

CABOT AEROGEL • A BUSINESS OF CABOT CORPORATION



The New Standard in Eco-Daylighting Solutions

LumiraTM
aerogel



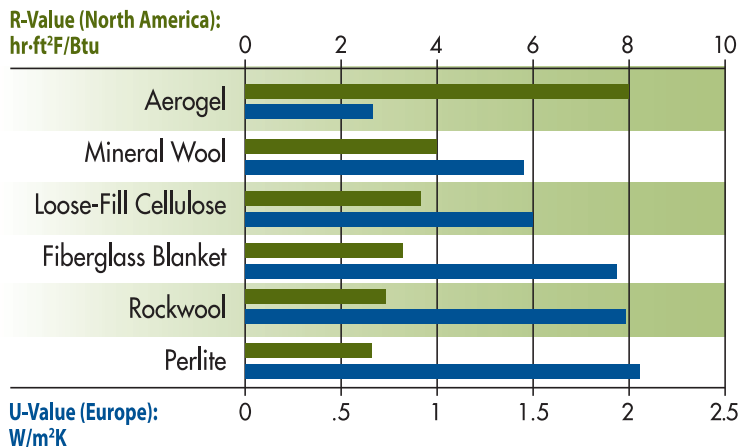
Why Lumira™ aerogel?

Architects and building owners face challenges everyday in balancing aesthetics and daylighting design needs with increasingly stringent building and energy code requirements. Coupled with the growing focus on proactively reducing the carbon footprint of dwellings and buildings, these challenges are becoming increasingly daunting. Translucent Lumira aerogel is the perfect solution to combat these issues by maintaining and enhancing energy efficiency while enabling a wide range of commercial and residential building design choices. The inclusion of Lumira in daylighting systems virtually eliminates the historical trade-off of insulation vs. natural light by providing 3 to 6 times the thermal performance of the traditional, poorly insulated

fenestration products, while maintaining optimal light transmission. As a result, even large daylight surface areas can maintain high energy efficiency by reducing thermal loads.

INSULATION VALUES OF EXISTING BUILDING INSULATION PRODUCTS

(Values are per 1 inch/25 mm of material)



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No compromises

Studies show that comfort, productivity, learning, healing and customer consumption/retention are dramatically improved by the tactical use of natural light as the primary source of illumination in workplaces, schools, hospitals, homes, and retail environments. Traditionally, this has resulted in a compromise, as the conventional materials used to transmit natural light have demonstrated an inability to insulate, while highly insulative materials have been unable to transmit meaningful quantities of daylight. Current transparent daylight systems, while allowing maximum daylight, also bring problems such as glare, solar overheating, drafts, hot spots and high contrast zones. Harnessing the exclusive properties of Lumira™ aerogel for use in daylighting systems has changed all that, with:

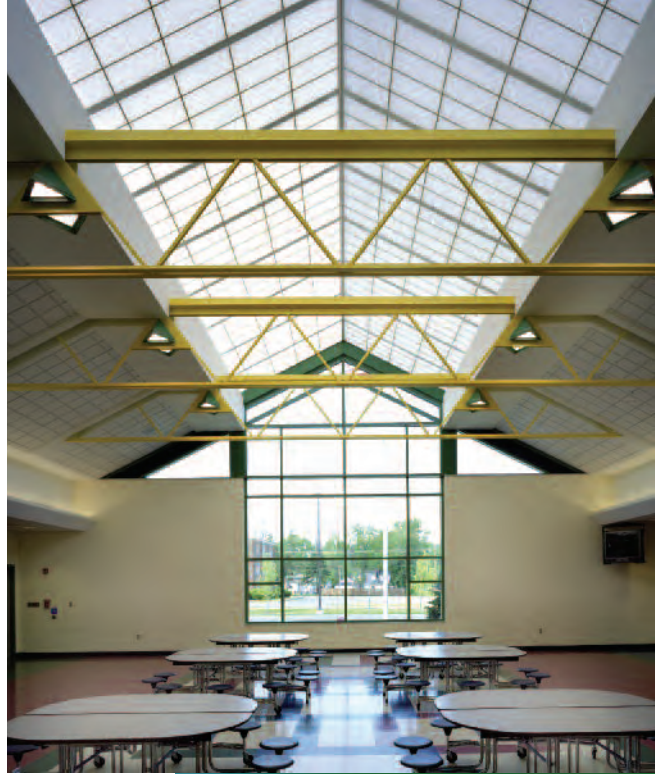
- Unsurpassed thermal insulation - R-value of 8 per inch / U-value of 0.64 W/m²K per 25 mm
- Increased natural light transmission - 75% per 3/8 inch / 80% per cm
- Superior light diffusion – elimination of glare
- Improved acoustic performance
- Reduced solar heat gain/loss
- Decreased energy consumption - heat, air conditioning, lighting, ventilation, carbon emissions
- Unmatched moisture resistance - 100% hydrophobic
- Exceptional color stability and insulation performance

Lumira™ Aerogel Performance Properties*

Thickness** (mm)	Light Transmission (%)	Direct Solar Transmission (%)	U-value (W/m ² K)	R-value (in)
10	80	80	1.38	3.2
16	70	70	1.00	4.3
20	62	62	0.78	7.2
25	55	55	0.64	8.0
32	47	47	0.51	11.1
40	39	39	0.42	12.0
50	31	31	0.34	16.0
70	19	19	0.25	20.0

*Values are for Lumira aerogel only

**Does not represent all available thickness options



High efficiency, lower costs

Strengthening the customary weak link of the building envelope with high performance Lumira daylighting systems considerably impacts cost and energy efficiency in a variety of ways. The natural light diffusion and glare elimination provided by Lumira aerogel can replace or supplement artificial lighting, resulting in significant energy and demand savings. Heat loss and gain are controlled by the unique characteristics of Lumira particles, which inhibit heat transfer, measurably impacting HVAC loads and occupant comfort, at great energy savings to the building owner. The UV stability, durability, and moisture resistance of hydrophobic Lumira insulation result in extended product life and lower long-term operational costs. These benefits hold true even in extreme or demanding applications such as passive houses, zero-carbon or positive energy buildings.

www.cabotaerogel.com

CASE STUDY

Defeating the compromise with sustainable design



Sports Complex - Souchais, Carquefou, France

Architect:	Murail Architectures – Nantes & Paris, France
Contractor:	Belliard (facade)
Owner:	City of Carquefou
Building size:	36,200 sq ft / 3,360 m ²
Facade coverage:	16,150 sq ft / 1,500 m ²
Facade thermal properties:	R-value 6.4 / U-value 0.89 W/m ² K
Total investment:	\$3.82 million / €2.9 million

RESULTS:

Capital cost savings:	Savings of \$818,000 / €620,000 vs. standard glazing and exterior solar shades
Energy savings:	55,440 liters of fuel or \$51,200 / €38,800 per year
CO ₂ emission reduction:	333,000 lbs / 151,000 kg per year
Aesthetics and comfort:	Soft diffused light without glare creates a high comfort level for the athletes and spectators. Sound dampening reduces internal noise interference.

“The combination of polycarbonate sheet and environmentally friendly Lumira™ aerogel particles provides a unique balance of cost, thermal performance, acoustic performance, visual comfort and aesthetics. It offers architects and developers an attractive, practical way of following the French HQE® approach to energy management and environmental impact.”

–Mr. Christophe Murail, General Manager, Murail Architectures



Hear the Difference

The structure of Lumira™ aerogel inhibits sound and vibration transmission not just by blocking, but by absorbing sound energy, creating significant sound control by reducing external and internal noise transfer.

The unique mechanical properties of Lumira particles enable it to absorb sound across a broad frequency band. Lumira-filled daylighting systems transmit much less sound than traditional systems, leading not only to better energy efficiency, but also quieter interior spaces. Lumira fabrics used in roofing systems can dramatically improve interior acoustics by significantly reducing reverberation and transmission of exterior noise. This means greater comfort for occupants, as well as freedom in design for mixed use facilities.



The Lumira difference in sustainable design

Lumira daylighting system projects have been installed all over the world. Visit our website, www.cabotaerogel.com, for more information.

Reduce your carbon footprint

Energy is a key part of the sustainability concept. It is widely acknowledged that the construction, occupation and running of buildings accounts for close to half of all energy consumption in the USA and Europe. Not only can Lumira™ aerogel save energy and reduce CO₂ emissions, it is also reusable when the building is decommissioned. Lumira aerogel is safe for human (particle sizes from 1 to 4mm) and ecological systems, and is manufactured with little to no impact on the environment. This means including daylighting systems with Lumira insulation in building designs can help create healthier living, recreational and work spaces, and can assist in securing LEED™ certification and meet or exceed stringent building codes such as Part L in the UK, Energieeinsparverordnung in Germany, and Reglementation Technique in France. Lumira aerogel holds Silver Cradle to Cradle™ certification from McDonough Braungart Design Chemistry. Cabot Aerogel is also a member of the American Architectural Manufacturers Association and the US Green Building Council.



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Performance Reaches New Heights



Dedmon Athletic Center - Radford University, VA

Project:	Retrofit of roofing system - mixed use facility
Architect:	Moseley Architects, Virginia Beach, VA
Engineer:	Stroud, Pence & Associates, Virginia Beach, VA
Contractor:	Branch & Associates, Roanoke, VA
Owner:	Radford University
Plan area:	54,804 sq ft / 5,090 m ²

RESULTS:

Energy savings:	\$91,500 / €64,200 per year*
CO ₂ emission reduction:	1,988,800 lbs / 904,000 kg per year**
Aesthetics and comfort:	Retrofit maintained the iconic roof structure while exponentially improving user experience through sound dampening, moisture resistance and thermal insulation.

The original air-supported fabric roof of the Dedmon Center was replaced with with a Lumira™ aerogel fabric layer sandwiched between two layers of structural PTFE fabric, creating ultra-high insulation levels. The fabric is less than 50mm thick, yet it more than triples the original roof's thermal insulation performance with a value of R-12 (U-value 0.47 W/m²K) and natural light transmission value of 3.5%. The results of the completed roof retrofit were measured through IR imaging (see inset above). On a cold winter night, the cool temperature of the arena roof (A) is readily apparent as compared with the adjacent traditionally insulated roof (B) and the natatorium fabric roof (C) which was constructed similarly to the original construct of the arena roof, with 2 layers of fabric. When measured, the ambient exterior temperature was 26°F (-3.3°C) and the interior temperature of the space was 68°F (20°C). The surface temperature of the arena roof was 28°F (-2.2°C) and the surface temperature of the rest of the facility roofs averaged 66°F (19°C).

* Calculated according to Fourier's Law of thermal conduction (integrated)

** Carbon calculations based upon the following formula: 1kWh=.537kgCO₂

High performance daylighting

When incorporated into the following systems, in both roofs and facades, Lumira™ aerogel offers architects and building owners a multitude of design benefits. Whether the installation is horizontal, vertical or at an angle, Lumira insulation retains its properties, enabling unflinching thermal efficiency while allowing exceptional daylight and optimized building aesthetics without sacrificing, but actually improving, occupant comfort and productivity:



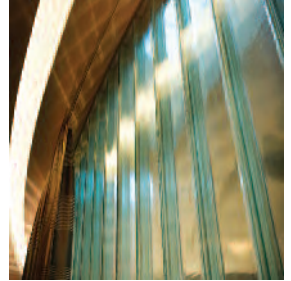
Structural Composite Panels for Skylights and Façades



Structural Polycarbonate Skylight Systems



Polycarbonate Façade Systems



U-Channel Glass



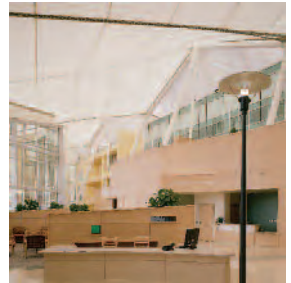
Insulated Glass Units



Continuous Vaults and Ridges with Ventilation Systems



Unit Skylights, Rooflights, and Smoke Vents



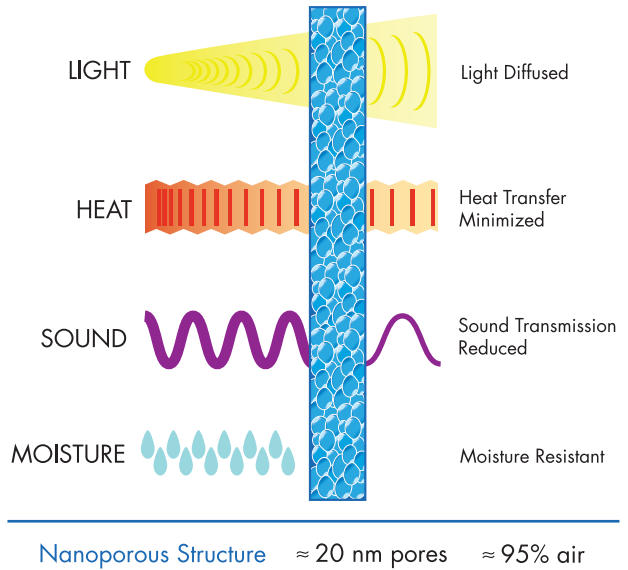
Tensile Structures /Fabric Roofing

Solid, non light-transmissive construction delivers an R-value of 24 (U-value 0.24), while high performance triple-glazed krypton glass glazing delivers R-8 (U-0.7), making the choice easy when compared to Lumira aerogel, which allows daylighting products to deliver a range of R-values from 6 to 20 (U-0.28 to 0.89) while cultivating essential natural daylight.



About Lumira™ Aerogel

Aerogel is among the lightest and most effective insulating materials in the world. Cabot's Lumira brand aerogel, formerly Nanogel®, is a solid which consists largely of air (>90%) contained in a structure with pore sizes less than the mean free path of air molecules, which severely inhibits heat transfer through the material, enabling world-class performance. Cabot produces Lumira aerogel at its state-of-the-art manufacturing facility located near Frankfurt, Germany where it began commercial production in 2003.



Cabot Aerogel is a business of Cabot Corporation, a global specialty chemicals and performance materials company, founded in 1882 and headquartered in Boston, Massachusetts, USA.

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The New Standard in Eco-Daylighting Solutions

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