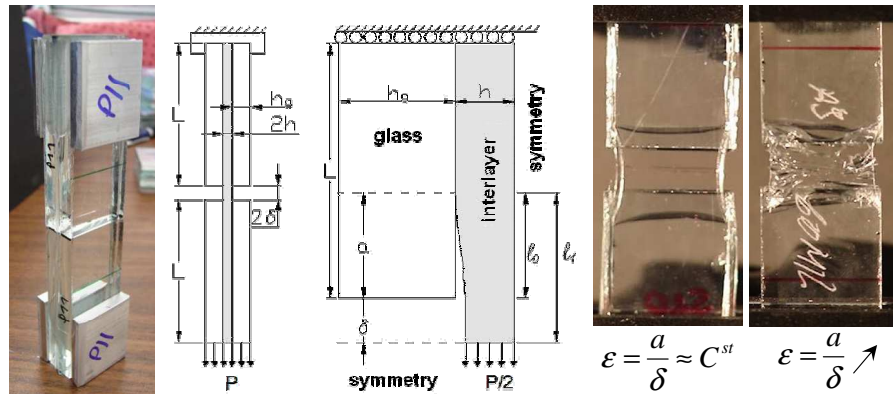


UGent LMO Project sheet

Research project : Post-breakage behaviour of laminated safety glass in structural applications

Image :



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2007 – ongoing

Description :

Laminated safety glass becomes more and more popular in structural applications, in particular regarding the important requirements on post-breakage performances, thanks to the ability of its interlayer to hold the broken glass pieces bonded together in case of breakage of the constitutive glass sheets. Although laminated safety glass is known for several decades, there is still a shortage in design rules, calculation models and corresponding characterization methods of the product properties. Consequently, in many cases extra tests are required to assess the performances for particular projects. Also, existing interlayer products made of traditional polyvinyl butyral (PVB) evolved and new ones appeared more recently, generally being stiffer. There are still many open questions related to 1) the selection of the optimal interlayer material in function of the design configuration and 2) the effective contribution of the interlayer material to the overall post-breakage performance, especially when the influence of temperature has to be considered.

This research aims at gaining a better understanding of those questions, in particular considering the SentryGlas® (SG) as interlayer material, a product known to be stiffer than conventional PVB. The more general goal is to contribute to the development of practical design methods and characterization methods of the material properties for laminated glass used in structural applications.

The experimental research focuses on the different mechanisms ruling the bridging behaviour of the interlayer near the crack opening. More specifically, the combination of the tearing of the interlayer and its delamination from the glass surfaces are investigated. To do so, the influence of random breakage pattern and crack propagation in the glass sheets, including the interaction

and crushing between the glass fragments, was avoided in the chosen testing configurations.

Preliminary tests have been conducted at different scales: i) simple uniaxial tensile tests on dog-bone SG-interlayer film samples according to ISO 572-3 (i.e. material scale); ii) Through-Crack Tensile (TCT) tests on different series of small samples of laminated glass with PVB and SG-interlayer, of which the two glass sheets were first cracked in the middle transversal section and subsequently subjected to a tensile force perpendicularly to it in the interlayer's plane (i.e. intermediate scale); iii) bending tests about the strong axis of laminated glass beams, which were pre-cracked in a similar way in their middle transversal section (i.e. element scale). Furthermore, the latter were realized inside a climatic chamber at different temperatures between 23 and 60°C.

Currently, the bridging behaviour is further experimentally investigated, in particular at different temperatures combined with measurements of the local deformation mechanisms around the crack. To do so, refined test and measurement methods are being developed. Subsequently, expected test results should support further investigation in modelling the post-breakage behaviour using more complex material and interfacial models in finite elements formulations.

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Most important publications :

- DELINCÉ, Didier; CALLEWAERT, Dieter; BELIS, Jan; VAN IMPE, Rudy
Influence of Temperature on Post-Breakage Behaviour of Laminated Glass Beams : Experimental Approach
Proceedings of Challenging Glass 2 2010, Delft, The Netherlands, 407-414
- BELIS Jan; DEPAUW, Jeffrey; CALLEWAERT, Dieter; DELINCÉ, Didier; VAN IMPE, Rudy
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Eng Fail Anal 2009: 16(6) 1866-1875
- DELINCÉ, Didier; SONCK, Delphine; BELIS, Jan; CALLEWAERT, Dieter; VAN IMPE, Rudy
Experimental investigation of the local bridging behaviour of the interlayer in broken laminated glass
Proceedings of the Third International Symposium on the Application of Architectural Glass 2008 (ISAAG), Munich, 41-49
- DELINCÉ, Didier; CALLEWAERT, Dieter; BELIS, Jan; VAN IMPE, Rudy
Post-breakage behaviour of laminated glass in structural applications
Proceedings of Challenging Glass 2008, Delft, The Netherlands.

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