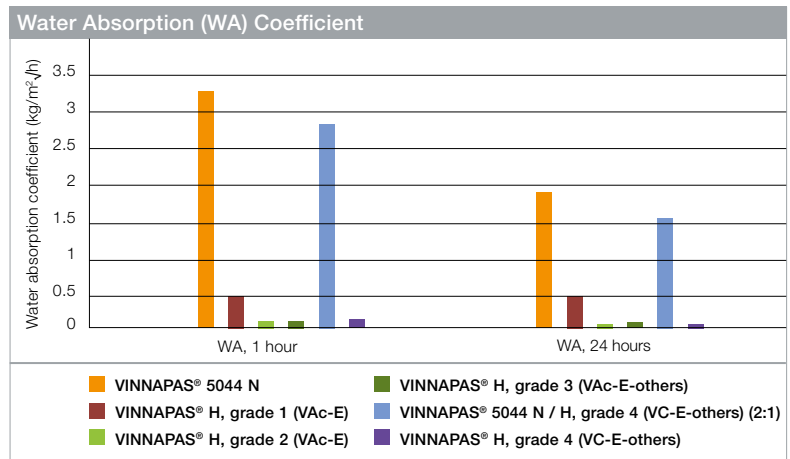
Hard body impact test with 3 joules at 23 °C without polymer modification



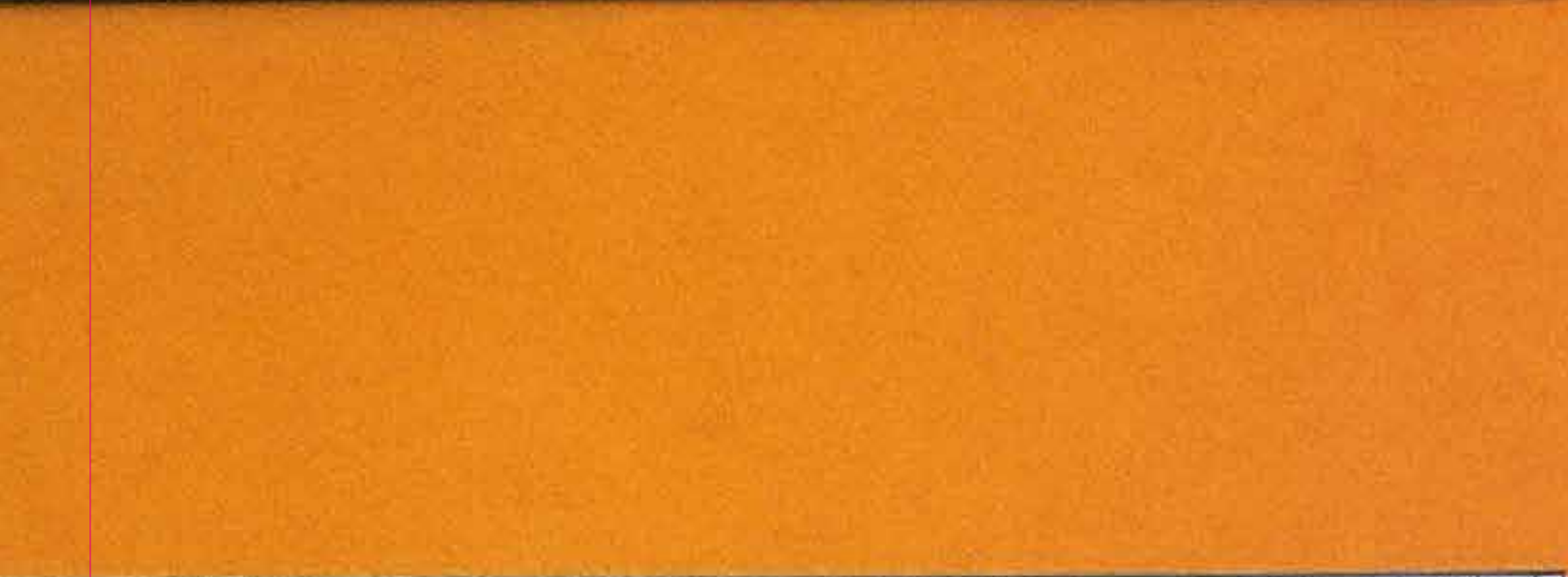
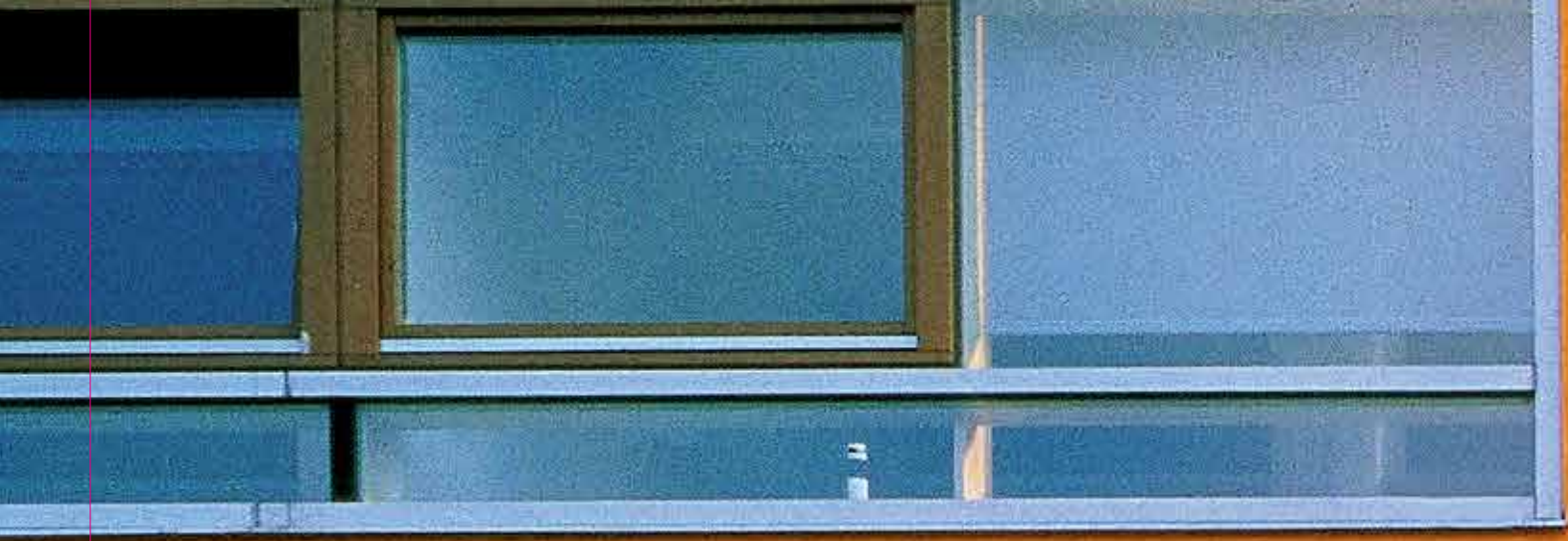
Hard body impact test with 6 joules at 23 °C with 4% VINNAPAS® 5044 N

Reliable Water Repellency without Adding Hydrophobic Agents

To preserve the insulation properties and durability of ETICS, it must not be soaked with moisture. Accordingly, not only the finishing coat, but also the base coat should be water-repellent. WACKER has developed specific dispersible polymer powders for cases just like this. Mortars treated with VINNAPAS® H polymer powders have excellent hydrophobic properties, rendering additional hydrophobic agents superfluous.



Water absorption coefficient (kg/m²·√h) according to EN ISO 1062-3 – 2% dispersible polymer powder



FACADES DO MORE THAN PUT UP A FRONT

External thermal insulation composite systems offer free rein for aesthetic expression. In theory, facades can be clad with any and all imaginable materials – even with tiling, for example. Usually, however, renders are used.

PROTECT THE VALUE WITHIN

External thermal insulation composite systems are protected with a finishing coat. In cold regions, the prime concern once again is to prevent outside moisture from getting into the system, but also to allow interior moisture to be transported out. In theory, this could be achieved using any number of materials and designs. Mineral-based polymer-modified renders are frequently chosen.

Water Stays Out

VINNAPAS® H polymer powders have been specially developed to deliver a strong hydrophobic effect. In mineral renders, they reduce capillary water absorption significantly and thus enable mortar formulations with very low water absorption. But the mortars themselves can be easily mixed with water and do not exhibit wetting problems.

Water Vapor Escapes

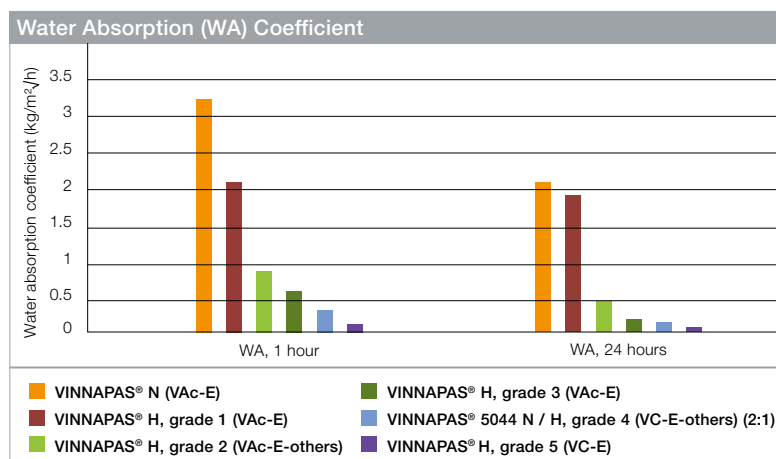
In cold regions, the system must also be water-vapor permeable. Otherwise the humidity could collect within the system. That would damage the building fabric. Modifying mortars with customary quantities of VINNAPAS® polymer powders has only an insignificant effect, if any, on water-vapor permeability. Sufficiently high water-vapor permeability and sufficient drying rates are thus assured. A mineral render enhanced with an appropriate quantity of VINNAPAS® has no problem meeting the criteria for a water-repellent coating set down in DIN 18 550/1 standard.

Feeling Comfortable

The combination of water repellency and water-vapor permeability contributes greatly to a pleasant indoor climate

Better Cohesion

Using polymeric binders like VINNAPAS® offers additional technical advantages as well. VINNAPAS® improves the cohesion and flexural strength. This also improves flexural strength. The same is true for VINNAPAS® H class products. This is particularly important because conventional hydrophobic agents usually have the opposite effect. They reduce adhesion, flexural strength and compression strength.



Water absorption coefficient (kg/m²√h) according to ISO 1062-3, 1 % dispersible polymer powder

For more information, please request our literature on modifying plasters with VINNAPAS® at www.wacker.com/publications



Hardened mortars absorb water via their capillary system. Reducing capillary water absorption not only limits the damage from the moisture itself. It also prevents the absorption and transport of other harmful substances. Penetration of dissolved salts such as chlorides or sulfates is greatly reduced, or prevented altogether.

The Alternative: Silicone Resin Renders

In addition to polymer-modified mineral renders or dispersion-bound synthetic resin renders, organosilicate renders and silicone resin renders can also be used for the finishing coat. The silicone-resin network contained in the latter creates a water-repellent capillary system: while water beads off, the material's pores still allow water vapor to escape by diffusion. To create these materials, WACKER offers SILRES® BS silicone resin binders and water-repellent additives.

The Paint Completes the Job

The most commonly used paint systems, standard emulsion paints, powder paints, silicone resin emulsion paints and silicate emulsion paints, are all compatible. WACKER offers VINNAPAS® dispersible polymer powders, VINNAPAS® dispersions and SILRES® BS silicone resins and hydrophobic additives to make these paints.

For more information on modifying paints with WACKER, visit www.wacker.com.

Go for the Optimum!

Polymer and silicone chemistry have changed the construction industry worldwide. WACKER offers you this expertise in a unique way. WACKER is:

- A worldwide leader in polymer binders for construction materials
- One of the biggest silicone producers worldwide
- Close to you through native expert staff
- And offers individual technical assistance and trainings through our technical centers and the WACKER ACADEMY in all key regions.

Profit from a Comprehensive Portfolio

Our diversified product portfolio and know-how in organic and inorganic chemistry enables us to recommend and develop optimum customized solutions independent of technologies.

Find out more about our solutions for the construction industry at www.wacker.com/construction



REDUCING CO₂ EMISSIONS BY 700 MILLION TONS IT'S THAT EASY



The installation of external thermal insulation composite systems is generally uncomplicated, since they don't require a whole lot of additional work. Systems can thus be easily installed on plastered or unplastered brickwork, concrete and wood, and on certain wood-based materials. As in all construction activity, it is of course essential that all components be compatible with each other, and that they be installed by competent professionals. Local regulations must also be taken into account.

Their versatility makes exterior insulation and finish systems popular all over the world. From their commercial introduction through 2011, approximately 840,000,000 m² in ETICS have been installed in Germany alone. That represents a reduction in CO₂ emissions of 700,000,000 metric tons.¹

¹ Fachverband Wärmedämmverbundsysteme e.V.



1
Apply adhesive mortar to the thermal insulation panels.



2
Bond the panels to the existing masonry without leaving any joints.



3
After the adhesive has cured, apply the base coat and embed the reinforcing mesh.



4
Finally, apply a decorative finishing coat to the facade. This coat may be mineral render, synthetic-resin render, silicone render or silicate render, and may be combined with paint.

Depending on particular requirements and specific construction regulations, additional measures that need to be taken may include the following:

- Additional fastening with wall anchors, rails or Stellfuchs-type fasteners
- Baseboards or corner beadings for side and bottom finishes
- Profiles to reinforce outer corners and edges
- Loop profiles or expanding jointing strips to form dynamic joints
- Various profiles and sealing tapes to form connections to other components such as windows, window sills, doors, roofs, system penetrations, drip edges, etc.
- Armored membrane or base protection plates to reinforce mechanically highly stressed areas such as plinths, doorways, waste containers, driveways, etc.
- Molded membranes for diagonal reinforcement at window and door apertures, transitions between lintels, reveals and facades, grooves and rustication.

IT TAKES TWO GENERATIONS TO SEE HOW GOOD ETICS REALLY ARE YOU WILL KNOW AFTER A MONTH

External thermal insulation composite systems are subject to an array of national standards and approval procedures. Here, too, you can count on WACKER's experience. To enhance VINNAPAS® polymer powders continuously and meet the requirements imposed, WACKER experts are always in close contact with their customers all around the world. In twelve technical centers located in all key regions, we conduct testing for you according to all national and regional standards and specifications; we help you adapt formulations for use with local raw materials, and advise you on how to achieve specific architectural or climatic requirements.

Europe does apply to the Guideline for European Technical Approval of External Thermal Insulation Composite Systems with Rendering (ETAG 004). It is supplemented in other regions by a variety of specifications. The guidelines and standards specify test methods for each component of the system, including insulation panels, meshes, adhesive mortar, base coat and finish coat. ETAG 004 states how ETICS must be tested and evaluated as a whole. Tests are performed using the EOTA wall, available at the WACKER technical centers in Burghausen, Moscow and Shanghai.

Global Knowledge Available Locally

WACKER technical centers for construction applications are located in:

- Allentown (USA)
- Beijing (GC)
- Burghausen (GER)
- Dubai (UAE)
- Melbourne (AUS)
- Mexico City (MX)
- Moscow (RUS)
- Mumbai (IND)
- Seoul (KR)
- São Paulo (BRAS)
- Shanghai (GC)
- Singapore (SING)



Almost all of these sites have a WACKER ACADEMY as well, which holds regular training courses on external thermal insulation composite systems. Find out more at www.wacker.com/wacker-academy.



A prepared wall (at right) is sprayed in the EOTA chamber

Compelling Overall Results

The EOTA wall makes it possible to test ETICS according to the specifications of ETAG 004 in a climatic chamber. In the testing, the ETICS undergoes defined aging cycles. This permits a realistic prediction of the durability of ETICS, and in Europe it is a prerequisite for approval according to ETAG 004. WACKER tests its new dispersible polymer powder products for external thermal insulation composite systems in the same manner. The tests provide for a realistic simulation of long-term weathering under different weather conditions. The wall undergoes a total of 80 heat-rain cycles and 5 heat-frost cycles.

A heat-rain cycle comprises the following phases:

- Heat: heat to 70 °C within one hour. Maintain at 70 °C and 10 to 15% relative humidity for 2 hours.
Total: 3 hours.
- Rain: spray for 1 hour, water temperature $+15 \pm 5$ °C, amount of water: 1 l/m² min.
- Drying: leave to dry for 2 hours at approx. +20 °C.

A heat-frost cycle comprises three phases:

- Heat: heat to 50 °C within one hour. Maintain at 50 ± 5 °C and 10 to 15% relative humidity for 7 hours.
Total: 8 hours.
- Cold: cool to -20 ± 5 °C for 2 hours. Maintain at -20 ± 5 °C for 14 hours.
Total: 16 hours at -20 °C.

Test conditions are adjusted regionally. In Moscow, for example, the frost cycle is measured at a low of -40 °C.

VINNAPAS® – THE PERFECT FIT FOR YOUR APPLICATION

Our portfolio of VINNAPAS® dispersible polymer powders has been developed and optimized in the course of over 55 years to offer you the perfect fit for your application, whether for today's or tomorrow's needs. To make it easier for you to choose the ideal product, we have divided our portfolio in product classes.

Do you need to enhance the adhesion and flexibility of your product while maintaining neutral rheology and a maximum of formulation freedom?

Then choose our VINNAPAS® Standard Offering!

**VINNAPAS® N Class –
Neutral effect on rheology**

For a high degree of formulation freedom and in various applications.

**Do you need more specific properties?
Then choose our VINNAPAS® Plus Offering!**

**VINNAPAS® E Class –
Enhanced properties**

For enhanced properties in a number of applications and improved essential characteristics like improved workability, increased adhesion or water resistance.

**VINNAPAS® H Class –
Hydrophobic excellence**

For remarkable hydrophobic properties in all types of plasters and tile grouts as well as ETICS (External Thermal Insulation Composite Systems).

**VINNAPAS® T Class –
Thixotropic expertise**

For high thixotropy, desirable in thixotropic tile adhesives and troweling compounds.

**VINNAPAS® L Class –
Leveling optimization**

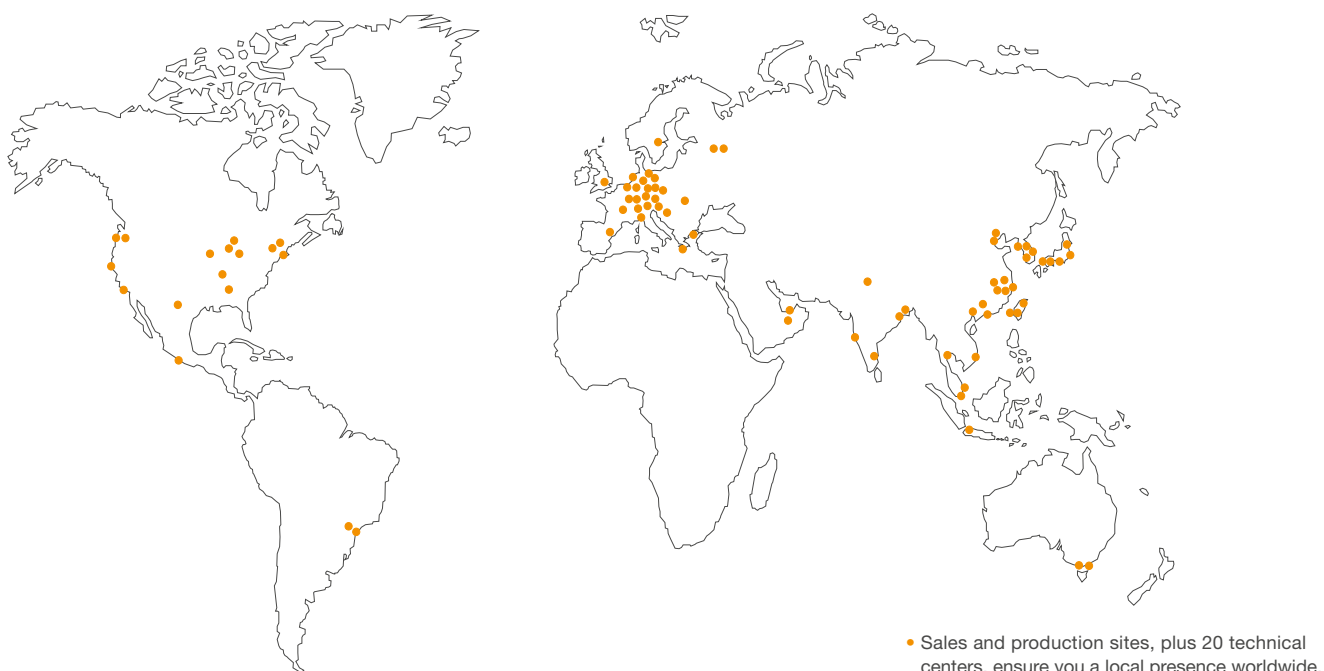
For smooth surfaces with excellent leveling properties, e.g. self-leveling compounds.

**VINNAPAS® F Class –
Flow superiority**

For excellent flow properties without additional synthetic superplasticizers or casein, suitable for self-leveling compounds and fillers requiring fast processing with a 2-in-1 solution.

Please be aware that not all products are available in all regions. For more information, please consult your VINNAPAS® sales manager.

EXPERTISE AND SERVICE NETWORK ON FIVE CONTINENTS



WACKER is one of the world's leading and most research-intensive chemical companies, with total sales of €4.63 billion. Products range from silicones, binders and polymer additives for diverse industrial sectors to bio-engineered pharmaceutical actives and hyperpure silicon for semiconductor and solar applications. As a technology leader focusing on sustainability, WACKER promotes products and ideas that offer a high value-added potential to ensure that current and future generations enjoy a better quality of life based on energy efficiency and protection of the climate and environment. Spanning the globe with five business divisions, operating 24 production sites,

WACKER is currently active in over 100 countries. The Group maintains subsidiaries and sales offices in 29 countries across Europe, the Americas and Asia – including a solidly established presence in China. With a workforce of 16,300, WACKER sees itself as a reliable innovation partner that develops trailblazing solutions for, and in collaboration with, its customers. WACKER also helps them boost their own success. Our technical centers employ local specialists who assist customers world-wide in the development of products tailored to regional demands, supporting them during every stage of their complex production processes, if required.

WACKER e-solutions are online services provided via our customer portal and as integrated process solutions. Our customers and business partners thus benefit from comprehensive information and reliable service to enable projects and orders to be handled fast, reliably and highly efficiently. Visit us anywhere, anytime around the world at: www.wacker.com



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