

Project datasheet COST Action TU0905	
Research project :	Stiffness of glass/ionomer laminates in structural applications
Images :	
Keywords :	Laminated glass, SG, SGP, Long term stiffness, Torsion
Researchers involved :	<ul style="list-style-type: none"> - CALLEWAERT, Dieter (PhD researcher) - BELIS, Jan (supervisor) - VAN IMPE, Rudy (supervisor)
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Time span :	September 2006 – 2011
Description :	<p>To raise the transparency in constructions, laminated glass is increasingly used as a load bearing element. Although the main reason to combine brittle glass sheets with soft polymer layers is to enhance the post-breakage behaviour (see LMO Project sheet Post-breakage behaviour of laminated safety glass in structural applications), these interlayer materials have an important influence on the overall stiffness and strength of the unbroken element as well. Therefore, the mechanical behaviour of the interlayer must be known accurately to allow a safe and economic design. Consequently, the objectives of this project are to experimentally determine the visco-elastic material properties of the ionomer interlayer SentryGlas® and to ameliorate the knowledge on the mechanical behaviour of laminated glass in general.</p> <p>Considering the various loads structural glass elements are often subjected to, the test programme was composed with two pure and complementary loading conditions: three-point bending about the weak axis and torsion about the longitudinal axis. With a combination of these two cases, most realistic loading situations can be evaluated, such as the lateral torsional buckling of laminated beams, which is dominated by the bending stiffness about the weak axis and the torsional stiffness of the laminate.</p> <p>Because this ionomer interlayer behaves visco-elastic, the mechanical properties vary in function of realistic load duration temperatures. Therefore, each experiment was performed at different temperature levels between 5 °C and 65 °C and lasted no less than 24 hours. Although the shear modulus of the interlayer is always at least a factor 100 smaller than the shear modulus of glass, the experiments proved that the visco-elastic material properties of the ionomer interlayer material extremely influence the overall mechanical behaviour of the laminate. By increasing the temperature or the load duration, the stiffness of the interlayer decreases and the stiffness of the laminate reduces significantly.</p>

	<p>From these experiments, it became clear that generalizations between the material properties of the interlayer - determined by the temperature and the load duration - and the overall stiffness of the laminate are dependent on the span and the loading conditions. For example, a change of span has a significantly different effect on the bending stiffness than on the torsional stiffness of the laminate. Consequently, a direct calculation of the stiffness of a laminate for each particular case based on a mechanical material model of the interlayer seems much more reliable than the use of a simplified factor which “translates” a certain interlayer stiffness to a generally valid overall stiffness of the laminate.</p>
Most important publications :	<p>[list of most relevant publications; max. 5]</p> <ul style="list-style-type: none"> - CALLEWAERT, Dieter; BELIS, Jan; DELINCÉ, Didier; VAN IMPE, Rudy <i>Experimental stiffness characterisation of glass/ionomer laminates for structural applications</i> Constr Build Mater 37, 2012, 685-692. - CALLEWAERT, Dieter <i>Stiffness of Glass/Ionomer Laminates in Structural Applications</i> PhD thesis, Ghent University, Ghent: 2011. ISBN 978-90-8578-469-2. - CALLEWAERT, Dieter; DELINCÉ, Didier; BELIS, Jan; VAN IMPE, Rudy Stiffness of Laminated glass: influence of different loading conditions Proceedings of Glass performance Days 2009, Tampere, Finland. - CALLEWAERT, Dieter; DEPAEPE, Jonathan; DE VOGEL, Kenneth; BELIS, Jan; DELINCÉ, Didier; VAN IMPE, Rudy Influence of Temperature and Load Duration of Glass/Ionomer Laminates – Torsion and Bending Stiffness Proceedings of International Symposium on the application of Architectural Glass 2008, Munich, Germany. - CALLEWAERT, Dieter; DELINCÉ, Didier; BELIS, Jan; VAN IMPE, Rudy Temperature-dependent behaviour of glass/ionomer laminates: preliminary test results Proceedings of Challenging Glass 2008, Delft, the Netherlands.
Working group :	WG 2. Material characterization and material improvement
Task Group :	TG6. Interlayer properties
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