

FEATURES

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Polymeric Sealing Slurries: Protection of Tomorrow's Resources

Water is a vital resource that is becoming ever scarcer and ever more precious around the globe. However, it is also a construction material's greatest enemy, since rainwater, groundwater and vadose water can cause rapid and extensive damage to buildings. Irrespective of whether we wish to minimize the risk of water damage or permanently prevent water loss, the solution is always to use water-repellent construction materials with sealing properties. WACKER sealing slurries based on hydrophobic VINNAPAS® dispersible polymer powders seal almost every kind of masonry and thus offer a sure form of lasting "water protection."

Aqueducts for supplying water

Since the times of ancient civilizations like the Romans, the Greeks or the Egyptians, aqueducts for supplying water have been built and thus created the first canal and sewage systems. But it was not until the 19th century that an extensive water-supply and sewer network was created in many parts of Europe.

"Back then, it was the frequent cholera epidemics that initiated the systematic construction of sewers," explains Dr. Jürgen Bezler, business development manager for Europe in the Construction Polymers business unit of WACKER POLYMERS. "The problem just is: Sections of today's sewer networks are more than a hundred years old."

According to the Federal Statistics Office, Germany's public sewer system totals some 515,000 kilometers in length – this is

Old, decrepit sewers

equivalent to 13 times the earth's circumference. However, almost 100,000 kilometers, or 25 percent, of the existing sewage and storm-water pipes are defective. Consultant engineer Professor Rudolf Pecher from Erkrath, Germany, warns that "a time bomb is ticking down below." In other words, there is a huge need for repair work.

A time bomb down below**Acute water shortage threatens the world's population**

Old and damaged sewers and pipe systems that might cause soil and groundwater contamination exist not only in Germany. According to UN figures, for example, there are already 1.4 billion people with no access to clean drinking water, and it is thought that by 2025 some 2.5 billion people – an estimated one third of the world's population at that time – will be endangered by an acute shortage of water. Most of the people affected will be living in developing countries.

Sealing slurries conquer the construction sector

Modern sealing slurries provide an ideal method of repairing water pipes and sewers. These materials already boast a forty-year tradition in the protection of buildings. To start with, purely cementitious sealing slurries were used. Nowadays, these only play a minor role because they do not provide an adequate barrier against groundwater or driving rain. Cementitious sealing slurries were later enhanced by mixing them with polymeric additives. Initially, these were added to the mortar at the construction site in the form of liquid dispersions.

A much easier way of working

However, the neatest and, for the user, most convenient products are today's dry mortars, which already contain the polymeric component in the form of a dispersible powder. Modern sealing slurries thus comprise cement, a filler, a

**Extensive research has
paid off**

polymeric binder and another special additive. At the construction site, these dry-mortar systems only need to be stirred with water, simplifying matters enormously for the building industry and ensuring consistent application properties.

In 1957, WACKER chemists succeeded in industrially manufacturing the first powder binder to be used as an additive for dry-mix mortars. VINNAPAS® dispersible polymer powders, with their numerous properties and applications, are the fruit of many years of R&D at WACKER.

**Damp substrates
present no problems**

These dispersible powders permit the formulation of mortars which, although hydrophobic in nature, can easily be gauged with water and do not show any wetting problems. Usually, around five percent VINNAPAS® dispersible polymer powder suffices to modify a fairly stiff mortar with sealant properties. More flexible mortars require 15 percent or more. The modified mortars adhere firmly even to difficult substrates. For example, they can be brushed even onto a damp substrate in typical coating thicknesses of around two mm, something that is usually impossible with conventional systems. When added to commercial mortars, dispersible polymer powders disperse quickly and completely to form polymer films. It is these that impart the hydrophobic property.

Precisely this hydrophobic property is foremost among the specific advantages of sealing slurries: water uptake through the pores is reduced significantly, not only lessening the damaging influence of damp, but also effectively preventing the uptake and transport of other pollutants. Dissolved salts such as chlorides

**Goodbye to the
enemies of masonry**

and sulfates, which are among the greatest enemies of masonry, can no longer penetrate easily via the pores. Sealing slurries also provide reliable protection in applications where hydrostatic pressure, for example of ground water, would otherwise be problematic. These applications, however, require higher proportions of VINNAPAS® dispersible polymer powders, typically 20 to 40 percent of a one-part system.

**Indoor climate
regulation**

An essential requirement for a healthy indoor climate is that walls are water-repellent yet permeable to water vapor. A wall of this kind regulates the indoor climate by keeping the heat in during winter and keeping the rooms cool in summer. If walls were impermeable to water vapor, temperature differences would cause water to condense inside the room or be deposited on the walls, thus damaging the building fabric.

**Concrete repair is an
important application**

“VINNAPAS-based sealing slurries protect cellar walls and foundations as well as water reservoirs and tanks,” emphasizes Bezler. “Typical applications range from all kinds of wet rooms, to swimming pools and wellness areas, through to wastewater drains. This applies not only to new buildings but also to the wide field of concrete repair.” WACKER supplies a broad range of binders for all these applications.

**Repair of an entire
service-water canal**

One example of concrete repair was the 16-km Alz canal, which was dug back in 1916 and traverses WACKER's premises in Burghausen. WACKER has been using electricity supplied by the Alzwerke power plant, Germany's largest industrial hydroelectric plant, ever since 1938. Nine years ago, the Alz canal was treated with sealing slurry to prevent water loss.

**Avoiding evaporation
from irrigation
systems**

Service water is used not only in industrial plants but also for irrigation purposes in arid regions, where water is precious. Here too, WACKER sealing slurries are indispensable. An example is to be found in Oman. Water is a rarity here in the south-east of the Arabian peninsula. To make matters worse, the annual rainfall of around 100 mm is very unevenly distributed over the year. Since ancient times, therefore, farming communities have used a sophisticated irrigation system of subterranean channels, each known as a “falaj.” The “falaj system” translates approximately as “water from the mountains.” This is why, in ancient times, Oman was also known as “the land of 10,000 falaj.”

**Agriculture thanks to
channeled water**

The groundwater flows at a depth of 30 to 80 meters, where it is prevented from evaporating. Without irrigation, Oman would have no dates, bananas, coconuts, onions, tomatoes, wheat, apricots or walnuts. Dates, along with limes and pomegranates, are among the country’s most important agricultural exports.

**Providing permanent
protection of a country’s
lifeblood – with sealing
slurries**

“Water is a vital resource. The use of polymer-modified sealing slurries to seal water channels and reservoirs can help save precious water and thus promote sustainable development,” explains Bezler. This example emphasizes how chemical innovations are often a major step on the road toward increased affluence, quality of life and sustainability. “This measure will not only permanently save water. “It will significantly improve the service life, load-bearing capacity and hygiene of the falaj system and hence also the long-term situation of the population.”

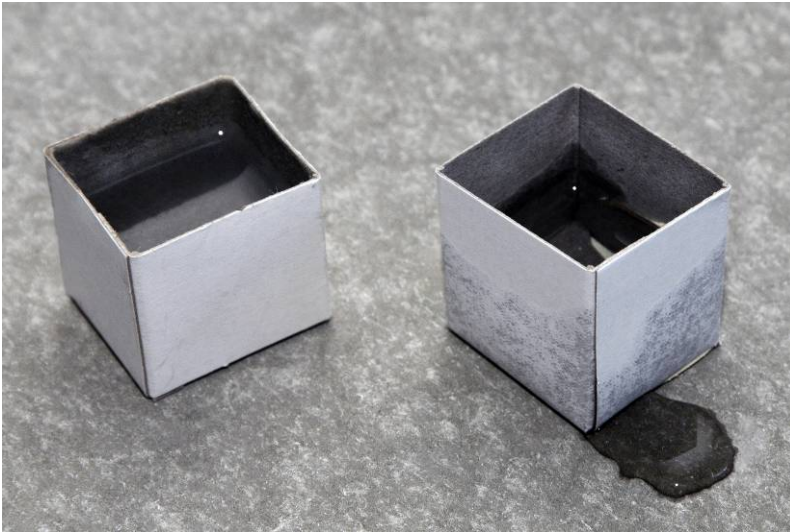
BACKGROUND INFORMATION ON VINNAPAS®

With its VINNAPAS® dispersible polymer powders, WACKER has been the global market and technology leader for more than fifty years in the field of polymeric binders for modifying cementitious systems. More than a million metric tons of VINNAPAS® polymer powders have been sold worldwide since they first launched. The main applications of polymer-modified premixed mortars are construction and tile adhesives, exterior insulation and finish systems, self-leveling mortars and grouts, as well as plasters and repair mortars.

WACKER pioneered polymeric binders in powder form for the construction industry as early as 1957. This technology revolutionized working methods in the sector, providing the first ever one-pack polymer-modified cementitious system. It only required water to be added on site. To this day, the system still represents a much simpler way of working, with substantial cost advantages.

The benefits that VINNAPAS® bestows on the end product include easier processing, excellent anchorage to all substrates, increased flexibility and flexural strength, and enhanced weathering resistance. Another advantage is that VINNAPAS® dispersible polymer powders do not contain plasticizers or film-forming aids, and therefore have low emissions levels.

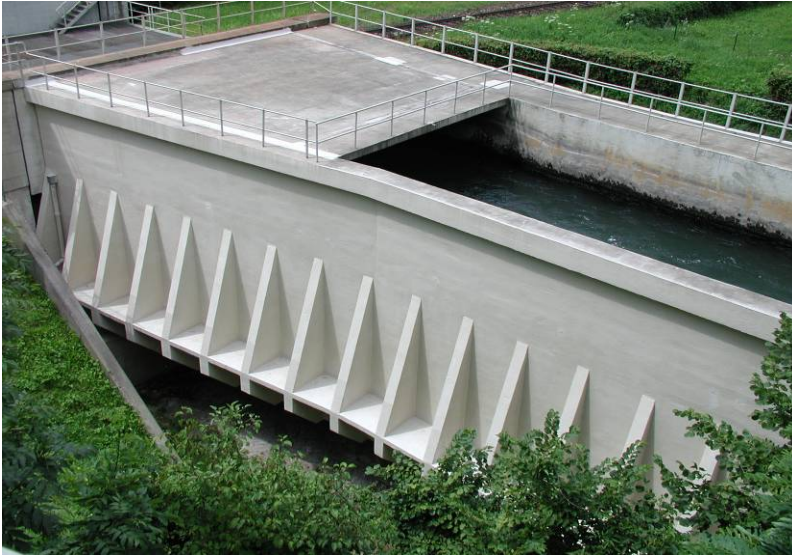
FEATURES
Page 7 of 9



Lab test: sealing slurries containing VINNAPAS® provide strong and long-term protection against water leakage or damage due to water penetration (left box), unlike conventional formulations (right box) (photo: Wacker Chemie AG).



Sealing slurries containing VINNAPAS® are extremely flexible and elastic, as well as easy to apply in a thin coat. These properties make VINNAPAS® ideal for application under tiles, e.g. in baths and pool/spa facilities, or as a coating for canals, pipes and basements (photo: Wacker Chemie AG).



The 16-km long Alz canal in Burghausen (Germany) was renovated and sealed using polymer-modified sealing slurries to prevent water leakage (photo: Wacker Chemie AG).



When applied under tile adhesives, sealing slurries modified with VINNAPAS® protect walls and floors against moisture in damp rooms, such as baths and basements (photo: Wacker Chemie AG).

FEATURES

Page 9 of 9

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The company in brief:

WACKER is a globally active chemical company with some 15,000 employees and annual sales of around €3.78 billion (2007).
WACKER has 27 production sites and over 100 sales offices worldwide.

WACKER SILICONES

Silicone fluids, emulsions, rubber and resins; silanes; pyrogenic silicas; thermo-plastic silicone elastomers

WACKER POLYMERS

Polyvinyl acetate and vinyl acetate copolymers in the form of dispersible polymer powders, dispersions and solid resins used as binders for construction chemicals, coatings, adhesives, paints, plasters and nonwovens

WACKER FINE CHEMICALS

Fine chemicals, biologics and other biotech products, such as cyclodextrins and cysteine

WACKER POLYSILICON

Polysilicon for the semiconductor and photovoltaics industries; solar wafers

Siltronic

Hyperpure silicon wafers and monocrystals for semiconductor devices