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Features

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50 Years of VINNAPAS®: Mortar's Metamorphosis – a Dispersible Polymer Powder Makes History

Usually invisible, but always indispensable: WACKER's polymer dispersible powders have been leaving their mark on the construction industry for 50 years. Enabling high-quality mineral building materials with precisely defined technical properties, as well as opening up a great many novel applications and techniques, these powders help rationalize construction-site processing. In sum: VINNAPAS® polymer powders have revolutionized the construction sector.

From early history to the world's tallest buildings

Binders have been around for a very long time. For example, about 14,000 years ago, craftsmen in what is now eastern Turkey used quick lime to lay bricks. 3,000 years ago, the Phoenicians were the first to mix lime with volcanic rock, thereby producing a material that hardened even under water. In Roman times, the first impressive structures made with mortar were built, such as the "Pont du Gard" in southern France. Nowadays, the construction industry mainly hits the headlines when taller and taller buildings spring up. The Petronas Towers in Kuala Lumpur and Toronto's CN Tower are good examples here.

Dispersible polymer powders create new innovation potential

Regardless of mortar's long history, the innovation potential of this time-honored material is by no means exhausted. Even though mortar is a traditional material, we would be wrong not to see it in a "high tech" light. Especially dry-mix mortar, modified with high-quality polymer binders, opens up broad innovative

potential and a great many novel functions. Even small quantities of dispersible polymer powder suffice to imbue the mortar with new properties and qualities.

It all began in 1957

Mortar's transformation began on July 2, 1957, when WACKER's Burghausen site ran its first tests to pulverize dispersions that previously were only availabe in liquid form. A further aim of these tests was to bag the pulverized dispersions and thus give the construction industry a quantum leap with regard to simple and reliable application and processability.

Construction boom necessitated better materials

Rising market demands were a major reason for these new impulses in mortar technology. In the 1950s, mortar was still prepared on site from the individual raw materials. Germany's first post-war construction boom, however, soon required enhanced mixtures. Because "traditional" mortar comprising cement, sand and water adheres by way of mechanically interlocking with the substrate, it can only be used with porous substrates. This meant the "old-timer" was soon unable to meet growing demands of the construction sector.

Looking for new solutions

As long ago as the 1950s, therefore, liquid polymer binders were added to mortar to enable better adhesion to a wide range of substrates. The drawback to this system, however, was that exactly the right amount of polymer binder had to be added to the mortar – at the construction site, which meant that metering errors were common.

Revolutionizing building sites

In contrast, the invention of dispersible polymer powders was tantamount to revolutionizing the construction sector, because they made it possible to pre-mix mortars at the factory. On construction sites, these dry-mortar systems only needed to be stirred with water, simplifying matters enormously for the

building industry and bringing economic advantages. Following WACKER's rapidly successful tests to produce a binder in powder form, a dispersible polymer powder plant was commissioned in 1958 with a monthly capacity of 100 tons.

The birth of "VINNAPAS®"

Thus, a cementitious, one-part system became available to the building sector for the first time. This system merely required the addition of water on site. The binder, marketed under the name VINNAPAS®, is a vinyl acetate/ethylene copolymer. VINNAPAS® polymer powders constitute what are known as spray-dried dispersions. The powder particles consist of a water-soluble protective-colloid matrix in which the water-insoluble, dispersible particles are embedded. An anticaking agent prevents the powder particles from sticking together.

Anticaking agent prevents particle agglomeration

Polymer bridges – a good ruse

The name dispersible polymer powder is based on its ability to "redisperse" when water is added. "As the mortar sets, flexible polymer bridges are formed between the brittle, mineral constituents of the mortar, thus greatly improving its adhesion to a wide range of substrates," explains Dr. Jürgen Bezler, director Technical Service Europe for the unit "Construction Polymers".

The polymer bridges also increase the system's flexibility. In addition, it is possible to incorporate extra properties such as thixotropy, leveling, superplasticizing and hydrophobicity. More than a million metric tons of VINNAPAS® polymer powders have been sold worldwide since they were first launched. While this construction solution has long been a matter of course in western industrialized countries, there is currently above-average growth in demand both in southern and eastern European countries and on Arab and Asian markets.

Over one million metric tons sold

Today, VINNAPAS® products are chiefly used as tile

adhesives. “This is because the so-called thin-bed technique of laying tiles would not be possible without dispersible polymer powders, which enable the tiler to work much more cost effectively,” explains Bezler. VINNAPAS® also outscores conventional mortars in ease and flexibility of handling, because it can stick to diverse substrates. For example, tilers used to face the horror scenario of bonding tiles to other tiles, wood, PVC, cement screed or fiberboard all in one building – which necessitated using a specific mortar for each substrate. This is no longer necessary, thanks to modern dispersible polymer powders.

Applicable as a cost-saving thin bed

Good anchorage whatever the substrate

Always working invisibly, dispersible polymer powders help in a wide variety of applications. Modified tile adhesives were used, for example, in construction work for the Olympic Games in Athens – both in swimming pools and the Olympic Village’s bathrooms. Tile adhesives containing VINNAPAS® polymer powder were also deployed in the Jin Mao Tower, China’s tallest building. Dispersible polymer powders are especially beneficial in skyscrapers, as they reduce the overall weight of such buildings and hence impact positively on the steel frame and foundations. WACKER expertise helps customers develop enhanced formulations tailored to their individual demands and respective needs and requirements – an approach that has proved extremely successful.

High-rises weigh less

Formulations tailored to individual needs

The flexibility of VINNAPAS® grades applies to regional distinctions. For instance, locally available raw materials such as sand, cement and fillers are not always the same. As a result, the formulation must be optimized for ingredients and take account of aspects such as the specific climate conditions.

Enhanced thermal insulation

The useful properties of dispersible polymer powders are employed to advantage in other fields, too. An example here is EIFS (exterior insulation and finish systems) to insulate outside walls of residential buildings. Effective thermal insulation is the best way to save energy: whereas a non-insulated outside wall lets about 50 percent of the heat escape, additional thermal insulation will reduce this figure to between 10 and 15 percent. On account of its excellent insulating properties, expanded polystyrene board is chosen as insulating material. However, it has the disadvantage of not forming a stable bond with cement.

Three to four percent VINNAPAS® is sufficient

This drawback may be overcome with VINNAPAS® polymer powder. “Adhesive mortar with just three to four percent VINNAPAS® will form a stable and permanent bond with the polystyrene board,” explains Klaus Bonin, Technical Service Manager at WACKER POLYMERS. This is equally true of the improved adhesion to all kinds of substrates, ranging from concrete, brick and old plaster coatings, to mineral wool.

Self-leveling grouts…

Similarly, it was dispersible polymer powders that first permitted the development of self-leveling floor screeds. These premium-quality leveling compounds are ideal for challenging floor covering substrates. “Self-leveling grouts serve primarily to prepare underfloors in readiness for the final floor covering,” explains Armin Hoffmann, technical service manager at WACKER POLYMERS. For this application, uniform absorbency and the capability to smooth irregularities are of great importance. Like modified tile adhesives, these high-quality self-leveling compounds, too, are characterized by rapid setting and drying, which happens virtually overnight.

… that dry overnight

Sealing slurries are based on VINNAPAS® polymer powders,

Preventing water damage…

… and seepage losses

as well. Because they are easy to use, the slurries are a sure form of protecting a large number of buildings from water damage. The slurries not only prevent damage caused by water ingress, but also help save water. Impregnated water channels and reservoirs, for example, prevent water loss, thus promoting the efficient and sustainable use of water.

Reflecting megatrends

Dispersible polymer powders have the potential to transcend current thinking by reflecting future megatrends. This applies as much to energy / watersaving opportunities as it does to improving life conditions, as in interior design and lightweight construction. For example, efficient polymer-modified insulation can reduce uncomfortable drafts and inhibit unhealthy growth of mold, thereby greatly enhancing the indoor climate.

… and the success story continues

It is exactly 50 years that WACKER produced its first dispersible polymer powders in Burghausen in the course of running a series of tests. At that time, no one could guess the major impact WACKER's pioneering work would have on the construction sector as a whole. Today, we are curious to see how things will develop. After all, mortar is not just a material with a rich history, but, more importantly, one that continues to blaze trails.

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The company in brief:
WACKER is a globally active chemical company with some 14,700 employees and annual sales of around €3.34 billion (2006).
WACKER has 22 production sites and over 100 sales offices worldwide.

WACKER SILICONES
Silicone fluids, emulsions, rubber and resins; silanes; pyrogenic silicas; thermoplastic silicone elastomers

WACKER POLYMERS
Dispersible polymer powders and dispersions for applications in the construction industry; PVAc solid resins; VC copolymers; polyvinyl butyrals and acetates

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

WACKER POLYSILICON
Polysilicon for the semiconductor and photovoltaics industries

SILTRONIC
Hyperpure silicon wafers and monocrystals for semiconductor devices