

- A1 Raw materials supply
- A2 Transport raw materials
- A3 Manufacturing
- A4 Transport
- A5 Site works

Ryder

# Thermulon Insulation Net Zero Nano Materials

Insulation is a key material in our transition to net zero buildings. Advancements in nanotechnology have allowed materials, previously developed by NASA, to be used to realise net zero buildings and improve building safety. We have formed collaborative research partnerships with pioneers in material science to explore a new frontier of carbon negative insulation.

- B1 In use
- B2 Maintenance
- B3 Repair
- B4 Replacement
- B5 Refurbishment

## Material science innovators

To improve building performance and deliver safer net zero buildings, we recognise the need to go beyond conventional practice and materials. To address the embodied energy in materials, we have sought out pioneering scientists working with cutting edge technology to help realise our ambitious net zero goals. By forming strategic partnerships and collaborating with likeminded thought leaders, we can deliver safer, warmer and more sustainable buildings. Here we take a look at aerogels in our latest collaboration with partners, [Thermulon](#).

## Aerogels

Aerogels are among the most insulating materials known to man. With 95 percent of their structure made from air, aerogels can reach an insulating value lower than conventional insulation materials, like mineral wool or plastic based insulation boards.<sup>1</sup>

“Aerogels are quite special. The material is so incredibly light yet filled with millions of nanopores, meaning that very little heat can pass through the material itself or through the air pockets. This means they are extraordinary insulants.”

Dr Sam Cryer, CEO, Thermulon

Using only a thin layer of aerogel leads to huge reductions in the amount of heat that escapes through a building’s walls (measured by U-value), reducing the operational energy demand of the building.<sup>2</sup>

- B6 Energy use
- B7 Water use
- C1 Deconstruction
- C2 Transport
- C3 Waste processing
- C4 Disposal

## Less is more

Working with an affordable high performance insulator, we can deliver ambitious energy efficiency requirements on the building envelope with a thinner wall build up, using less material and unlocking valuable floorspace.

## Healthy and fire safe

Following new guidance on building safety, we are exploring the use of affordable aerogels in wall build ups for buildings above 18m. Aerogel panels can be A2 fire rated, meaning they are suitable for tall buildings.<sup>2</sup> Depending on the build up, the properties of aerogel ensure it is also breathable — helping prevent problems with moisture, condensation and mould.

## Addressing embodied carbon

It is intuitive that insulating a building will reduce the amount of energy it needs to operate. Aerogels illustrate the point: Their low rate of thermal transmittance means a 10mm layer of aerogel insulation can lead to a reduction in heating demand of 25 percent.<sup>3</sup>

**10<sub>mm</sub>** layer of aerogel insulation      **25%** reduction in heating demand

As buildings become more energy efficient and are powered by a greening grid, the importance of embodied carbon in construction materials grows. Currently, nearly 80 percent of emissions from buildings arise from their operation and 20 percent are embodied.<sup>4</sup> This is changing as renewable electricity generation is added to the grid. Embodied carbon footprint could rise to up to 70 percent of overall carbon footprint for some buildings by 2030.<sup>4</sup>

Alongside a low energy production process, Thermulon use construction waste in the production of their aerogels. Closing the loop and using waste that would normally go to landfill can drastically reduce the embodied carbon.

## Reducing the carbon footprint of insulation

There are three main avenues to reduce the carbon footprint of building insulation:

**50% thinner** aerogels achieve the same thermal performance

### 1 Reduce the amount of material used

Aerogels can achieve the same thermal performance and energy efficiency as mineral wool with half the insulation thickness.

**200k tonnes** construction materials that we can reuse

### 2 Reuse materials

Aerogels are inert and their thermal performance does not deteriorate over time — they can be reprocessed and reused.

**<2.9 years** estimated carbon payback period using aerogel insulation

### 3 Recycle materials

Today, there are 200k tonnes of construction materials that Thermulon could use to produce aerogel insulation. By using material that would otherwise go to landfill, Thermulon estimates a reduction of the carbon price of its materials to less than 2.9 years.

We are excited to be collaborating with Thermulon on several research projects, in an innovative partnership to realise net zero buildings and address building safety concerns. It is an affordable, high performance and fire rated insulation that will provide warmer, safer buildings, and unlock valuable liveable space through thinner wall build ups in both new builds and retrofits.

- D Reuse

# References

1 NASA. (2011) Aerogels: Thinner, Lighter, Stronger. Retrieved from <https://www.nasa.gov/topics/technology/features/aerogels.html>

2 Thermulon. (2021) About. Retrieved from <https://thermulon.com/>

3 Guinoa, D., Zambrana Vasquez. D., Alcade, A., Corradini, M., and Zabalza-Bribián, I. (2017) Environmental assessment of a nano-technological aerogel-based panel for building insulation. *Journal of Cleaner Production*, 161, 1404-1415.

4 UK Green Building Council. (2017) Embodied Carbon: Developing a Client Brief. Retrieved from <https://www.ukgbc.org/sites/default/files/UK-GBC%20EC%20Developing%20Client%20Brief.pdf>

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