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From window to facade

Large-format windows that also help to provide bracing for the building and are quick to assemble are opening up new opportunities for builders. These glass elements, normally full-height, are glued to a surrounding connecting strip made of birch plywood, which is then simply screwed to a pre-assembled post-and-beam structure. Known as wood-glass composites, they take on static load functions, and enable construction jobs to progress rapidly. As a result, builders can produce facade designs that would, in most cases, have previously required steel construction. A certified glazier supplies perfectly fitting elements, which can later be individually replaced if the need arises. The company to talk to in Germany is Uniglas, whose "Facade" system has received the General Building Authority Approval for non-load-bearing facades from the German Institute for Construction Engineering (DiBt - Deutsches Institut für Bautechnik). The supplier in Austria is Petschenig Glastec. And with its "Fasco" system, Knapp offers a wood-glass composite system using strips of fibre-reinforced plastic (FRP) instead of wood, although this does not yet have the German Building Authority Approval.

Wood-glass composites in practice

The single-family house "Schattenbox", in the vicinity of Vienna, won the Lower Austrian Timber Construction Award in 2009. A special feature of this two-storey wooden building was its southern facade made of wood-glass composite elements. Commercial buildings have been constructed using this system since then: the training and logistics centre of Otto Chemie in Fridolfing was fitted with a wood-glass composite facade from Uniglas measuring 45 m in length and 10 m high. This uses alternating white facade panels and panes of solar control glass, each 1.25 m wide and 2.50 m high. In addition to the fixed glazing, it also has casement windows that can be opened. The wood-glass composite system made it possible to complete the

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Veranstalter
Organizer
NürnbergMesse GmbH
Messezentrum
90471 Nürnberg, Germany
T +49 9 11 86 06-0
F +49 9 11 86 06-82 28
frontale@nuernbergmesse.de
frontale.de

Vorsitzender des Aufsichtsrates
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facade in just one week. In Haslach, a commercial building using wood-glass composite elements up to 4.1 m high at ground-floor level was constructed in 2012. And in Austria, a number of projects have recently been completed using this technology from Petschenig.

Development began as early as 1997

Initial research began in 1997 at the Bern University of Applied Sciences – Architecture, Wood and Civil Engineering, which investigated the use of gluing technology to improve wooden windows.

With input from Holzforschung Austria (HFA) in Vienna and German adhesive manufacturer Otto Chemie, the question of gluing was expanded to include how far the static load on wooden windows could be increased. Working with the Vienna University of Technology and industry partners, the institutes examined the extent to which wood-glass composites could be used in facade construction.

Research leads to improved bracing at Vienna University of Technology

Research into wood-glass composites continues at the Institute of Architectural Science, Structural Design and Timber Engineering at Vienna University of Technology. Professor Wolfgang Winter (since retired) commented in 2016: “Our current activities focus on the long-term performance of the adhesive and a safety system assured in accordance with Eurocode.” And Peter Schober commented: “With wood-glass composites, we originally developed a system in which the glass panes were glued in place and the acting forces were deflected using shear adhesion alone. We face the limitation that strong deformations occur under relatively minor loads, and we are unable to use the performance of the adhesion to its full advantage. The restricting factor for us was therefore the deformation of the existing wood-glass composite element. But we could change the design to enable higher loads to be transferred. This is exactly the approach adopted by Professor Winter.” In addition to the adhesive used to date, efficient bonding should be applied, like a kind of fluid padding, which will let the glass sit up against the frame or the connecting strip, as appropriate. This

improves the bracing by a factor of five, which enables a much greater load to be transmitted than with the previous shear adhesion alone.

How this works in practice was demonstrated in a breaking test at the Vienna University of Technology in 2016. A beech I-beam, 8 m long with a glass central web, was subjected to a 30-tonne load. Professor Winter sums up: “The arguments in favour of the new and highly resilient wood-glass composite system are compelling: it is more effective and thus more economical, it needs less material, and the building process can be made leaner. All that is needed is the efficient fluid padding.”
Research into the fluid padding is being carried out in parallel at the Bern University of Applied Sciences, which raises the prospect of numerous new developments for windows and facades.

BU: *Training and logistics building of Otto Chemie in Fridolfing, Germany*

Contacts for press and media
Stefanie Haug, Lena Vogl
T +49 9 11 86 06-83 23
F +49 9 11 86 06-12 83 23
lena.vogl@nuernbergmesse.de

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