

Translucent Insulating Glass Brick



Highlights

- translucent – aerogel glass composite
- load-bearing – high compressive strength (45 MPa)
- insulating – low thermal conductivity ($53 \text{ mW}/\text{m}\cdot\text{K}$)

Background

Glazed construction elements are an established technique to transmit light to shaded areas of a building without creating a transparent connection as windows or mirrors do. In particular, glazed elements allow to make good use of environment-friendly daylight, reducing the need for artificial illumination. However, to maximize this advantage they would preferably fill entire walls. This in turn requires them to feature effective thermal insulation, and to be able to carry at least their own load – a combination not available in the market.

Invention

Glass bricks filled with translucent silica aerogel offer a new structural loadbearing façade element for perimeter walls with high thermal insulation performance. Aesthetic and durable surfaces for daylighting possibilities in large areas can be created. Such contrary requirements are met via staggered spacers between the glass panels which ensure structural stability along with minimal thermal transmission.

The glass brick has a measured thermal conductivity of $53 \text{ mW}/\text{m}\cdot\text{K}$ and a compressive strength of almost 45 MPa. This is the highest insulation performance of a translucent brick reported in literature, let alone on the market.

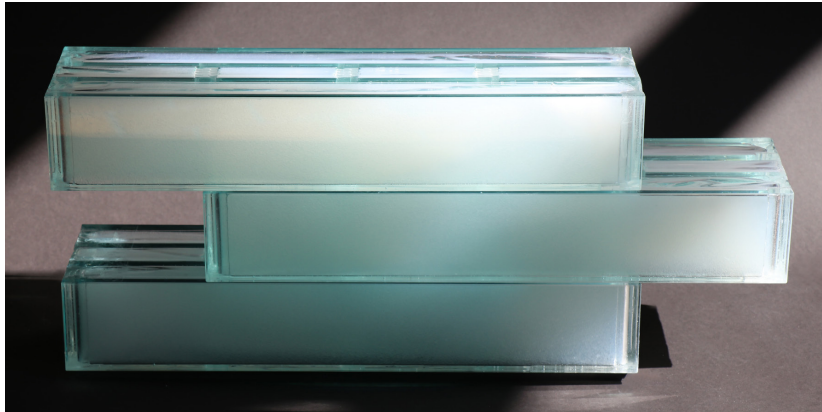
Advantages

Silica aerogel granules as insulating material offer a unique combination of vapor diffusion openness, superhydrophobicity, very low thermal conductivity and excellent optical properties. Their inclusion in glass bricks opens new architectural design options for both the refurbishment of buildings and new constructions with glazed areas.

Applications

Translucent glass bricks are suitable for

- spaces which **avoid visual connection** from the exterior (for reasons of privacy, security, avoidance of disturbances, etc.) while still **bringing diffusive daylight inside**. Examples include libraries, galleries, museums, foyers, offices, staircase cores, gym halls, multipurpose halls, apartment houses, art workshops
- spaces where daylight is necessary for **healthy circadian rhythm**, like buildings for people (residential homes, hospitals, sanatoriums), animals (zoos, stables and animal farms) or plants (greenhouses)
- places which require **harvesting maximum daylight and space saving** such as in dense cities (highrise buildings, city apartments)
- buidlings for **harvesting heat from sunlight** through infrared radiation (Trombe walls, patios, atriums)



Ownership

Empa, Swiss Federal Laboratories for Materials Science and Technology, Überlandstrasse 129, CH-8600 Dübendorf; Patent pending

References

Michal Ganobjak, Wim J. Malfait, Janis Just, Marcel Käppeli, Francisco Mancebo, Samuel Brunner, Jannis Wernery, Get the light & keep the warmth – A highly insulating, translucent aerogel glass brick for building envelopes, Energy & Buildings (submitted)

Ganobjak M., Let's build translucent walls! | DLA Annual Conference 2021
<https://www.youtube.com/watch?v=wplo8hsfioQ>

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Contact

Empa, Technology Transfer
Dr Markus Kasper, markus.kasper@empa.ch
Phone +41 58 765 44 38

Technical Information

Dr Michal Ganobjak, michal.ganobjak@empa.ch
Phone +41 58 765 60 32

Dr Jannis Wernery, jannis.wernery@empa.ch
Phone +41 58 765 49 46



Empa

Materials Science and Technology

Empa

CH-8600 Dübendorf
Überlandstrasse 129

Telefon +41 58 765 11 11
Telefax +41 58 765 11 22

CH-9014 St. Gallen
Lerchenfeldstrasse 5

Telefon +41 58 765 74 74
Telefax +41 58 765 74 99

CH-3602 Thun
Feuerwerkerstrasse 39

Telefon +41 58 765 11 33
Telefax +41 58 765 69 90

www.empa.ch

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