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ADHESIVE WINDOW TECHNOLOGY BRINGS
MORE LIGHT INTO BUILDINGS

Rainer Hardtke

Hardtke Kommunikation
Cecilienstraße 30
D-53840 Troisdorf
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Hardtke Kommunikation
Cecilienstraße 30
D-53840 Troisdorf
E-Mail: rainer@hardtke-pr.com

ABSTRACT: The technology of bonding large frameless insulated windows directly to commercial facades has been used for decades, but the technology has always been too costly and difficult for use on home windows. When a supplier of windows for new construction wanted to develop bonding for use by home builders, they needed to ensure mass-produced bonded windows could provide durability, strength and security to buyers. Silicone adhesives helped deliver those qualities consistently, along with enhanced energy efficiency.

St. Gallen, the company headquarters of swisswindows, is located 700 metres above sea level in the direct vicinity of Lake Constance. It’s a wonderful view. Food for thought? The deciding factor? The view may well have been a factor, but it was not the main reason for plans that Dörig Fenster Service AG made shortly after the turn of the century. In 2004/2005, before Dörig had joined the swisswindows association with Herzog and Kufag, the company was looking for a new direction in window manufacturing to meet future demands. In the process, considerations such as heat insulation, production efficiency, and architectural demands were significant. The discrepancy between ever-larger window surfaces and greater heat insulation led to the use of new manufacturing technologies. The bonding of large-size frameless insulated glass to the façades of high-rise buildings had been available from façade builders for decades, in addition to façade windows bonded directly to frames, but this technology had not yet found its way into the serial production of home windows. This was perhaps due to the lack of a suitable adhesive that was technically superior, but not yet well enough developed for serial use in window manufacturing, which demanded a high turnout during a short production period. While looking for a suitable adhesive, swisswindows came across the worldwide leading supplier of silicon technology, Dow Corning, which fulfilled all these needs and demands with a unique silicon adhesive. The lengthy experience and considerable expertise of Dow Corning in respect to tested and proven adhesive technology were the basis for this successful cooperative work.

With defined market demands and this new know-how, swisswindows developed the design window system “imago” which immediately received numerous awards: in 2007, “imago” was awarded the “Industrial Panel Product Design Award 2008” in the category of “Industry/Buildings” and in 2008 also the “Red Dot Design Award”. The jury was impressed by the clear design, its proven technical qualities, and the versatile decorative variations. Architects continued to define residential architecture in terms of well-developed lighting and room transparency without visual obstruction. As a result, window surfaces and elements were developed out of this. The necessary technology thus became secondary for planners and even more so for consumers. As long as the technology works, the ambiance is conveyed and the energy efficiency of the building is correct, quality demands by consumers are fulfilled. Consumers determine the criteria. If these are fulfilled, the quality is appropriate. Windows must satisfy these demands.

For many years, plastic windows with wide and bulky frames were met with disapproval and
rejected by architects. The innovative development of adhesive technology in the recent past brought along with it a technical and design advancement for plastic windows: more glass and less frame. By bonding the glass directly to the window frame, the static of the entire frame was improved even with narrow and filigree frames. At the same time, steel reinforcements could be dispensed with and window surfaces expanded, leading to better window energy efficiency with the proper insulation. Architects and residents are equally pleased with the narrow profiles which mean more light in rooms through larger window surfaces and improved energy efficiency. Furthermore, the combination of glass, fitting and bonding increases protection from theft with double-wing windows: WK1, WK2 and WK3 are also possible.

“These positive performance features would not have been possible without bonding”, acknowledges Adrian Schlumpf, Managing Director at Dörig Bauphysik AG and an executive at swisswindows AG, with satisfaction. The imago window is bonded only during manufacturing, not during installation. Adrian Schlumpf states: “We consciously decided in favour of the Dow Corning bonding system because we were then able to achieve our unique marketing strategy. This involves an extremely fast vulcanising silicon structural sealant. The timing of the curing process of this sealant ideally fulfils production requirements. This led to the decision to use this two-component bonding system exclusively in automated production, but not manually at building sites. Only in this way can we guarantee the necessary consistency and reliability in processing.”

Swisswindows has devoted itself to the key issue of consistent quality control in window manufacturing so that the exact production dates and conditions as well as all the relevant details can be retrieved for each manufactured window. These requirements demand processing at the highest level. The durability and performance of the silicon sealant is especially impressive considering that bonded structures have been holding up against high winds and formidable weather for over 40 years now. These windows therefore have the same product life as standard windows. One advantage is that the window frames no longer sag and readjustment is therefore not necessary as before. They are maintenance free and built to last. Proof of their durability is the “ETAG 002”, the “Guideline for European Technical Approval for Structural Sealant Glazing Systems”, which through testing prescribes considerably tougher conditions than actually exist. “The tight-sealing and powerful glass adhesive together with the window frame forms an extremely torsion-free unit. In addition to better thermal insulation, as well as the improved use of light inside buildings and increased theft protection, the narrower yet more stable profile combinations of the new bonded plastic windows show real product advantages and visible innovation in plastic window construction”, emphasises Idil Yurdakul, Major Market leader Building Assembly for Dow Corning. In the process, the fast reactive silicon sealant not only provides significant advantages for the product, such as outstanding adhesion without a primer on various surfaces, enormous strength, continuous elasticity and the highest resistance against ultraviolet rays and weathering which guarantee long-lasting bonding. The advantages for the manufacturer are also obvious: short cross-linking times and quick finalising work on the windows accelerate the production process and increase capacity. Dow Corning can draw upon decades of experience in manufacturing bonding systems for glass façades. And Dow Corning was involved in bonding windows from the very beginning. The first window systems were bonded and installed in France as early as 1997. “We still favour the two-component bonding system in manufacturing because it is simply the most reliable for processing. Single-component reaction systems are extremely dependent on temperature and humidity which can vary greatly in the course of a year”, stresses Sigurd Sitte, application engineer at Dow Corning. “In the meantime, two-component systems can also be used for manual bonding. In this respect, we have recently introduced a new system to the market, which allows for consistent and reliable processing straight from the cartridge. In application technology, we are also making continuous developments and improvements for our customers and perhaps will soon be able to launch something new and innovative.”
“Long-term durability” was also an important criterion in the development of imago. Swisswindows placed great emphasis on developing a modern window system in a simple, straight-lined design not subject to fads. After all, the installed plastic window is supposed to offer enjoyment for decades and not become obsolete after a short time. The multiple award-winning imago system achieves this with 87% glass, an overlapping casement of 92 mm visible from the outside (95 mm inside), and three energy-saving sealants with a $U_W$ value of up to 0.75 W/m²K. The system is also safeguarded by the “Long Life Protector” (LLP). Snapped below the positioned window, LLP protects the rim of the glass against mechanical damage, ultraviolet rays, and climatic conditions.

The imago system has opened up new possibilities and changed perspectives for architects and planners. “Interestingly, architects no longer ask us whether imago is a plastic or a wooden window. Apparently, the new system has eliminated the question of material, and planners are now concentrating entirely on their design work”, states Adrian Schlumpf.

About swisswindows

Dörig Fenster Service AG, Herzog Fenster AG and Kufag AG merged in 2009 under the trade name swisswindows. Three Swiss window manufacturers steeped in tradition make up the windows division of the swisspor group, which specialises in the protection, sealing, and insulation of buildings. The corporate group consists of 26 companies and operates in Switzerland as well as in five other European countries. It employs 2,900 workers and has a group sales volume of approximately one billion Swiss francs. In addition to swisswindows, the swisspor group is also comprised of companies from the insulation specialist swisspor such as Eternit (Switzerland) AG and the Austrian company Eternit-Werke Ludwig Hatschek AG.

www.swisswindows.ch
www.swisspor.com

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1 For triple glazing with $U_G 0.5$, double-winged, calculation according to EN ISO 10077-1 or measurement according to EN ISO 12567-1, overall window size 1.75 x 1x30 m (w x h)
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