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FEATURE SERVICE

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Keeping Odor and Flames at Bay: Novel VAE Binders for Low-Emission Carpet Applications

The choice of binders plays a key role in many applications and industries. With the recently developed VINNAPAS® CA 55, WACKER experts have managed a breakthrough in a market where binders based on vinyl acetate-ethylene copolymers (VAE) had only been seen as a niche product in the past, namely the carpet industry. Yet VAE dispersions offer a variety of advantages over traditionally used latex in carpet backings: their price is more stable, they emit hardly any volatile organic compounds, provide greater flame-retardance, are easy to process – and are almost odorless.

The absence of smell …

This carpet does not smell. At least, not in the characteristic way of new carpets, even though it has come directly from the factory. It's the new polymeric binder in the backing that makes all the difference – including the absence of odor.

… is due to the choice of binder

"At first glance, you don't notice anything different," says Dr. Holger Künstle with a satisfied smile. The carpet backing looks the same as always, it holds the carpet together, stopping the fibers from coming out even after many years' wear and tear. The typical smell that usually pervades a room for days after carpeting has been fitted is due to conventional styrene-butadiene (SB) latex binders, explains Künstle who is in charge of WACKER's carpet applications lab in Burghausen, Germany. But this carpet contains VINNAPAS® CA 55, a novel binder based on vinyl acetate-ethylene copolymer dispersions, replacing conventionally

used latex binders in the formulation of the carpet backing.

A pioneer in VAE technology

Polymeric binders are a traditional mainstay of the WACKER portfolio. Burghausen chemists began producing vinyl acetate from acetic acid in 1928. By 1966, the researchers had succeeded in combining vinyl acetate with ethylene to produce a copolymer. They created a binder that has now become an integral part of a wide range of applications, and a core technology at WACKER. VAE dispersions are widely used in adhesives, low-odor interior paints, textiles or nonwovens – and by now also in carpet applications.

Seizing new opportunities

When Robert Tangelder, Business Development Manager for WACKER POLYMERS' dispersion team in Europe, introduced these VAE dispersions for carpet backing applications to Willem van der Meer, Purchasing Manager at the Dutch carpet producer Edel Group, van der Meer realized this unique opportunity to start something new. Subsequently, he teamed up with his colleague Dr. Mike de Lange, a doctor in polymer chemistry, who brought in his technical perspective to explore the innovation.

An alternative for a previously unrivaled product

De Lange was immediately interested when Tangelder showed him the new VAE binders tailored to the European carpet-industry needs. For the first time, the VAE binders gave him an alternative to the previously unrivaled SB – an alternative that could be processed using existing equipment, too. "Customers from Scandinavia, a very environmentally conscious market, had often asked me why we couldn't manage without SB," explains de Lange. Now he finally saw an opportunity to do so and introduce a totally satisfactory substitute. Furthermore, the choice of a

suitable carpet-backing binder includes two additional factors: more security regarding the supply, and more stable prices. This is one of the main advantages of VAE dispersions since they are less at the mercy of crude oil than SB.

Stable supply and prices …

VAE dispersions have already enjoyed tremendous success in the USA. Even though VAE has been used at a low level for over 30 years, WACKER has experienced a 10-fold increase with all the key carpet manufacturers for the past three years. In North America, this shift has been enabled by the high and volatile price of butadiene, helped by the steady climb in the price of styrene. Both of these raw materials are traded globally so the wave of volatility has been felt in all regions.

… combined with performance benefits …

Of course, the price of VAE would mean little if it did not perform – and it does. Over several months, WACKER's American carpet experts in Dalton, GA, successfully switched over the precoat of one production line after the other and have been providing solid technical support to the mills ever since. In a next step, WACKER's experts started to approach the European carpet market – and found Edel Group extremely receptive right from the start. Since every carpet manufacturer has their own recipe adapted to existing equipment, Künstle and his team in Burghausen collaborated with Edel Group's technical experts to create the optimal VAE carpet binder formulation for each carpet type.

… make for the optimal carpet binder

Over the last few months, many square meters of carpet have passed through the hands of the chemist and his staff. Künstle's team tested the coated carpet specimens under practical conditions, using machines that simulate shoes walking over the car-

Tried and tested

pet thousands of times or the repeated rolling of office chair casters. The WACKER expert was particularly impressed by the tests carried out in his lab's combustion chamber. During this test, he set fire to films of carpet backing compounds, some made with VAE, some with SB. He observed that VAE films are less flammable than SB films. What's more, certain VAE grades were even self-extinguishing – whereas compounds formulated with SB latex burnt completely, releasing black smoke in the process. He further realized that if the backings are bonded with VAE binders, much less flame retardant additive, such as aluminum trihydrate, has to be added, which lowers the costs of the final formulation. Due to their lower flammability, carpets with a VAE backing are therefore ideal for commercial installations, such as in hotels and offices, or in aircraft construction and shipbuilding, where fire safety is a high priority.

Lower flammability …

… for more safety

Equally important is the question of indoor emissions. Since their surface area is large, floor coverings have the potential to emit volatile organic compounds (VOCs) to the environment. The Association of Environmentally Friendly Carpets (GUT e.V.), an initiative launched by European carpet manufacturers, has established the "GUT" label. To receive this label, carpets must undergo extensive analysis for possible pollutants and must meet the rigorous standards. Carpets are tested, among other things, for plasticizers, biocides, pesticides, aromatics, hydrocarbons, aldehydes, and ketones. Additionally, a sensory odor test is performed. "Our tests showed that with a VAE carpet backing, the total emissions of VOCs are much lower than when SB latex is

Less emissions, less odor

used," says Dr. Mike de Lange.

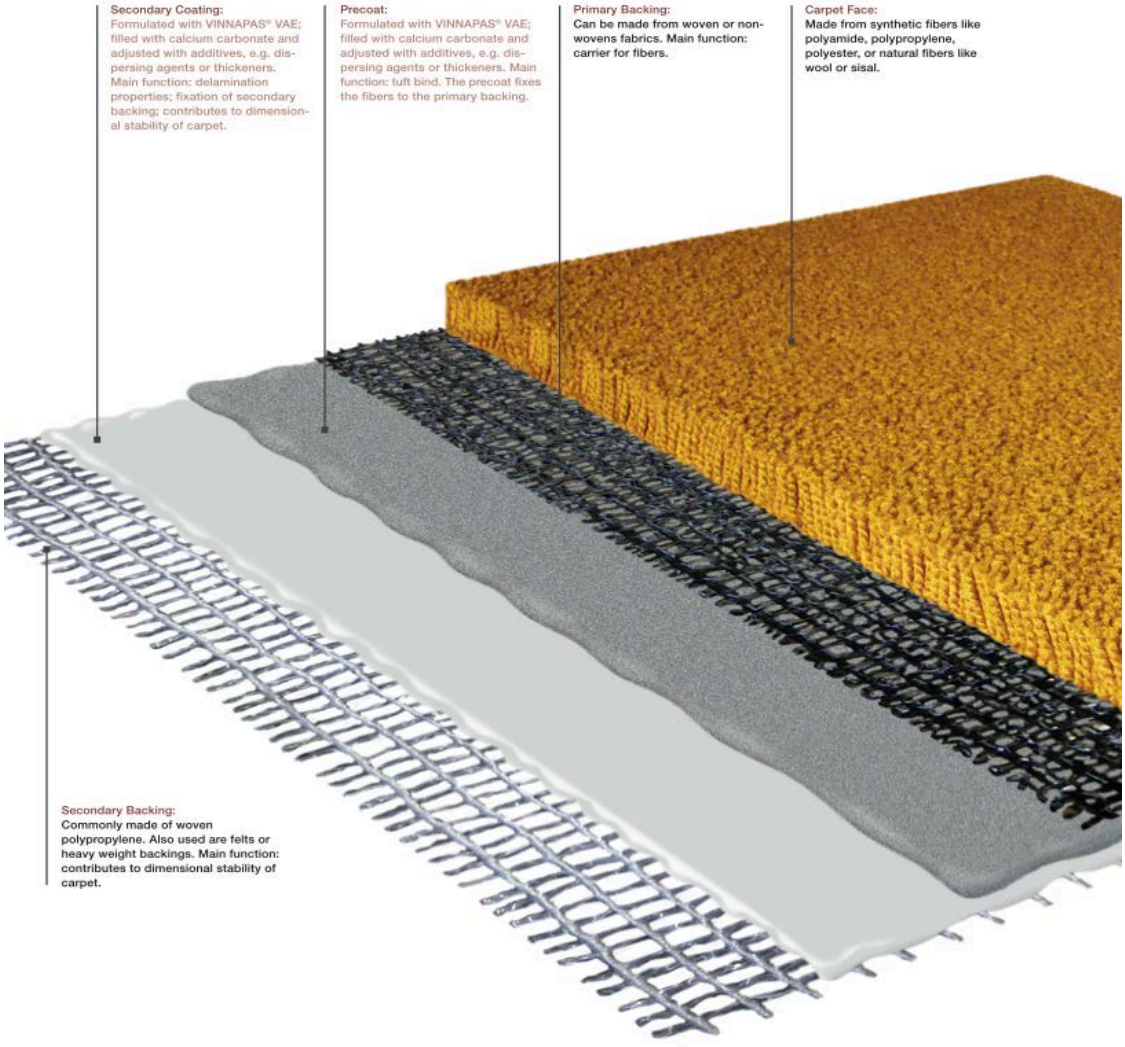
Ready for a change

Initially, de Lange certainly had his doubts about switching their tufted carpet backing production completely over to VAE. When he used SB and VAE in parallel, the inherent differences in the flow properties of the two binders became apparent. The VAE formulation had to be optimized. But once VINNAPAS® CA 55 was adjusted and following six months of intensive carpet testing, Edel Group was ready to change its production. "From the moment we switched production entirely over to VAE, everything was fine", de Lange recalls, adding that, today, the in-factory processes are more stable and uniform with VAE than with SB in the past, and don't have to be modified as often. Plus, ever since they changed to VAE, Edel Group has been able to guarantee its customers stable terms and conditions for the next quarter. "That would have been unimaginable for SB, as its price constantly peaks and troughs," says Willem van der Meer.

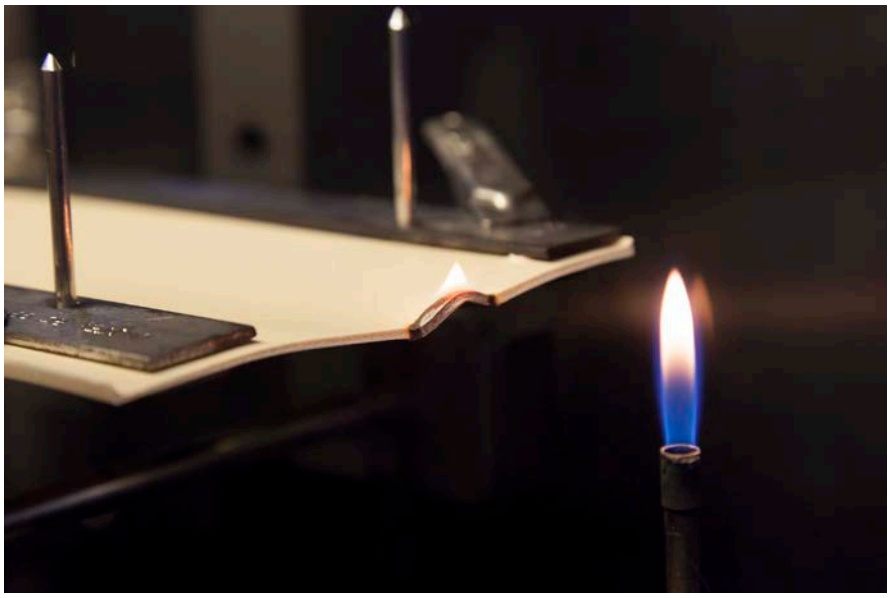
A uniform process with stable conditions

A breakthrough in a challenging market

That's something Feike van der Heide likes to hear. The Dutchman is responsible for VAE dispersions in WACKER's EMEA region (Europe, Middle East and Africa). "The European carpet industry is quite a large, strategically important market for us," he explains. "We have focused our efforts to penetrating this market by means of VINNAPAS® CA 55, our dispersion specifically designed for carpets. We're now glad that we made the breakthrough." What's more, van der Heide is very proud of the close cooperation with a first mover such as Edel Group, which has been the first manufacturer to switch over its production entirely to VAE both for the precoat and the secondary coat.



Composition of a tufted carpet: The new VINNAPAS® CA 55 is suitable for formulating highly-filled precoats which bond carpet fibers to the primary backing. In addition, it also enables the formulation of secondary coatings, which, in turn, bond the carpet to the secondary backing (graphics: Wacker Chemie AG).



Furnace chamber test: Films made with VAE and SB binders are tested at WACKER's carpet lab in Burghausen. The tests show that specific VAE-based films are self-extinguishing (above), while films made with SB burn readily, issuing black smoke (below). VAE-based binders therefore allow for formulations that need fewer flame retardant additives (photos: Wacker Chemie AG).

Tuft bind test: A WACKER employee examines the adhesion of the fibers to the primary backing. As a binder, the new VINNAPAS® CA 55 not only offers excellent bonding and processing properties for tufted carpets, but also low emission values, reduced odor and increased flame retardant properties (photo: Wacker Chemie AG).

Note:
These photos are available for download at:
http://www.wacker.com/pressreleases

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The company in brief:
WACKER is a globally active chemical company with some 16,300 employees and annual sales of around €4.63 billion (2012).
WACKER has a global network of 24 production sites, 22 technical competence centers and 53 sales offices.

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

WACKER POLYMERS
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