

Compressive behavior of vacuum insulation panels according EN 826

Christoph Sprengard, Gerald Coy,
Susanne Regauer – FIW München

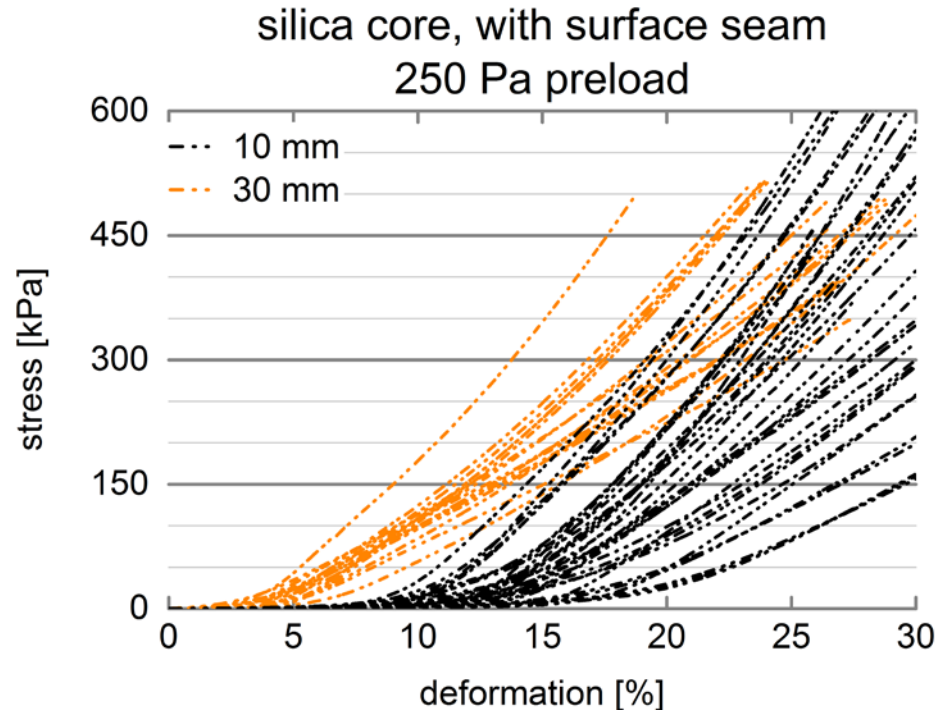


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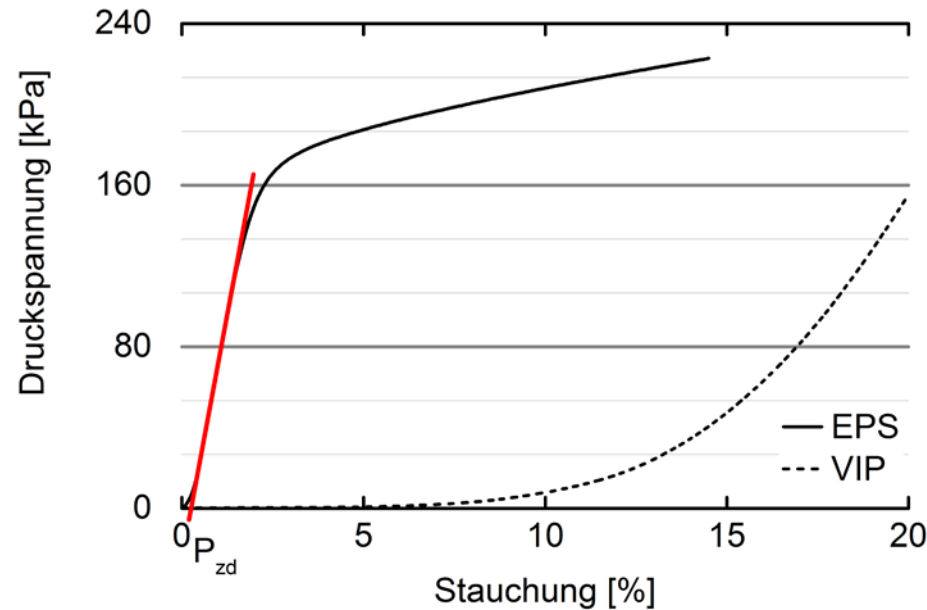
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Problem definition



- Number and design of surface seams
- Warping of the panels
- Panel thickness
- Different introduction of the force caused by warping and seam design
- Inhomogeneous product
 - Core (Fiber/Silica)
 - Foil
 - Fleece

Problem definition



- Analysis of a nonlinear compressive behavior acc. EN 826: Zero-deformation point as the deformation corresponding to a stress of 250 Pa

➔ New testing method for vacuum panels necessary

Requirements on the new testing method



- Reproducible test result, not depending on testing apparatus, laboratory, examiner and specimen design
- Comparable
- Easy feasible testing procedure
- Normative easy implementable (e.g. product standard)

Approaches

Specimen Design

- Specimen dimension
- Without surface seam

Testing Procedure

- Preload
- Testing area smaller than panel size
- Suitable coating of specimen

Approaches

Specimen Design

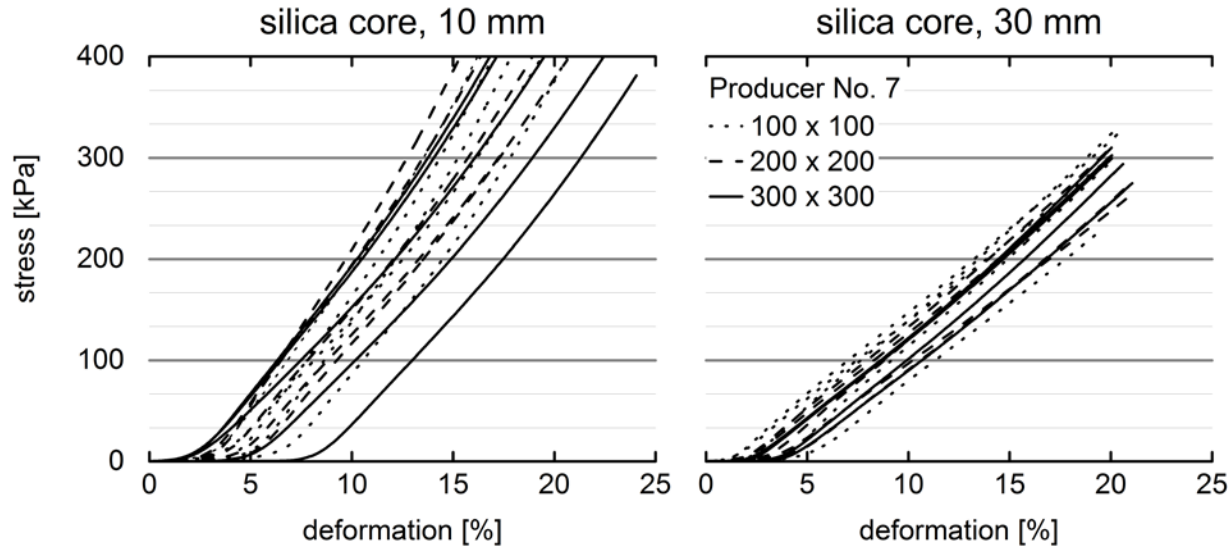
- **Specimen dimension**
- Without surface seam

Testing Procedure

- Preload
- Testing area smaller than panel size
- Suitable coating of specimen

Approaches

Specimen dimensions



Analysis: ■ by manufacturer

■ by dimension

Result: ■ No mathematical correlation

■ 300 mm x 300 mm not feasible

Approaches

Specimen Design

- Specimen dimension
- **Without surface seam**

Testing Procedure

- Preload
- Testing area smaller than panel size
- Suitable coating of specimen

Approaches

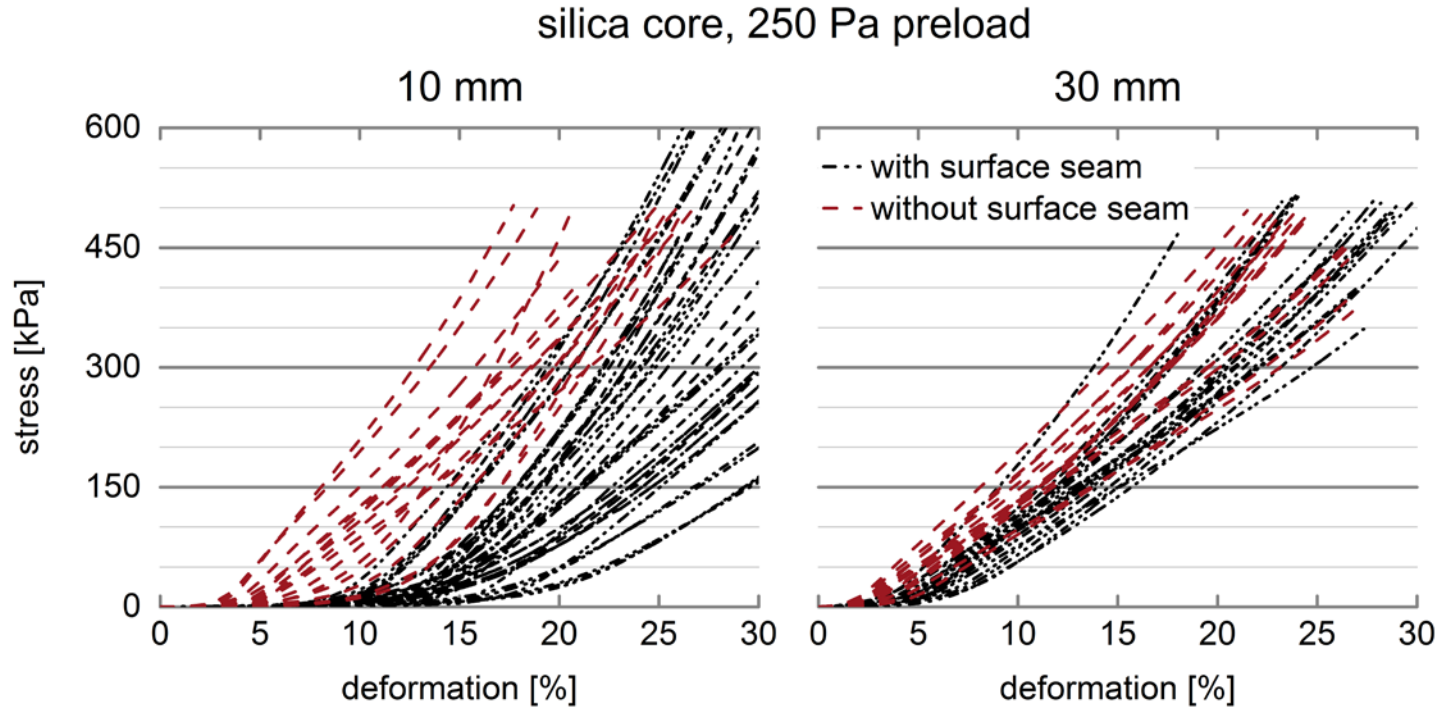
Surface seam

- Influencing factors
 - Protrusion of foil
 - Number of surface seams
 - Stiffness of foil

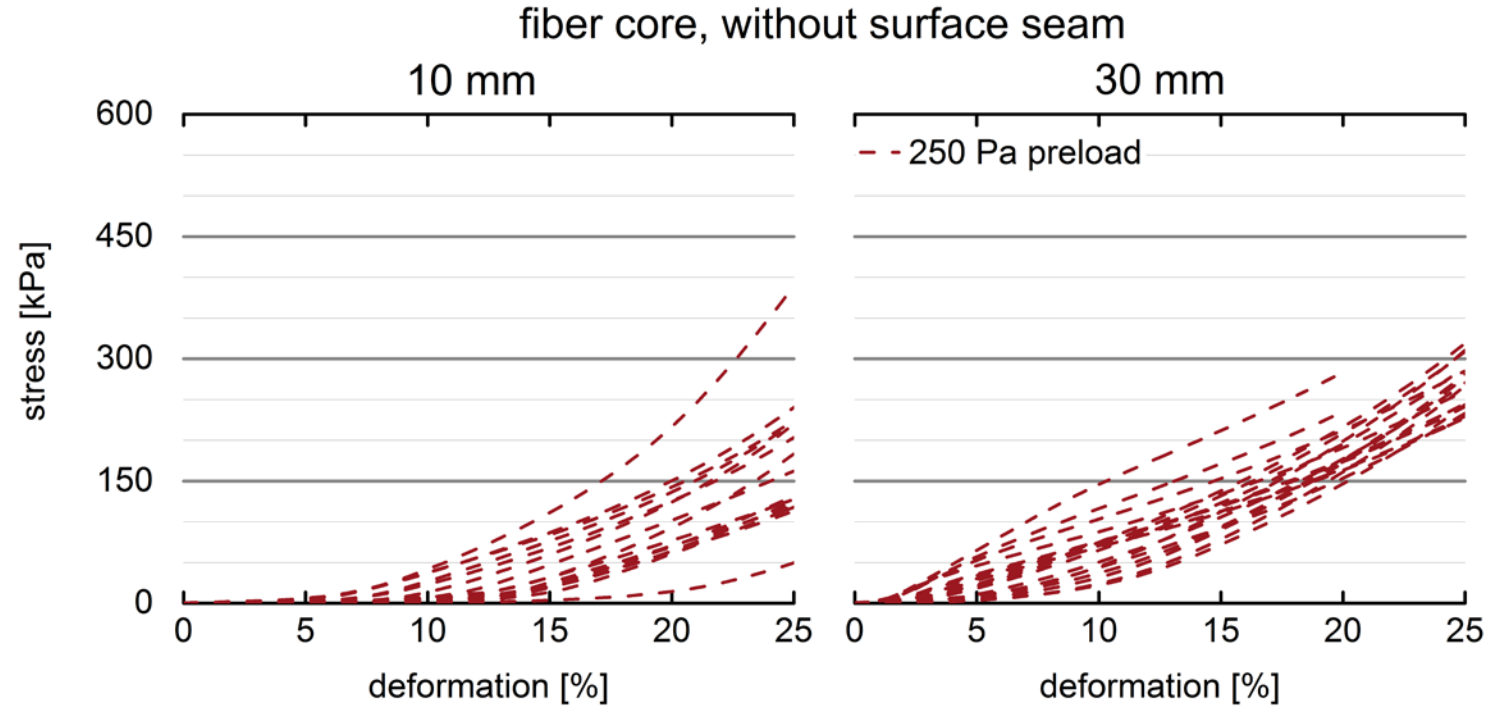


Foto: FIW München

Approaches



Approaches



Approaches

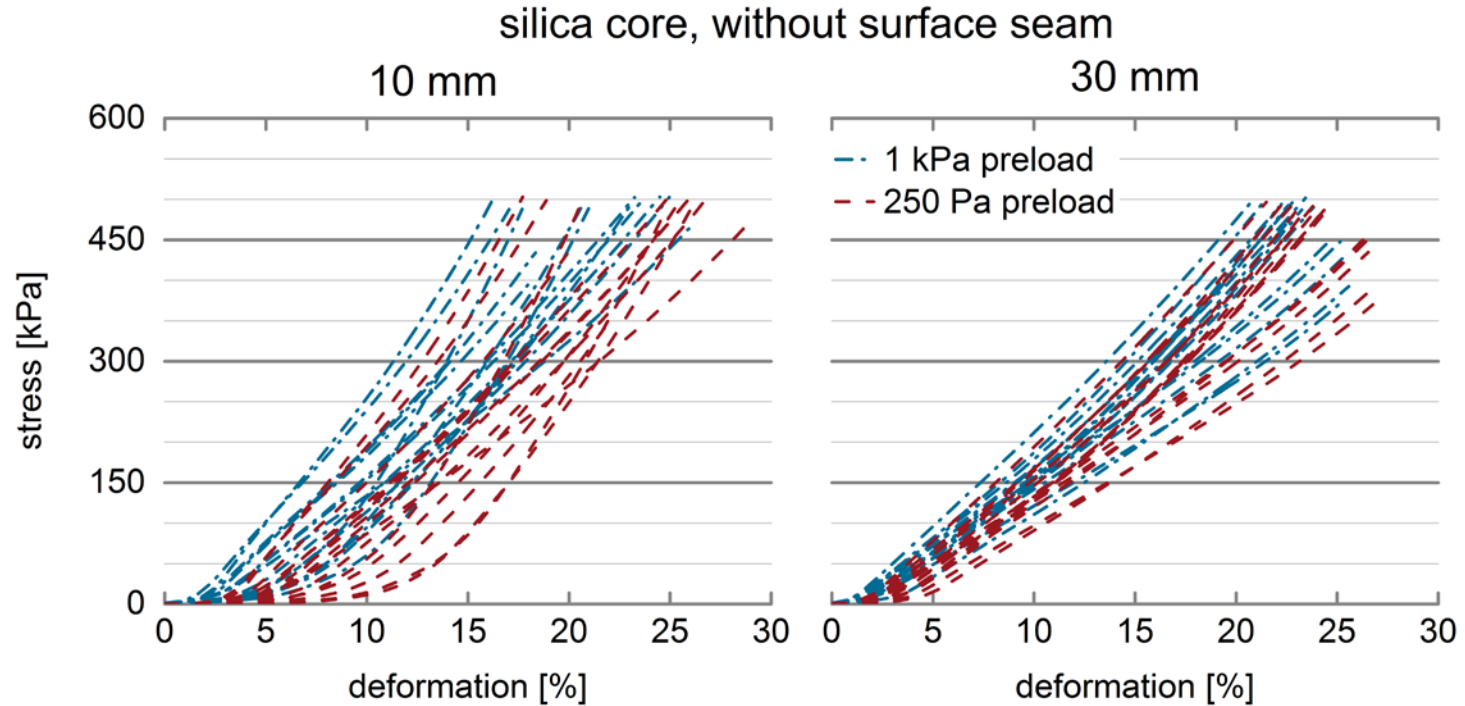
Specimen Design

- Specimen dimension
- Without surface seam

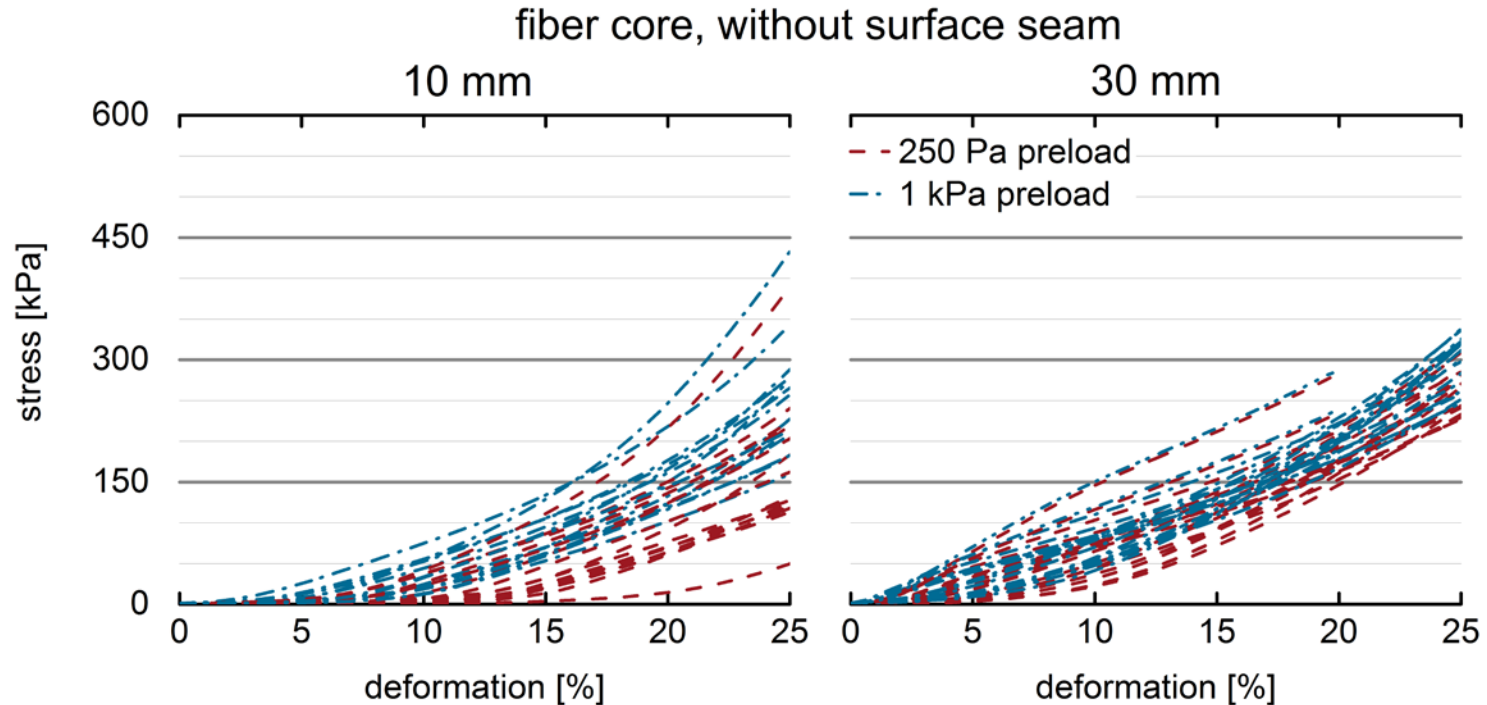
Testing Procedure

- **Preload**
- Testing area smaller than panel size
- Suitable coating of specimen

Approaches



Approaches



Approaches

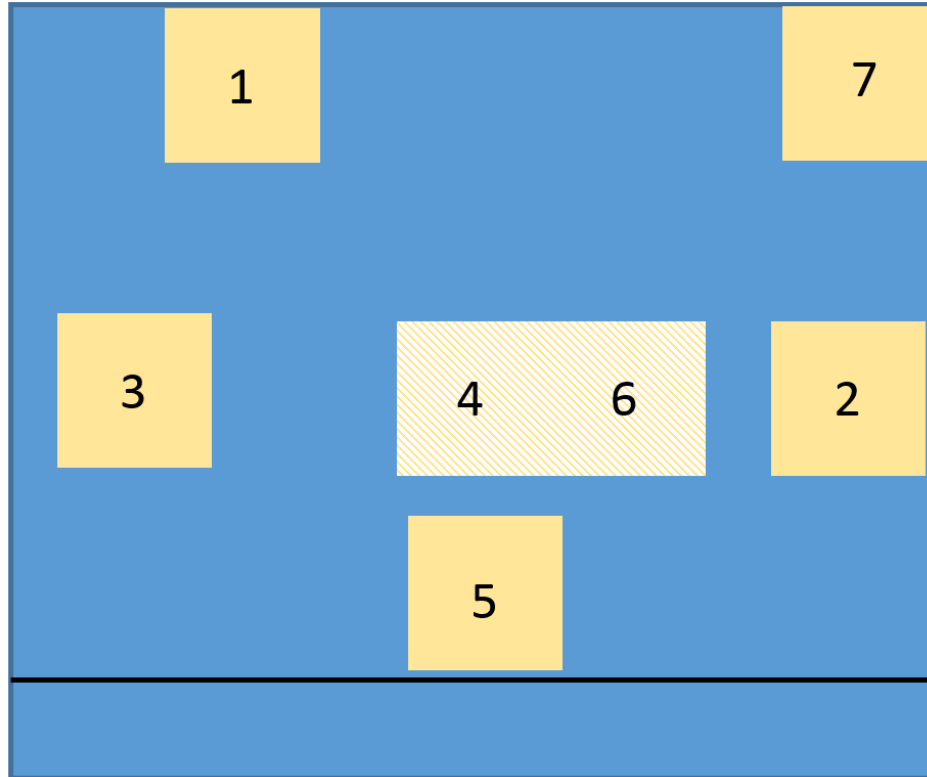
Specimen Design

- Specimen dimension
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Testing Procedure

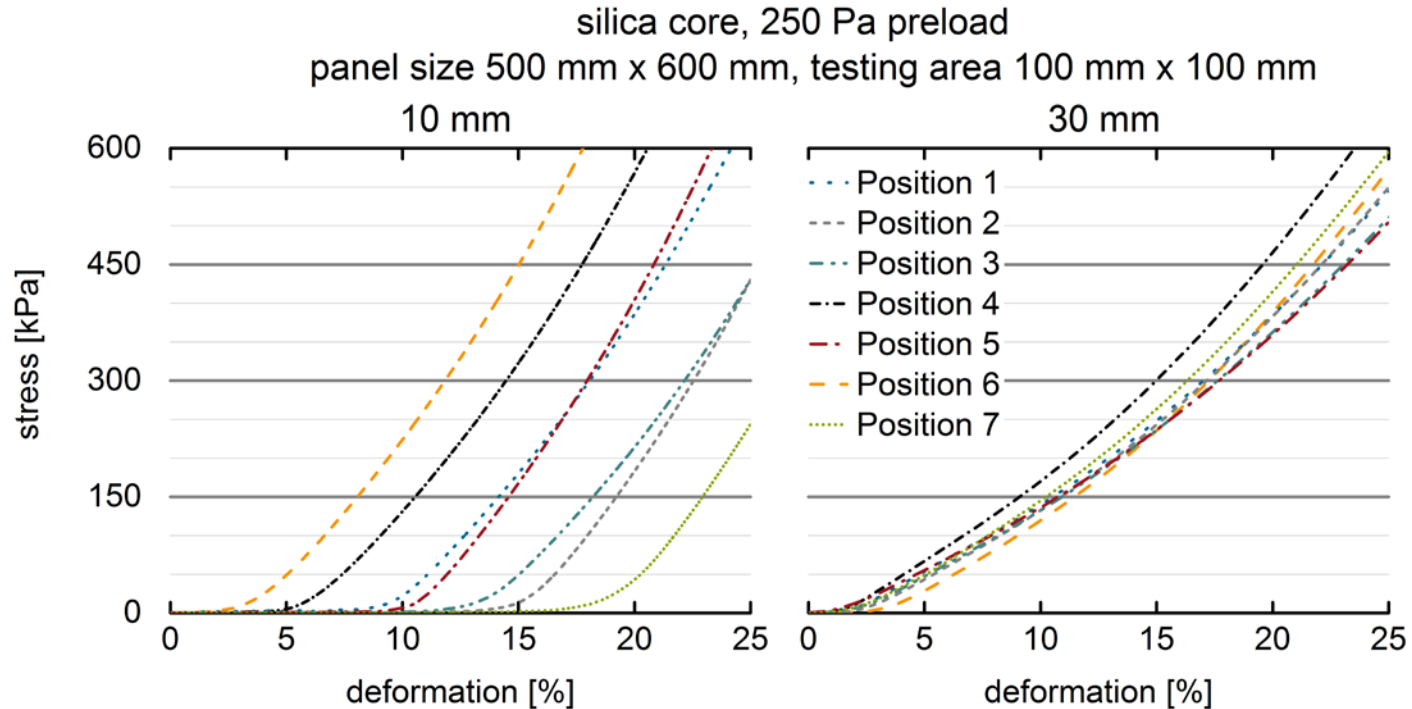
- Preload
- **Testing area smaller than panel size**
- Suitable coating of specimen

Approaches



- Distance to the seams
- Density distribution in the panel
- Number of fleece layers
- Distance in between metering areas
- Distance to the edge

Approaches



Approaches

Specimen Design

- Specimen dimension
- Without surface seam

Testing Procedure

- Preload
- Testing area smaller than panel size
- **Suitable coating of specimen**

Suitable coating of specimen

- Coating requirements
 - Workability (expenditur of time, harmless, waste)
 - Availability
 - Price
 - Low viscosity (to eliminate slightest unevenness)
 - Incompressible (otherwise superimposition with the stress-deformation curve)
- Already mentioned in a harmonized standard

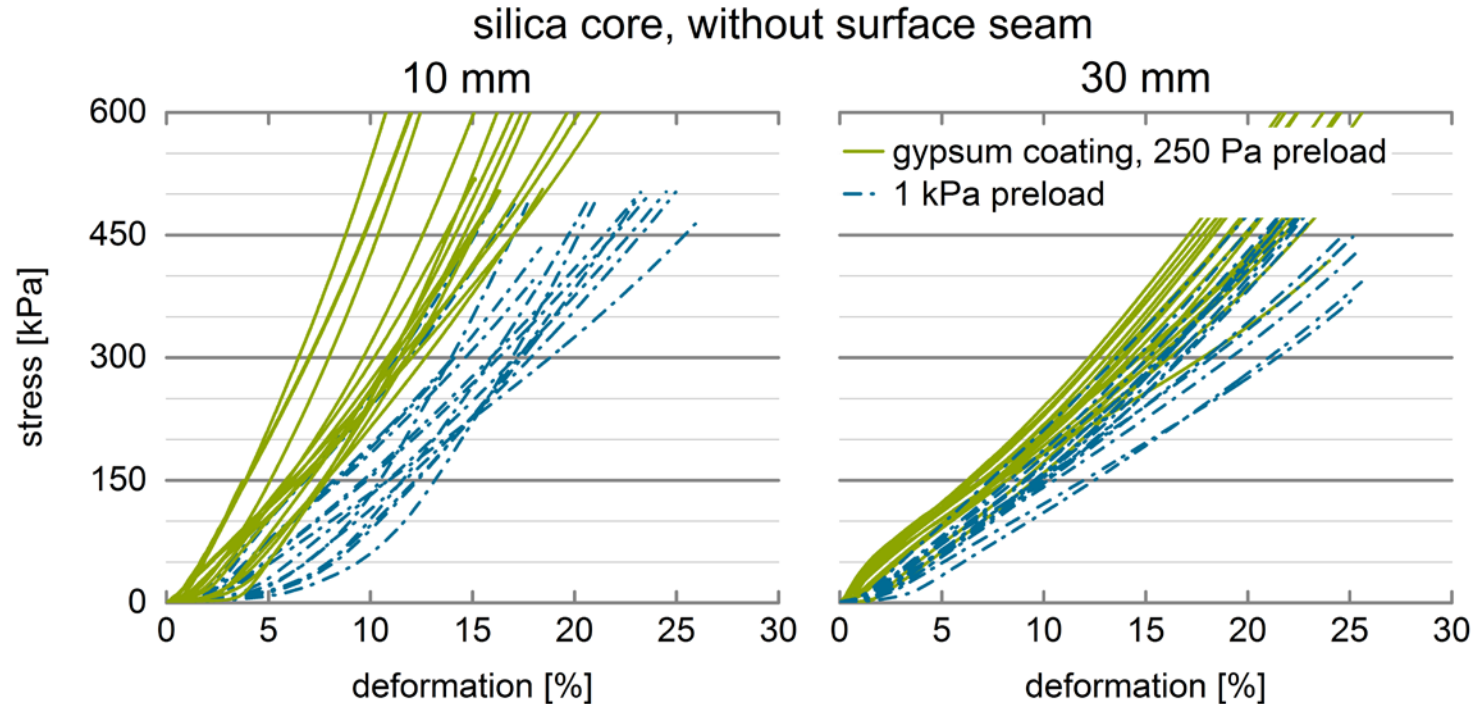
Approaches

Suitable coating of specimen

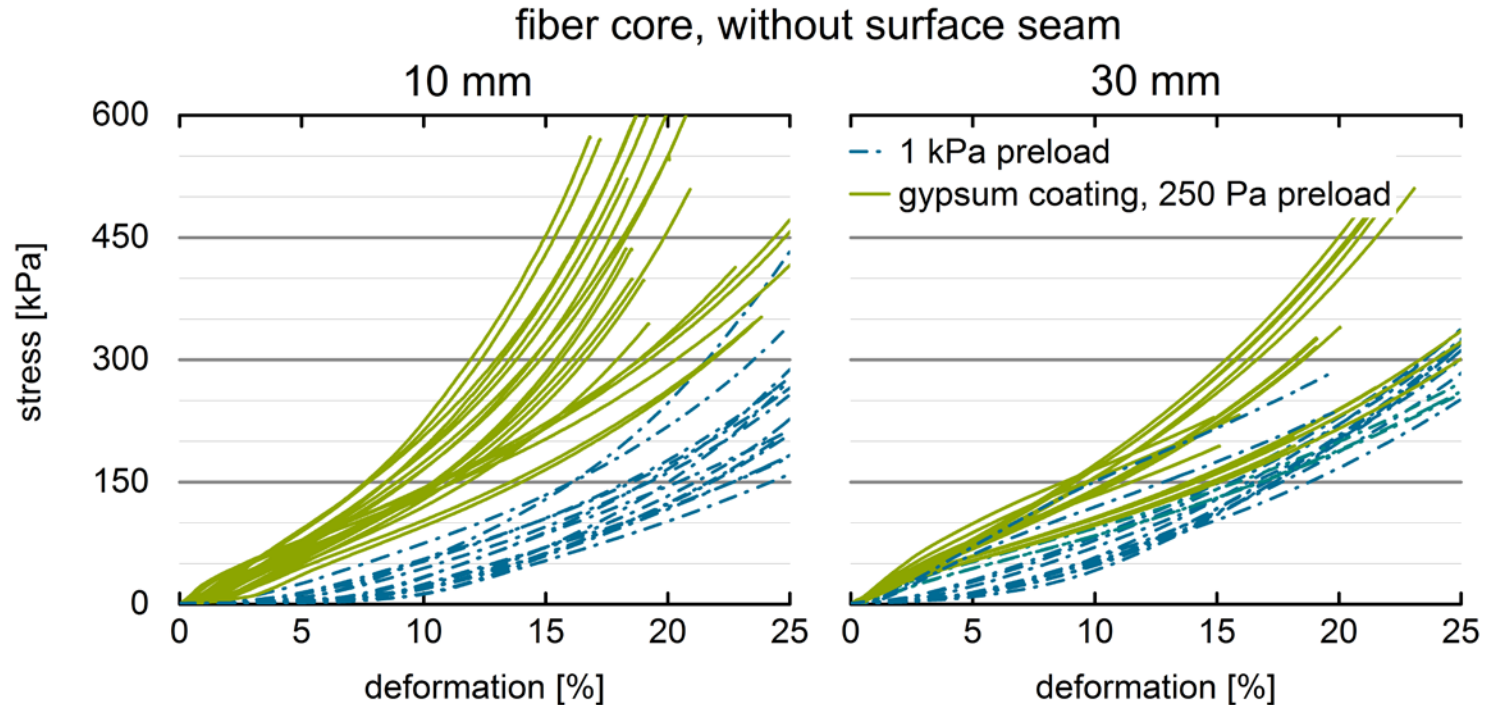
- Decision on gypsum – Fulfills all requirements



Approaches



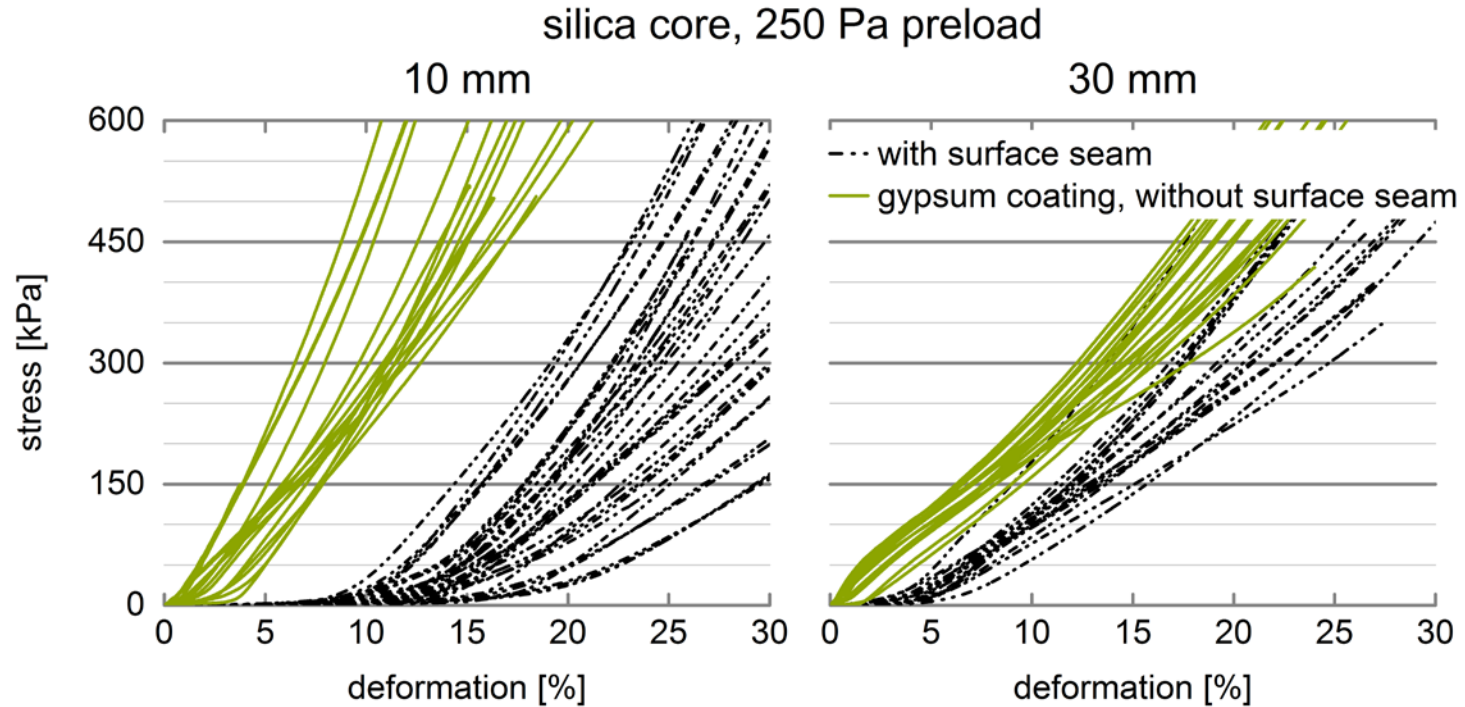
Approaches



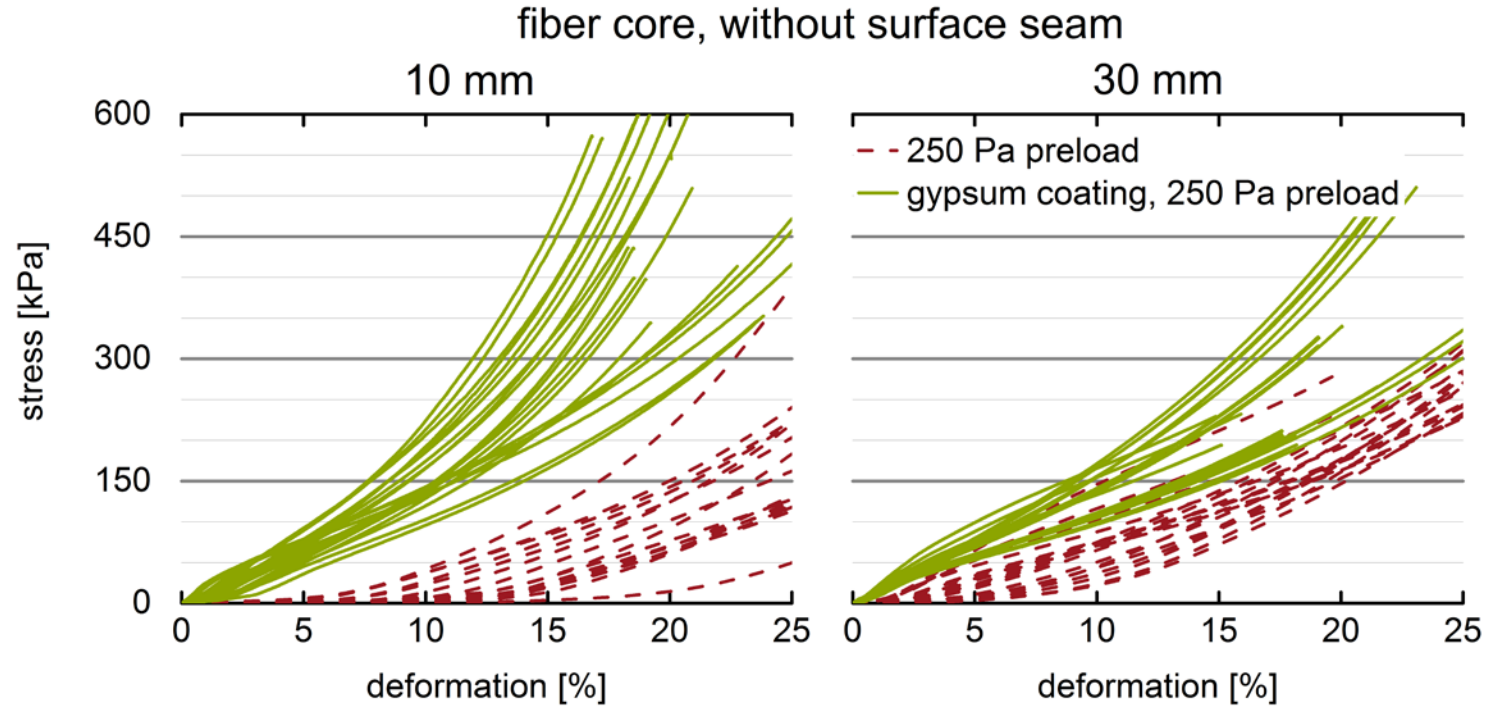
Conclusion - testing methods

- Specimen: ideal 100 mm x 100 mm, 200 mm x 200 mm
- Surface seam: Should be avoided, with gypsum coating irrelevant
- Preload: 1 kPa or 250 Pa possible as well
- Coating: Gypsum

Conclusion - testing methods



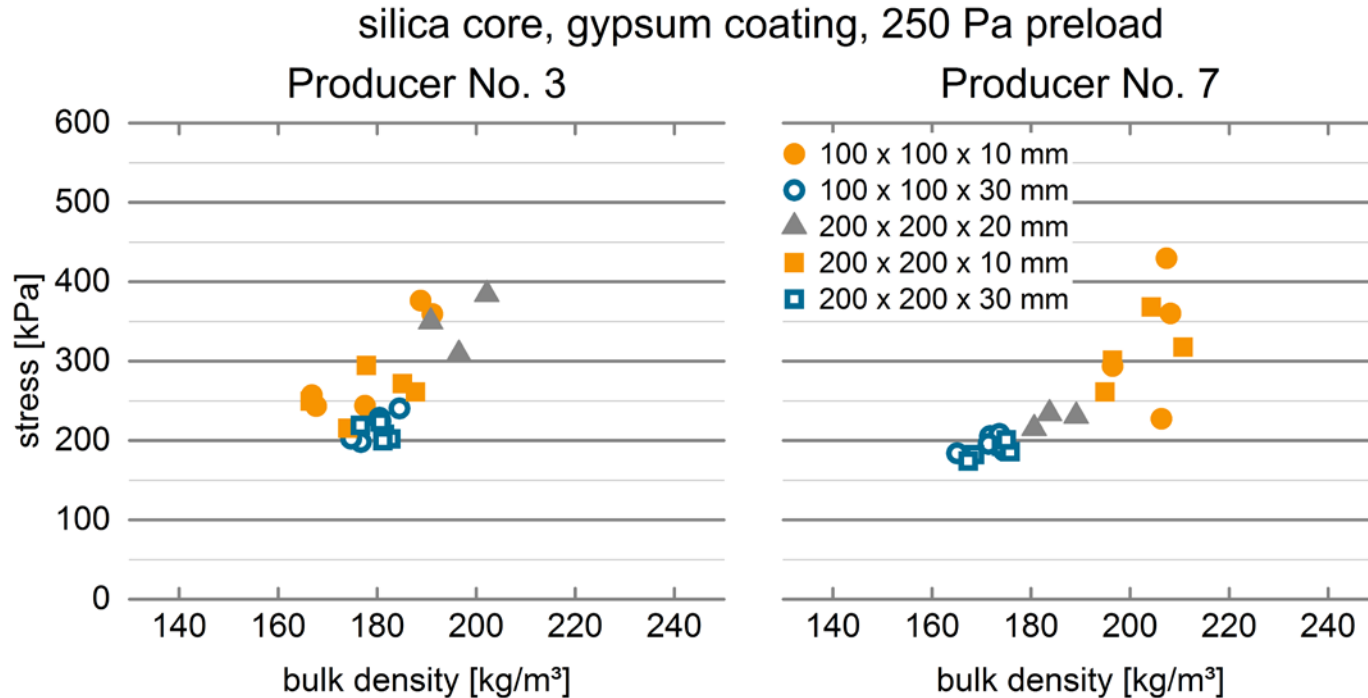
Conclusion - testing methods



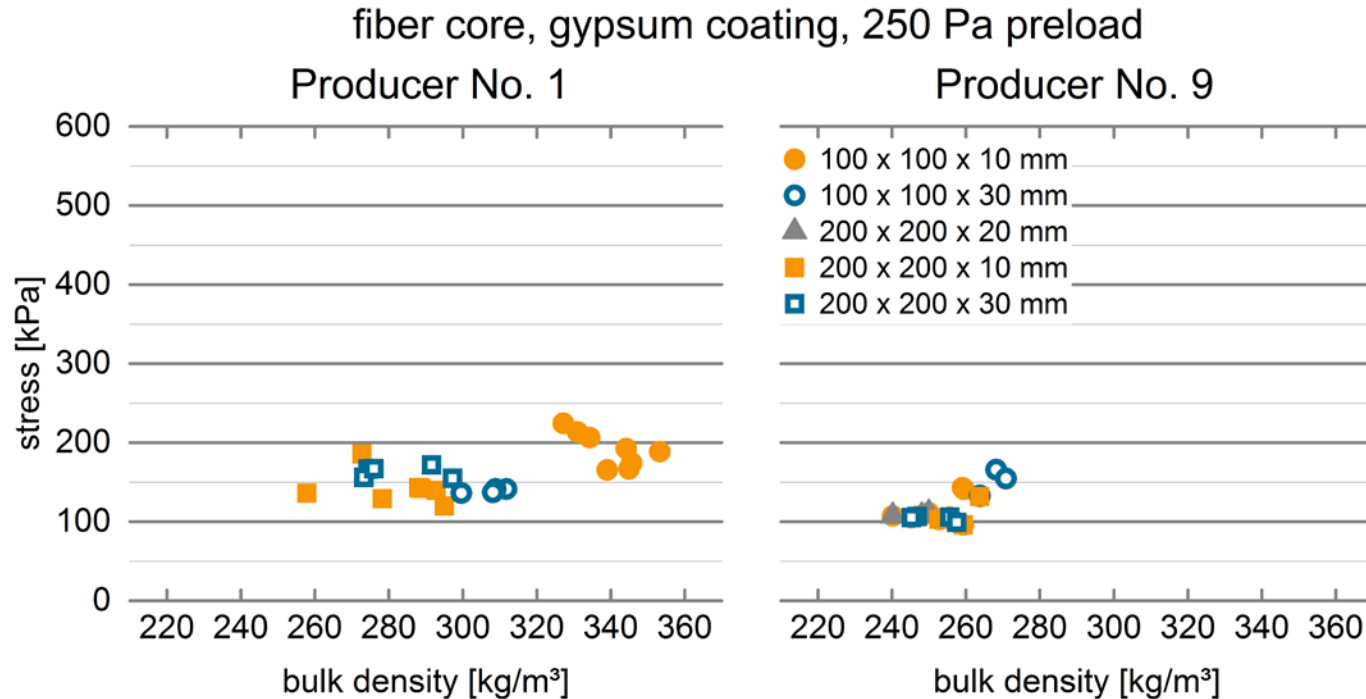
Correlation between bulk density and compressive behavior

- Suggested by VIPA members during conference call
- Indirect measurement, mentioned in draft version of the VIP standard
- All compressive values achieved with gypsum coating
- Density maybe higher caused by testing procedure

Correlation between bulk density and compressive behavior



Correlation between bulk density and compressive behavior



Conclusion - Correlation between bulk density and compressive behavior



- Correlation roughly exists for silica panels
- Correlation depends on thickness
- No correlation for fiber core panels
- Many tests necessary to find correlation (tests with gypsum coating)

Outlook

- Results can be presented to ISO or CEN committee
- Derived from these results, testing method can be described for VIP standard
- If VIPA members agree, results could be presented at upcoming IVIS 2017 in Paris
- Results could be implemented in GSH quality document

Thank you for your attention!



Christoph Sprengard
Forschungsinstitut für Wärmeschutz e.V. München
FIW München
Research & Development
Lochhamer Schlag 4, 82166 Gräfelfing, GERMANY
Telefon +49 89 85800-0, Telefax -41
www.fiw-muenchen.de
sprengard@fiw-muenchen.de