# Load Transfer Materials for Hybrid Glass-Steel Façade Elements

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## Summary

In the rising research field dealing with facades glass and the different products made of this material take an important place. Beside developments regarding energy efficiency and building physics the structural use of glass is another main research topic in this field. Up to the present moment glass panes are used in transparent facades only as infilling elements.

This paper presents in a first part suitable load transfer mechanisms for transferring in-plane and out-of-plane loads between the metal frame and the glass pane of hybrid facade elements. In a second part experimental investigations on selected suitable materials for these mechanisms are described and their results are discussed. Short-term and long-term uniaxial compressive tests on a resin-based mortar to be used as setting blocks in the façade elements as well as uniaxial tensile tests on two structural adhesives are presented. Finally the experimental results are compared to potential material models and an outlook of next research steps is provided.

**Keywords:** hybrid glass-steel structure, transparent façade, linear adhesive bonding, setting block, silicone, acrylate, resin-based mortar, experimental material test, material model.

## 1. Introduction

Increasing requirements regarding the energy consumption of buildings leads to a rising research interest in the field of facades. Beside the objective to save energy during the life-time of a building by using highly advanced building services, a reduction of the material consumption by using the properties of the façade materials at their maximum is aimed.

Considering especially office and public buildings a tendency for highly glazed facades is still current. For achieving the demanded transparency glass is an indispensable material, but from a load-bearing point of view a high unused potential of the material glass in facades exists. The load-bearing structure of highly glazed facades consists usually of a frame structure made of steel or aluminium, while the glass panes are only infilling elements.

The high compressive strength of glass (~ *900 N/mm*$^2$) is an argument to use this material in a structural way. Although, its brittle failure under tension due to flaws at the surface or at the edge and the poor existing design codes compared to other materials are the main reasons why only few projects with structurally used glass exists.

One of the applied lightweight principles used in the car and the plane industries is the activation of the high in-plane load-bearing capacity of the skin. The use of the in-plane load bearing capacity of the glass panes in a highly transparent façade would be a similar development. The main aspect to analyse for this step is a suitable load transfer mechanism between the metal frame and the glass pane with proper materials which prevent a glass failure due to stress peaks at the glass edge or glass surface.

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