Poster 29 – AB25_72

AB 2025

8th international Conference on Adhesive Bonding 2025

Creep behavior of two-component silicone adhesives

V Ginster[1], R Brand[2], S Bögershausen[3], A Schiebahn[1], B Abeln[2], T Brepols[3], M Feldmann[2], U Reisgen[1]

[1] RWTH Aachen University, Welding and Joining Institute, Pontstraße 49, 52062 Aachen, Germany

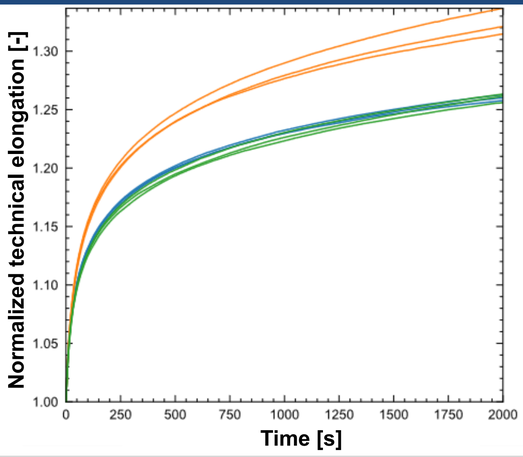
[2] RWTH Aachen University, Institute of Steel Construction, Mies-van-der-Rohe-Str. 1, 52074 Aachen, Germany

[3] RWTH Aachen University, Institute of Applied Mechanics, Mies-van-der-Rohe-Str. 1, 52074 Aachen, Germany

Introduction

- Structural sealant glazing is a method for load-bearing bonding of facade elements.
- Hyperelastic 2k silicone adhesives are used for this purpose.
- However, the time- and temperature-dependent behavior of materials has not yet been fully described.

- As a result, there are currently no recognized technical rules for the construction of glass facades.
- A consistent methodology for evaluating silicone adhesive bonds is necessary.

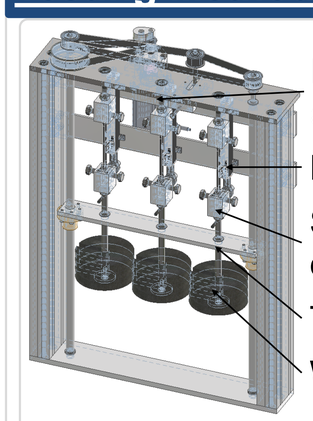


In comparison, various 2K silicones exhibit comparable creep behavior in tension in terms of quality, but with different degrees of rigidity.

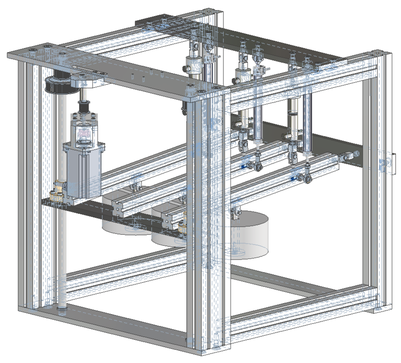
Challenges

- The behavior of silicone adhesives depends heavily on the elongation rate.
- The periods considered for material characterization must be representative of the service life of a building.
- The characteristic material softening (Mullins effect) must also be taken into account in long-term creep and relaxation tests.

Testing Methodes for hyperelastic Adhesives



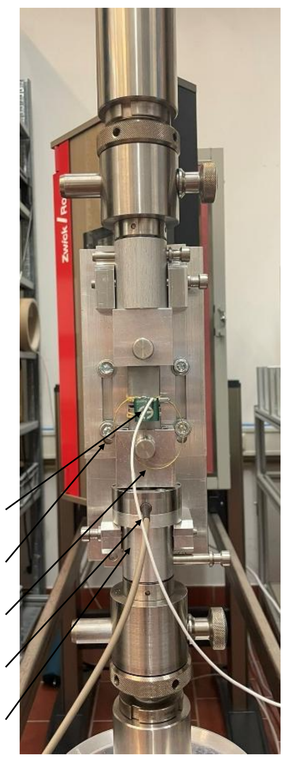
In contrast to H-specimens, thick adherent shear tests, and butt joint specimens, uniaxial tensile specimens demonstrate significantly greater deformation at lower forces. This necessitates the development of two distinct test rigs: one with lever arms and one without.



- With the help of the drive, the weight can be distributed in a controlled manner.
- Recording of the test elongation using the position sensor with an accuracy of 0.01 mm

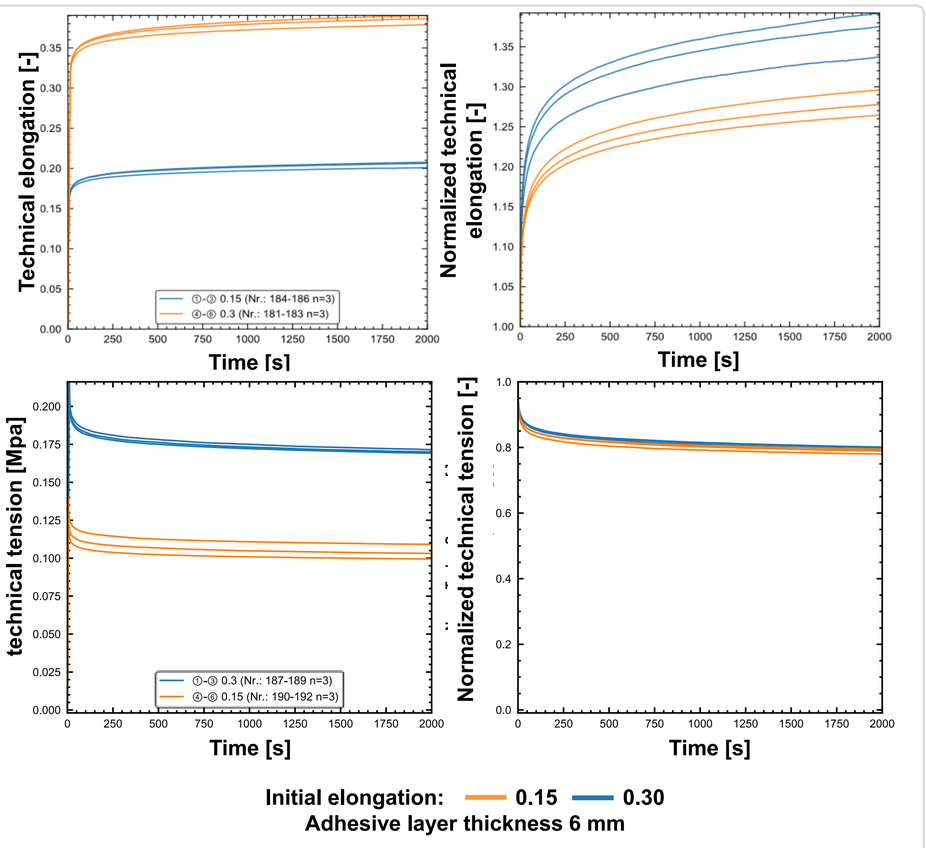
Devices for creep tests

- The load can be applied in a controlled manner using the tensile testing machine
- The target elongation is regulated using the extensometer
- Once the device has been clamped in place, it can be removed from the testing machine

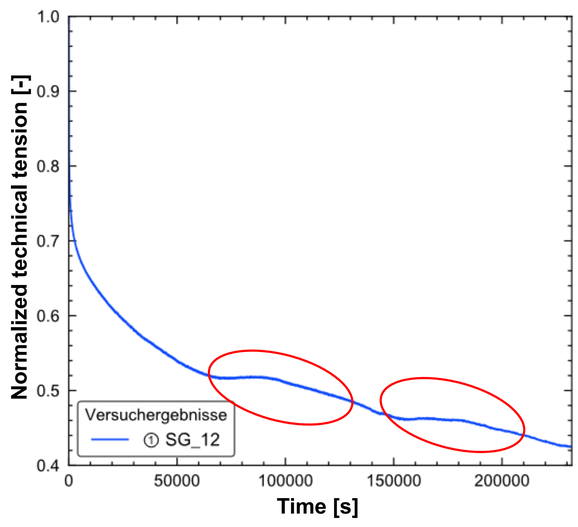


Test device for relaxation tests

Results



H-specimens according to ETAG 002 under shear



- The relaxation behavior is overlaid by thermal expansion.
- However, it can be seen that no secondary creep has occurred within 3 days.

Tensile test under relaxation

Outlook

- Testing of various sample geometries (H specimens, thick adherent shear tests, butt joint specimens, and uniaxial tensile specimens) over a period of two years under creep and relaxation loading at two stress levels.
- Conducting tests at elevated temperatures over a period of two months to determine the influence of temperature on material behavior.
- Addition of the influence of temperature and long-term loading to an existing simulation model that takes into account multi-axial stress states, characteristic material softening (Mullins effect), reduction in stiffness due to the formation of cavities, and crack failure.

Contact:
Vinzenz Ginster, M. Sc.

Tel.: +49 241 80 94974
Email: ginster@isf.rwth-aachen.de

Supported by:
Bundesministerium für Wirtschaft und Energie
on the basis of a decision by the German Bundestag

RWTH Aachen University
Welding and Joining Institute
Univ.-Prof. Dr.-Ing. Uwe Reisgen
Pontstraße 49, 52062 Aachen, Germany
www.isf.rwth-aachen.de