

Topic of joint research:

On the interfacial adhesion and post-fracture behavior of laminated safety glass

Introduction:

The joint research has been carried out by the *Institute of Structural Mechanics and Design (ISMD)*, TU-Darmstadt and the *Research Group for Multi-Storey and Tall Steel Buildings and Fire-Resistance of Steel Structures*, Tongji University since 2018. The main participants are Prof. Jens Schneider, Dr. Philipp L. Rosendahl and Ms. Miriam Schuster (Ph.D. candidate) from TU-Darmstadt, and Prof. Suwen Chen, Dr. Xing Chen and Ms. Zhifei Chen (Ph.D. candidate) from Tongji University. For a better academic cooperation, Dr. Xing Chen has been working at TU-Darmstadt for post-doctoral exchanging since 2019, financially supported by the Sino-German (CSC-DAAD) Postdoc Scholarship project and the Career Bridging Grant of TU-Darmstadt.

The joint research mainly focuses on quantification of the interfacial adhesion as well as the post-fracture performance of laminated safety glass. So far, the following progress has been,

- ***Standardized implementation and evaluation of pummel test.*** A software-based texture analysis method was developed using MATLAB to quantitatively characterize the fracture pattern and texture feature of digital images, and to evaluate pummel values of laminated glass. The method was validated against a series of pummel tests and visual evaluations. Good agreement can be observed if the glass surfaces are adequately pulverized.
- ***Identification of fracture properties of laminated glass.*** The adhesion parameters at interlayer-glass interface were calibrated in a numerical cohesive zone approach within an implicit finite element framework of ANSYS. The conversion of energy during the delamination process and the mixed-mode delamination mechanism were investigated
- ***Delamination behavior of laminated glass.*** A series of through-cracked tensile (TCT) tests were performed to study the delamination performance of laminated glass. Different interlayer types (PVB and SGP), moisture conditions and loading rates were considered.

Based on the research results, two joint papers concerning the software-based evaluation of pummel test and the identification of fracture properties of laminated glass have been finalized and submitted (under review), and one paper concerning the delamination behavior of laminated glass under quasi-static loading is to be completed. Besides, two joint papers, which are concerned with the moisture effect and strain rate effect on the delamination performance of laminated glass, are planned.

Newspaper-style

The joint academical activities between the *Institute of Structural Mechanics and Design (ISMD), TU-Darmstadt* and the *Research Group for Multi-Storey and Tall Steel Buildings and Fire-Resistance of Steel Structures, Tongji University* were started by Prof. Jens Schneider and Prof. Suwen Chen in 2018. Regular academical exchanges have been conducted, e.g., the 1st and 2nd TU-Darmstadt – Tongji Symposium on structural engineering held at Tongji in 09/2018 and at TU-Darmstadt in 08/2019, respectively, as well as the upcoming virtual Tongji Darmstadt Glass + Facade Seminar in 06/2019. These events established a platform for learning about research progresses and idea exchanges between the groups. Besides, Dr. Xing Chen has been working at TU-Darmstadt for post-doctoral joint research since 2019, financially supported by the Sino-German (CSC-DAAD) Postdoc Scholarship project and the Career Bridging Grant of TU-Darmstadt. His joint research focuses on the quantification of the interfacial adhesion as well as the post-fracture performance of laminated safety glass. Dr. Philipp L. Rosendahl and Ms. Miriam Schuster (Ph.D. candidate) from TU-Darmstadt, and Ms. Zhifei Chen (Ph.D. candidate) from Tongji University are involved. Based on the research results, two joint papers concerning the software-based evaluation of pummel test and the identification of fracture properties of laminated glass have been finalized.