VIP A B C

Vacuum Insulation Panels Applied in Building Constructions

RESEARCH SCHOOL
INTEGRAL DESIGN OF STRUCTURES

Speerpunt BOUW

Subject

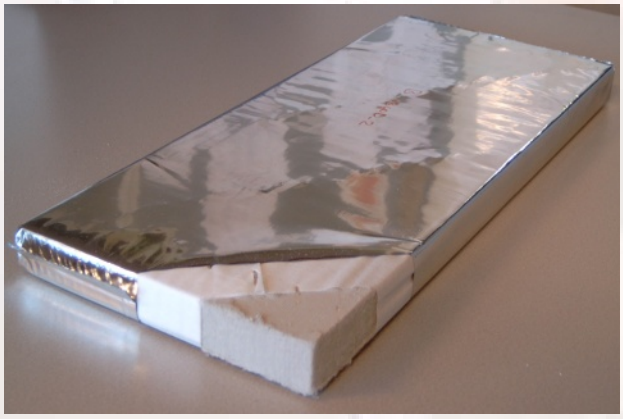
'How and under what conditions can vacuum insulation panels (VIP) be integrated successfully into building façade components or structures and how can relevant properties regarding thermal, hygrothermal, structural and economic aspects be modelled accordingly?'

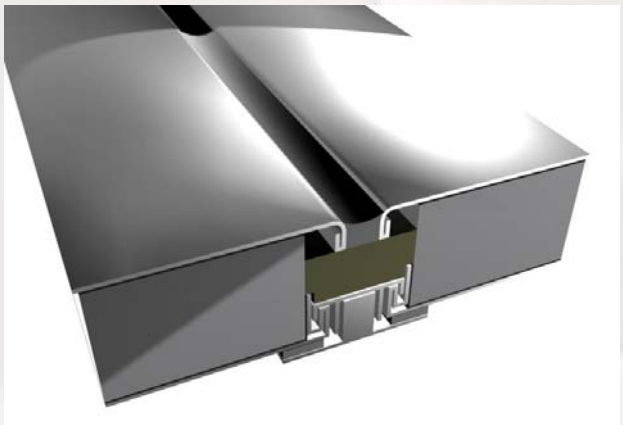
Goal

Developing theoretical models for determining/estimating the thermal, hygrothermal, structural and acoustical properties of VIPs and testing these models in practice by designing several application cases.

Expected Results

Theoretical models, façade panels, floor heating system, refurbishment solutions for dwellings





Researcher	Martin Tenpierik / m.j.tenpierik@tudelft.nl / +31 15 27 84411
Supervisor	Hans Cauberg / h.cauberg@chri.nl / +31 15 27 83387
Program / Subprogrm	Design Integration of Sustainability and Comfort / Skins
Host University	Delft University of Technology / Faculty of Architecture

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TU Delft

Vacuum Insulation Panels Appl. in Building Constructions
The building scientific and architectural integration of VIPs in buildings

Martin Tenpierik[1], Hans Cauberg[2], Wim van der Spoel[2] and Arjan van Timmeren[2]

[1] PhD Researcher, m.j.tenpierik@tudelft.nl, http://www.vipabc.bk.tudelft.nl/
[2] Supervisors
Delft University of Technology, Faculty of Architecture, Building Technology, Delft, The Netherlands,

Subject
The subject of this study is the application of vacuum insulation panels in building constructions. Vacuum insulation panels are thermal insulators that combine high thermal performance with limited construction thickness. They consist of a nano-structured microporous core material that is evacuated and then tightly sealed into a high barrier envelope. Due to this state of vacuum, a VIP of only 2 cm thermally performs equally well to approximately 20 cm of mineral fibre insulation.

Goals
The development of guidelines and rules of thumb for a successful integration of VIPs in building (façade) components in specific and façade constructions in general regarding thermal, hygrothermal and structural aspects including their interrelationships; and the development of tools and methods regarding thermal, hygrothermal, structural and economic aspects to support designers and engineers in the process of designing VIP integrated building components and constructions and in the process of getting their designs approved by building authorities.

Research Question
How and under what conditions can vacuum insulation panels (VIP) be integrated successfully into building façade components or structures and how can relevant properties regarding thermal, hygrothermal, structural and economic aspects be modelled accordingly?

Strategy
The fundamental research into VIPs as entities and into applied VIPs will be conducted using mathematics, numerical simulation software, and experimental set-ups. These studies will lay a foundation on which design solutions for a floor-heating system, a sandwich façade panel and retrofit applications (research by design) will be proposed to validate the methods and tools developed.

Expected Results
The expected results of this research are journal and conference publications, a dissertation, prototypical models of a floor heating system and a sandwich panel and design solutions for the energetic refurbishment of dwellings. With respect to content, a series of models, equations, charts and methods for application in a design process in which VIPs are applied are expected as outcome. These methods and tools will be checked and tested using case studies.

Preferred Partners Applications / Sponsors
Façade industry and contractors

Prime Publications / Prototyping
- Tenpierik M.J., J.J.M. Cauberg and T.I. Thorsell (2007), Integrating Vacuum Insulation Panels in Building Constructions: an Integral Perspective, *Construction Innovation* 7 (2): 38-55.
- Tenpierik M.J. and J.J.M. Cauberg (2007), Analytical Models for Calculating Thermal Bridge Effects Caused by Thin High Barrier Envelopes around Vacuum Insulation Panels, *Journal of Building Physics* 30 (3): 185-215.
- Tenpierik M.J., W.H. van der Spoel and J.J.M. Cauberg (2007), VIP Integrated Facade Designs: The Advantage of Combining High Thermal Performance with Limited Construction Thickness,
In: S.K. Wittkopf and Tan B.K. (eds.), Proceedings of *PLEA2007*, PLEA/NUS, Singapore, September 22-24, 2007, pp. 303-310.

Research Period
February 2005 – February 2009