Structural adhesive SikaForce 7710 L100

Experimental characterization

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Abstract text

Structural adhesives are an essential element in the majority of the structural glass constructions. Present design guidance for structural glass is not yet completed established, and does not cover complex systems, often required for large structures or elaborated details. For these cases, the design must be established from numerical modelling calibrated with results from full scale testing.

The preparation of effective numerical models requires the accurate knowledge of the geometry and mechanical properties of all the materials involved. This is particularly critic in structures encompassing flexile materials, namely adhesives, in the sense it affects global deformability, the distribution of internal forces, and ultimately the resistance.

Adhesive materials are rubbery polymers with complex behaviour affected by a number of factors like load duration and environmental factors, and feature mainly hyperelastic behaviour. For these reasons, the full characterization of the structural behaviour of adhesives is complex. In terms of experimental assessment, a significative number of tests is needed, opposite to what happens with standard non-flexible materials.

The aim of the present work is to present the experimental characterization of the structural adhesive SikaForce 7710 L100, and the subsequent establishment of calibration parameters needed for fitting to hyperelastic models in the FE code Abaqus.

The experimental tests were performed at the Civil Engineering and Mechanical Engineering departments of the University of Coimbra, Portugal (2017). The tests included uniaxial

tension, plane tension and plane shear (Fig. 1 to 3). An optical data aquision system was used to ensure the necessary accuracy (Fig 4).

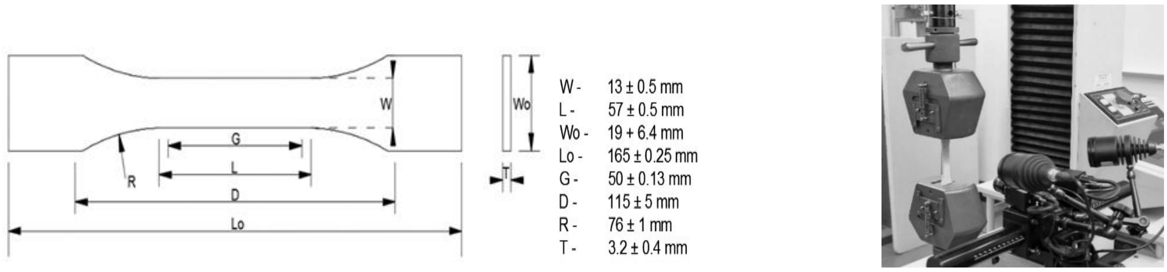

Fig. 1 Specimens for the uniaxial tension tests (schematics and test layout)

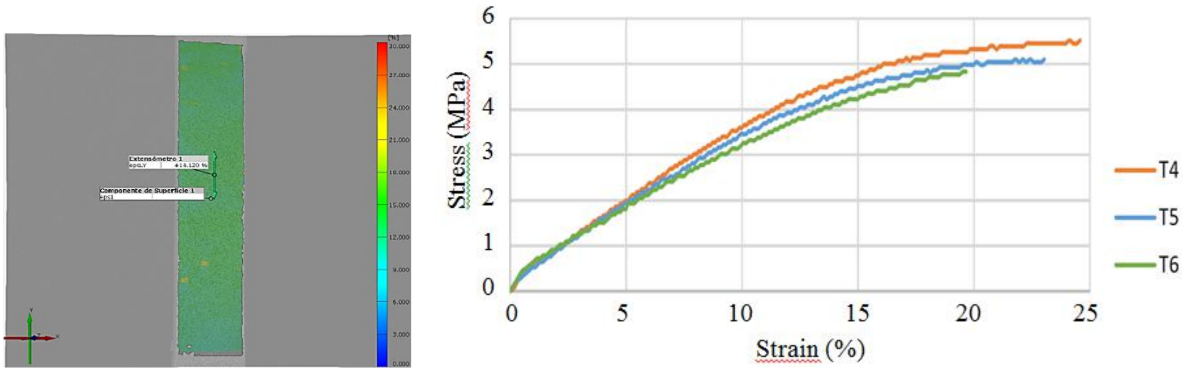

Fig. 2 Results for the uniaxial tension tests (strain from Aramis and σ *vs* ε curves)

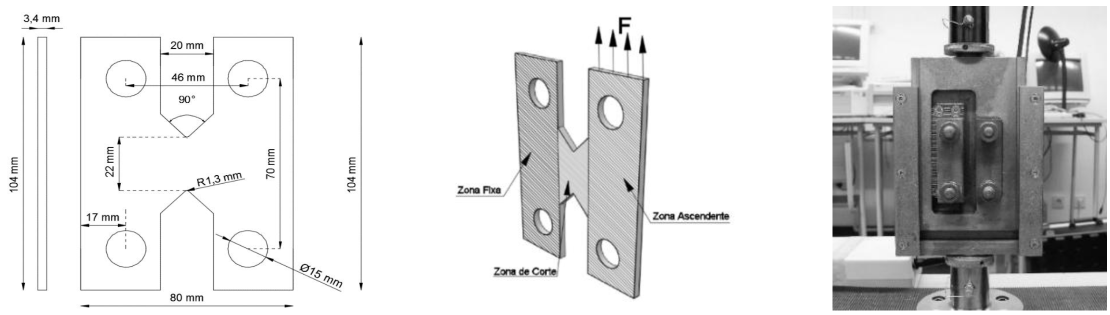

Fig. 3 Specimens for the plane shear tests (schematics and test layout)

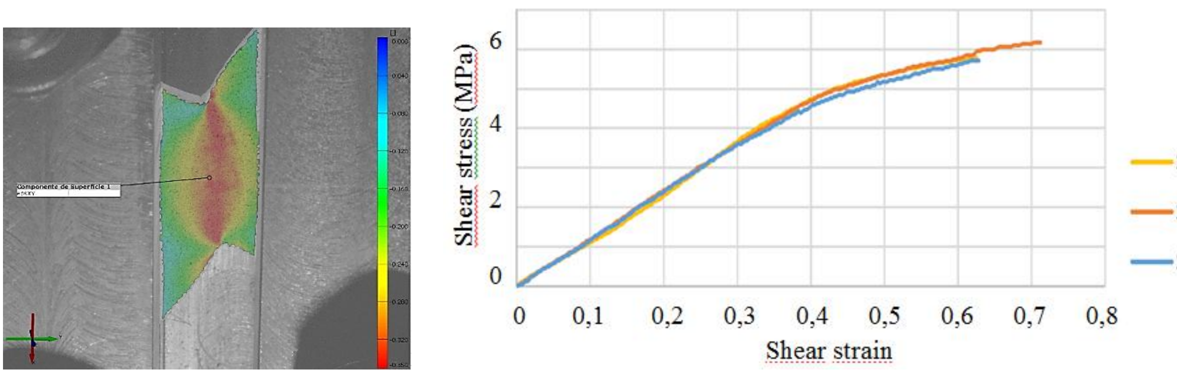

Fig. 4 Results for the plane shear tests (strain from Aramis and σ *vs* ε curves

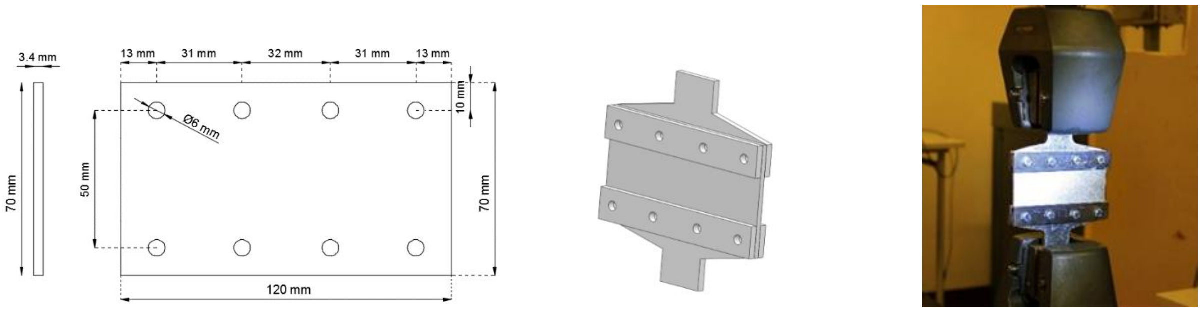

Fig. 5 Specimens for the plane tension tests (schematics and test layout)

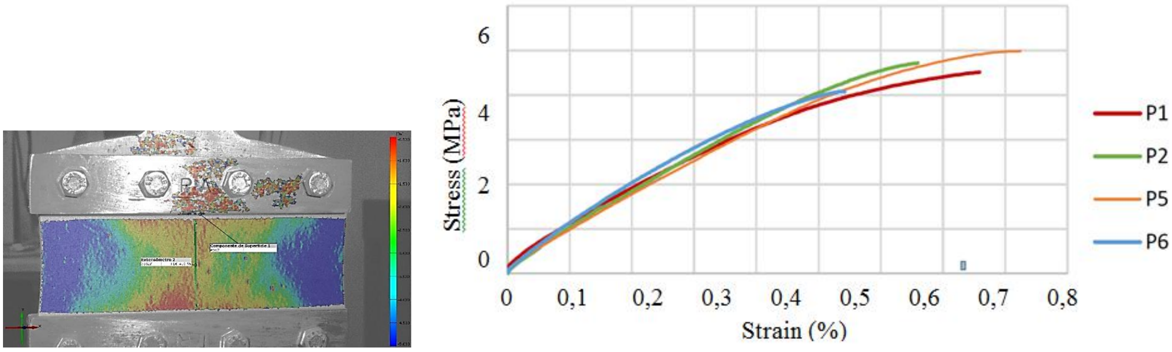

Fig. 6 Results for the plane tension tests (strain from Aramis and σ *vs* ε curves)

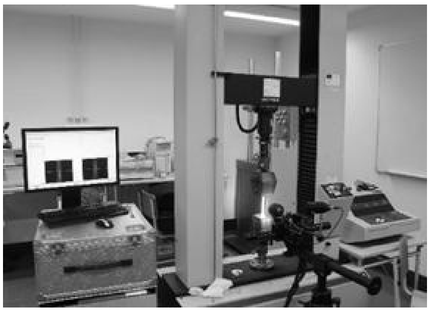

Fig. 7 Test apparatus and optical system *GOM Aramis 3D.*

The results for each test are quite uniform, with little scatter, thus providing the rehologic data needed for describing the hyperelastic behaviour of the adhesive for numerical analysis.

Keywords

Structural adhesive, hyperelastic material, rheological characterization, experimental tests, FEM calibration/fitting parameters

Event Theme (please chose one of the following)

1 – New Functionalities

References

Leitão, C., Galvão, I., Leal, R. M., & Rodrigues, D. M. (2012). “Determination of local constitutive properties of aluminium friction stir welds using digital image correlation.” *Materials & Design, 33*, 69-74.

ASTM (2000). “Standard Test Method for Tensile Properties of Plastics”. D 638 -99, American Society for Testing and Materials, USA.

ASTM (2005). “Standard Test Method for Shear Properties of Composite Materials by V-Notched Rail Shear Method”. D 7078/D 7078M – 05, American Society for Testing and Materials, USA.

Leitão, C., Costa, M., I., Rodrigues, D., M. (2014). “Assessment of mechanical shear response using digital correlation”. *Revista da Associação Portuguesa de Análise Experimental de Tensões, Vol. 23*, 31-39.

Rodrigues A. (2017). “Caracterização do comportamento do adesivo estrutural SikaForce 7710 L100” Dissertação de Mestrado, Departamento de Engenharia Civil, DEC-FCTUC, Univ de Coimbra, Coimbra.

Firmo, F. (2015). “Análise experimental/FEM de vigas híbridas vidro-aço”. Dissertação de Mestrado, Departamento de Engenharia Civil, DEC-FCTUC, Universidade de Coimbra, Coimbra.

Silva, V. D. (2004). “Mecânica e Resistência dos Materiais”. Zuari, Coimbra.

Sasso, M. Palmieri, G., Chiappini, G., Amodio, D. (2008). “Characterization of hyperelastic rubber like materials by biaxial and uniaxial stretching tests based on optical methods” *Polymer testing, Vol. 27*, 995-1004.