International Journal of Engineering Research
Volume No.7, Issue Special 2, pp : 147-148
ISSN:2319-6890 (online),2347-5013(print)
11-12 Jan. 20178

Aerogel Glazing- An Emerging Energy Efficient Technology For Windows

Sarika Thakoor

D Y Patil School of Architecture, D Y Patil Knowledge City, Charholi Bk. Lohegaon, Pune
Email: sarika@dypatilarch.com

Abstract: The construction industry is one of the most energy consuming industry. It has not only adversely affected the environment but also the quality of living of the people and their health. One of the elements of building apart from the structural walls which lead to uncomfortable indoor conditions is the glazed windows, glazed facades or glazed roofs. This paper focuses on comparing Aerogel glass, an emerging technology in the field of glazing with other conventional glazed system. It also discusses other advantages resulting in better indoor thermal conditions by using Aerogel glass instead of conventional glass systems.

Keywords: **Aerogel, glazing, nano technology, window, energy efficiency**

Introduction

Many of the construction companies have been researching on producing energy efficient windows with energy efficient glass. The lower the U value of the glass, the more energy efficient it is. Some types of energy efficient windows are double or triple glazed windows with insulating material like noble gases such as argon, xenon sandwiched between them or vacuum insulated glass windows. When the glazed surface area in a building is larger or for cases like heritage buildings where maintaining architectural integrity becomes essential, not all structures are capable of holding the weight or accommodating the area of the double or triple glazed windows. There is a need for better alternatives which are practical solutions to such problems.

Aerogel Glazing

One of the emerging and most researched trends in the construction industry is Nanotechnology. There are many nano materials such as nano concrete, phase change materials, steel, photovoltaic materials and many more that are changing the age old technologies for the better. Aerogel is a nano material which is made from 4% silica and 96% air. In Aerogel glass, the microscopic cells entrap air which prevents convection but still allow light to pass.

For a window, the two factors contributing to its efficiency are the frame and the glass. So its total U value is- Uf + Ug = Uw,

where Uf is U value of the frame, Ug is U value of the glass and Uw is U value of the window.(Aspen Aerogels,2017)

For the current study, only the Ug factor has been considered for simulations.

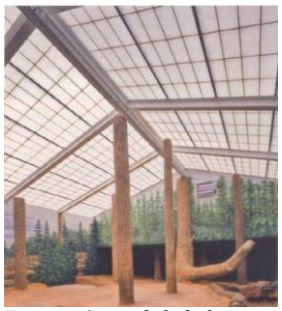


Figure 1 Aerogel skylight (Kroto & Veith, 2008)

Figure 2 Aerogel glass wall panel (Kroto & Veith, 2008)

Building Simulation

The objective of building simulation of the room model is to analyse the direct and indirect solar gains and losses and the resulting annual heating and cooling load differences by comparing aerogel glazing with double glazed window.

Methodology:

Energy simulation was carried out in Autodesk Ecotect software. For simulation, a room, fully air-conditioned during working hours, located in New Delhi was considered. The room was modelled and two cases were considered for simulation. In the first case, a room having a double glazed window was simulated. In the second case, a room with Aerogel glazing was simulated.

Basic design parameters:

The basic design parameters common to both the models are as follows:

i. Location and climate:

Location: New Delhi, India
Lat.28º06" N, 77º02"E

ii. Building model:

Type of building: A typical office room, fully air conditioned during operating hours.
Structure: Ground only
Dimensions: 3m x 4m x 4m
Area of the room: 12 sq.m.
Operating hours: 9am to 6pm
Working days: Monday to Friday (5 days a week)
Holidays: Saturday and Sunday (weekends)
Orientation: Longer axis along East West.

ISSN:2319-6890 (online),2347-5013(print)
11-12 Jan. 20178

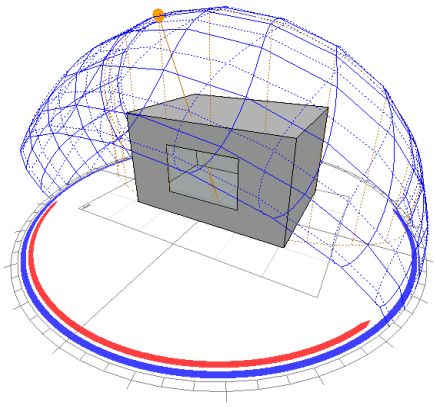


Figure 3 Room model with window on South facade in Ecotect software

The two cases of glazing considered were-

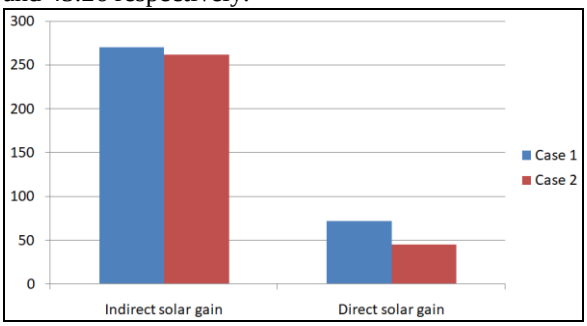
Case 1- Double glazing with xenon gas in 30 mm between two panes of 6mm glass

Case 2- Aerogel glazing 16mm thick

Simulation Results

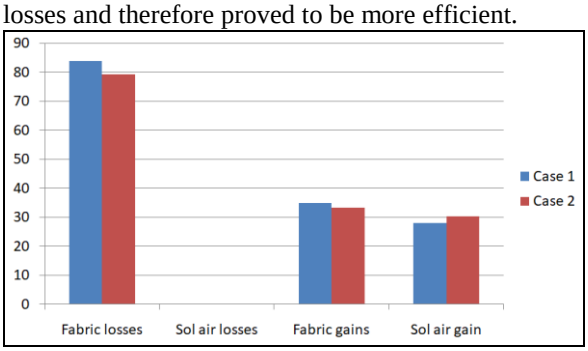
The simulation results can be divided into three categories.

The first category includes comparison between direct and indirect solar gains for both the cases. The results show that both direct and indirect solar gains were lesser in the second case where Aerogel glazing was used i.e. indirect solar gain as 270.3 and 262.04 respectively and direct gains 72.32 and 45.26 respectively.



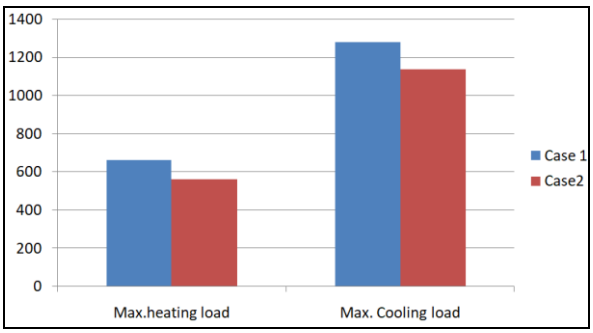
Graph 1 Indirect and direct solar gain comparison

The second category includes fabric losses and gains and sol air losses and gains for both the cases. The results show that the second case with Aerogel glazing had lower gains and losses and therefore proved to be more efficient.



Graph 2 Fabric and sol air losses and gains comparison

The third category of results shows the annual heating and cooling loads consumed. The graphs show that Aerogel glazing results in lower heating and cooling loads thus proving to be more energy efficient.



Graph 3 Annual heating and cooling loads

Conclusion

Thus from the simulation results, it has been proved that Aerogel glazing when used against conventional double glazing low-e windows, the result would be better indoor living conditions due to favourable achievable temperatures. Also, it would lead to better acoustical insulation as well as energy efficiency by reducing the HVAC loads leading to substantial energy savings in the long term. Aerogel as a glazing material needs to be promoted more and used at a larger scale, which would thereby lead to its price reduction after rise in demand.

References

i. *Kroto, H., & Veith, M. (2008). Nano Materials. Berlin: Birkhauser Verlag AG.*
ii. *Acharya, A., Joshi, D., & Gokhale, V. A. (2013). AEROGEL – A Promising Building Material for Sustainable. IISTE. Retreived on December 02, 2017 from www.iiste.org*
iii. *http://www.cabotcorp.com/solutions#products-plus*
iv. *Retrieved on December 18,2017*
v. *http://www.tgpamerica.com/products/glass/pilkington-profilit-insulation/ Retrieved on December 19,2017*
vi. *http://blog.aerogel.com/making-better-windows-with-aerogel Aspen Aerogels retrieved on December 19,2017*