

Dr. Michael Ludewig (left) and Dr. Joachim Simon inspect a new STP binder.



New adhesives move into the construction industry

Extreme elasticity

In car production, elastic adhesives have become indispensable. Now these polymers are beginning to take over the construction industry too. On walls and facades, floors and roofs, there are all kinds of items to be stuck and sealed.

All home improvement enthusiasts have used silicone at some time in their lives. Whenever joints have to be sealed in the bathroom or the kitchen, this viscous mass is indispensable. The paste is easy to apply and cures quickly at room temperature. But what about painting over the silicone seams or using the product to lay a new parquet floor in the living room? Preferably not. On such occasions, the professional will opt for polyurethane, which has better paint adhesion as a sealant and much better mechanical properties as an adhesive. Researchers from Bayer Polymers – which has extensive experience with polyurethanes – have now developed a range of adhesives and sealants that combine the advantages of polyurethanes with those of silicones and minimize their disadvantages at the same time: silane-terminated polyurethanes (STP). "Chemically speaking, adhesives and sealants are very similar to each other," says Dr. Joachim Simon, Head of Bayer Polymers' Aromatic Coating Systems Department in Leverkusen. Both are thread-like molecules that react with one another under the influence of atmospheric moisture or, in the case

of two-component adhesives, through the addition of a hardener, and crosslink to form giant molecules. Their elasticity is dependent on the length of the individual molecule threads.

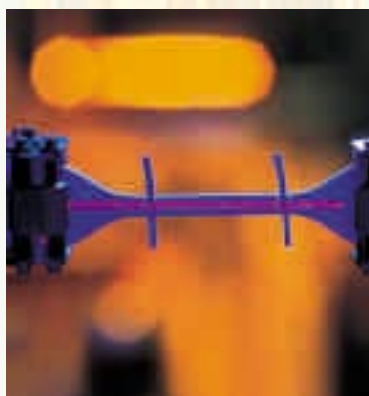
Normally, isocyanates (highly reactive chemical groups containing nitrogen, carbon and oxygen atoms) are positioned at each end of the polyurethane molecule. They react with the water in moist air, with the result that pairs of thread ends link up and release carbon dioxide (CO₂).

"What we did was replace these reactive end-groups in the polyurethane with something else," explains Bayer chemist Dr. Michael Ludewig of the Innovation Polyurethanes Department. "We replaced the isocyanate with a methoxysilane." Consequently, the crosslinking process now proceeds in a similar way to that of a specific type of silicone. This has the advantage that even under the most unfavorable conditions, no CO₂ bubbles can form during curing, a particularly important aspect with very thick joints.

Bayer owes the fact that it can make the polyethers in its new adhesives so long – molecular weights of over 10,000 g/mol are possible – to its "Im-

pact" technology. "This makes it possible to produce defined chain lengths with exactly the desired number of end-groups," says Simon. "And that means we are close to large-scale realization of the ideal molecule." STP binders can now be made as soft or as hard as required. "The longer the chains, the softer the binder".

They will probably only really be able to play out their strengths to the full under extreme conditions, says Dr. Mathias Matner, who looks after applications development in the adhesives and sealants team at Bayer Polymers. He is thinking here of the "facades of high-rise buildings, which are subjected to extreme temperature fluctuations." At high temperatures, the facade panels of Eternit or plastic expand, and when it is cold, they shrink. "The sealing joints must be able to balance out these movements, which may be as much as a few centimeters." But even in traditional domains of polyurethane adhesives, for example, when laying the wooden planks on the deck of a sailing boat, STPs could really be useful. The first products are already on the market under the names Desmoseal® and Baycoll®.



www.Bayer-Is.com/Is/Iswebcms.nsf/id/arch_e

An Internet site that explains the basic principles of bonding in simple form.

Tensile test: the strength of the clamped specimen is determined by measuring the force on tearing