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Titolo generale della ricerca:



PERCORSI E GESTIONE DELLE INFORMAZIONI TECNICHE PER LA PROMOZIONE E IL CONTROLLO DELL'INNOVAZIONE NEI MATERIALI E NEL PROGETTO DI ARCHITETTURA

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Texlon, The climatic envelope

The Texlon cladding system offers designers unparalleled opportunities in the development of the climatic envelope.

Texlon consists of pneumatic cushions restrained in aluminum extrusions and supported by a lightweight structure. The cushions are inflated with low pressure air to provide insulation and resist wind loads

The cushions are manufactured from between two and five layers of the modified copolymer Ethylene Tetra Fluoro Ethylene (ETFE). Originally developed for the space industry, the material is unique in that it does not degrade under Ultra-Violet light or atmospheric pollution.

As Texlon is extremely long lasting, it can be used as part of the permanent building envelope. Furthermore, as the surface is very smooth and has anti-adhesive properties, the envelope self cleanses under the action of rain.

Texlon combines exceptional light transmission with high insulation. Each layer can incorporate different types of solar shading enabling the designer to optimize the aesthetic and environmental performance of the building envelope. We can even create cladding systems that react to the sun and change their transmission and insulation throughout the day.

Through sophisticated load analysis and patterning, we can engineer Texlon to virtually any size or shape. This, coupled with Texlon's innate flexibility, allows designers to create structures of unusual lightness and elegance.

These properties, coupled with Texlons' very low levels of embodied energy and outstanding environmental properties, allow the realization of the true climatic envelope

The Technology

The Texlon cladding system comprises a number of layer of the UV stable copolymer Ethylene Tetra Fluoro Ethylene (ETFE) welded into cushions or foils.

The cushions are restrained around their perimeter by aluminium extrusions, which are in turn fastened to a supporting primary structure. The cushions are inflated with low-pressure air to provide insulation and to resist wind loads.

A Texlon cushion comprises at least two layers. However, more layers can be added into the system to enhance the cladding's insulation properties.

Each foil can be treated with a variety of treatments to control and manipulate the aesthetics quality of the roof, the visual transparency and the level of solar gain.

The Texlon system has both exceptional durability and a high resistance to tearing.

Texlon Cushions can either be completely prefabricated in the Factory or can be clamped into their supporting framework on site. Our aluminium extrusions incorporate secondary drainage channels and the highest quality EPDM gaskets to ensure the waterproof integrity of the cladding over the life of the building.

Texlon cushions can be fabricated in any size or shape with limiting factor being the wind and snow loads that the cladding has to resist. We would recommend an early discussion with our engineers during the conceptual planning stages of projects to ensure that the structural grid and cladding interface is optimised.

Structural Concepts

Texlon cushions can be manufactured in large sizes and can span a much greater distance than conventional cladding technologies. This provides designers with the opportunity to integrate the design of the cladding with the primary structure, and develop aesthetics of simplicity and elegance.

The material's innate toughness, high resistance to tearing and ability to work harden over a 300-400% elongation range means that the Texlon system can naturally deal with very large deflections in the support structure.

This has allowed the development of unique lightweight structures such as Uniaxial cable nets and large scale geodesics.

As the Texlon cushions are pneumatically pressurized, the forces generated in the cushions by inflation and external loads such as wind and snow have to be carried by the primary structure. The loads imposed are a function of both the span of the cushions and the amount of rise of the cushion. These in-plane loads are generally in equilibrium with only the normal component having to be engineered for. The perimeter structure however needs to be sized to accommodate these loads.

The engineering of Texlon is a very specialist area as the material quality and performance make it unique. Vector's service includes a full cushion engineering and patterning service, including non-linear load analysis and patterning software. In addition we frequently engineer, design and erect the entire envelope including all support structures, opening vents and adjacent cladding.

We would recommend an early consultation in the development of design proposals in order to optimize the opportunities offered by Texlon's unique properties at concept stage.

Property	Value	Test Method
Density	1.75 ± 0.05 g/cm ³	DIN 53479 at 23°C
Ultimate Tensile Strength	40 – 50 N/mm ²	DIN 53455,
Elongation at break	300 – 400%	Instrom at 100mm/min
Yield Stress	20 – 30 N/mm ²	Instrom at 100mm/min
Elongation at Yield	15 – 20%	Instrom at 100mm/min
Cold fracture temp	-180°C	DIN 53372
Tear Propagation	400 – 500 N/mm	DIN 53363, 23°C

Solar Control and Variable Skins

Texlon's multi-layered construction can be exploited to create climatic envelopes that sense their environments and change their insulation and solar transitivity as required.

By printing overlapping gestalt graphics on multiple layers and integrating the cushions with sophisticated pneumatics, we can move the different graphics together and apart from each other.

This enables us to vary both the amount of solar gain penetrating the building and the visual appearance of the envelope.

Not only can this phenomenon be exploited to control the amount of solar transmission through the envelope, but it can also be used to vary the number of air chambers within a cushion, thereby changing its U value.

These unique properties enable designers to create buildings that are energy efficient, cost effective and visually responsive to changing climatic conditions.

The Transparent Envelope

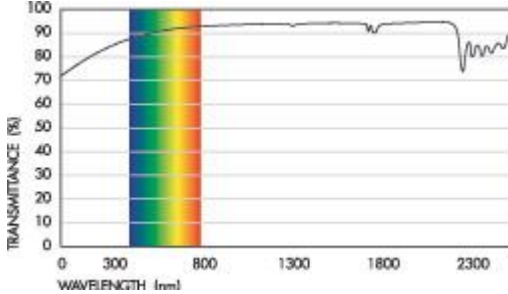
Texlon's multi-layered construction offers the designer numerous opportunities to control the amount of solar shading and manipulate the visual transparency of the building envelope. This has enabled the development of low energy, naturally engineered environments.

Clear Texlon is extremely transparent, with the material having a transparency of 92-95%. This transparency occurs over most of the electromagnetic spectrum including UV which is essential for plant growth and photosynthesis.

Vector Foiltec has pioneered the use of selective coatings on Texlon in order maximize Texlons performance under a variety of conditions. In addition, Vector Foiltec has pioneered techniques to control light refraction in the 300-800nm wavelengths. This is critical to the visual clarity of Texlon and near perfect clarity is now achievable. For more details and applications please contact our office.

TECHNICAL DATA

Texlon: Clear

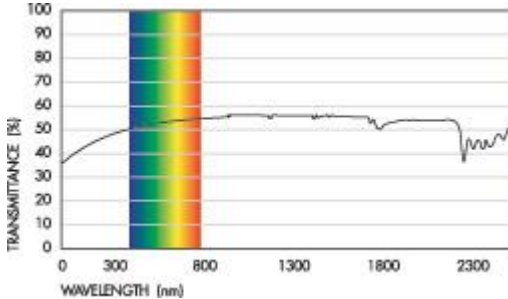


The Printed or Fritted Envelope

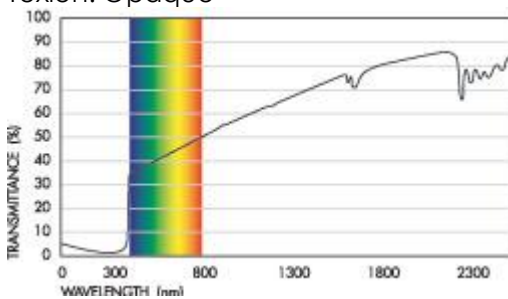
The Texlon cushions can be printed with graphic patterns of translucent or opaque flouro-polymers. A wide range of solar shading can be achieved whilst retaining the visual transparency of the envelope.

TECHNICAL DATA

Texlon: Frit



Texlon: Opaque



The Translucent Envelope

The Texlon Foil can be produced with a translucent body tint. By varying the number and type of layers, the density, colour and light transmission properties can be infinitely varied.

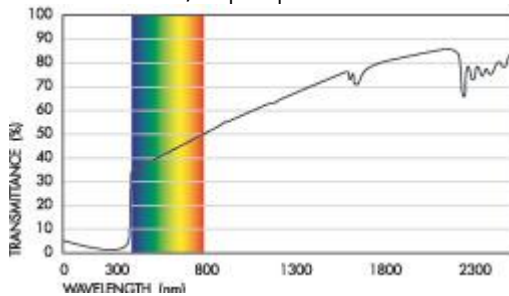
Standard colours available are white, blue, yellow, red and green.

Generally we would recommend the use of a white body tint to ensure internal daylight colour rendering.

A product range of matt surfaced Texlon which can further enhance the designers choices is also available. This product has been used extensively for lighting applications.

TECHNICAL DATA

Texlon: White / Opaque



Insulation, Ventilation

Texlon cushions are typically fabricated from between two and five layers of foil.

As each layer of foil encloses a layer of air, the U value of the envelope is very low and can be optimised to suit each application.

Vector Foiltec is a pioneer in the use of selective coatings to fluoropolymers in order to further enhance the high insulation qualities of the envelope.

In addition to exceptionally low U values, heat losses within the system due to infiltration are reduced to zero as the Texlon cushions form a protective pressurised enclosure around the building.

In addition to the many opportunities Texlon offers for controlling U value and solar gain, we can also engineer opening vents in the building envelope.

Texlon is unique among building technologies in that its high flexibility enables one to engineer much larger vents and movable structures than conventional technologies have previously allowed.

Through manipulation of the 'Stack Effect', the designer can also control internal stratification and ambient air temperatures and therefore minimise the buildings energy consumption while maximising internal comfort.

No of foils	U Value
2	2.94 Wm ⁻² K
3	1.96 Wm ⁻² K
4	1.47 Wm ⁻² K
5	1.18 Wm ⁻² K

Note: Typical U values are for horizontally orientated cushions (vertical cushions have even better U values)

Life and Ecology

Texlon is unaffected by atmospheric pollution and UV light. The material does not harden, yellow or deteriorate over time. This makes its use ideal for long life, low maintenance buildings such as hospitals, railway stations, leisure centres and botanical houses.

Our unique detailing strategies and range of patented extrusions ensure that building movement is accommodated across the whole surface of the cladding.

This strategy reduces stress concentration at movement joints and vastly increases gasket life.

Texlon's ability to self cleanse under the action of rain further reduces life cycle costs to very low levels.

Texlon is both an energy efficient and ecologically friendly technology. The raw material is admitted under the Montreal Treaty and is not a petrochemical derivative. The production process is an enclosed water based process and does not involve the use of any solvents.

The material is 100% recyclable and we construct many components from recycled material.

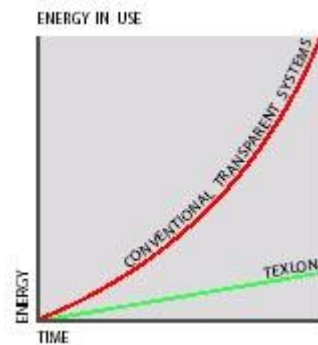
Texlon cladding is therefore a highly energy efficient cladding technology due both to its environmental performance i.e. high insulation and optimised solar controlled and its low embodied energy (less than 1% of conventional technologies).

Technical Data:

EMBODIED ENERGY:



ENERGY IN USE:



Fire

Texlon has been extensively tested at various institutions around Europe and has the unique property of 'self venting' the products of combustion to the atmosphere.

Under fire conditions, any hot gases impinging on the cushions at a temperature above approximately 200°C will soften the foil. As the foil is under strain from inflation, the foil will fail and shrink back from the plume, effectively venting the fire to atmosphere.

Any fragments of Texlon Foil still present will be swept upwards by the plume and, as the quantities of material used in the roof are so small, one does not experience drips of molten ETFE falling to ground.

This 'self venting' feature of Texlon prevents the build up of high temperature gasses under the roof construction and therefore the possibility of flash over and/or catastrophic structural collapse of the primary structure.

In situations where the plume does not reach 200°C, Texlon can be fitted with opening smoke vents or the patented Texlon SV™ technology to ventilate the products of combustion. Both systems can be operated by the Building Management System and linked to heat, smoke, wind and rain sensors.

Texlon's lightness and flexibility can be further exploited to engineer very large opening roofs, enabling atria to operate as light wells under fire conditions or internal courtyards to become external courtyards on sunny days

Technical information:

The melting point of ETFE is approximately 275° C, although the foil softens below this temperature.

The presence of fluorine in the ETFE structure makes the material self-extinguishing.

Texlon is in the low flammability category B1 when tested to DIN 4102.

Texlon has an oxygen index (LOI) 35% when tested to ASTM D 2863/77.

Texlon is considered to be Class 0 under UK regulations.

Texlon is classified M2 (i.e. no burning drips) according to NF P 92-505.

Texlon is classed as 0 to AS/NZS 1530.3 (non flammable and does not support combustion).

Vector maintains an extensive library of technical knowledge regarding Texlon performance under fire conditions. Further technical information is available upon request.

Texlon SV™ technology is a patented solution that allows us to turn any Texlon ETFE panel into a passive smoke vent system.

Acoustics

One of the most underestimated criteria in people's perception of their environment is the acoustic ambience. Irrespective of whether the building is an atrium, a foyer, a leisure pool or a hospital, the internal acoustics of the space has a big effect on the comfort levels of the occupants.

As Texlon cladding is very light, with a mass of less than 1 kg/sqm, it is acoustically soft and does not reflect internally generated noise back to the occupants. This means that the internal environment is considerable more comfortable with lower reverberation times than if the cladding had been constructed from an acoustically hard material such as glass. This is particularly evident on spherical domes or other structures where the focus effect of hard acoustic cladding can make speech almost unintelligible.

This innate feature of Texlon cladding means that cost intensive counter measures such as the integration of acoustic absorbers into the internal walls are usually completely unnecessary. Furthermore, with a sound absorption of less than 10dBA, the Texlon encourages people to linger and spend time in the space due to the increased comfort levels.

Texlon can even be fitted over very noise sensitive areas such as libraries and offices by fitting one of our rain suppressors that are designed to reduce the rain generated noise to below that experienced by conventional transparent cladding systems.

Portfolio

Vector Foiltec have completed over 300 ETFE projects worldwide totalling over 500,000sqm. A selection of our feature projects is listed below.

If you require further information about any of these projects or other ETFE projects, please contact us.

Commercial:

Lacon House
Adastral House
Sainsbury PLC Headquarters
Vodafone World Headquarters
Braun Headquarters
Festo Technology Centre
Festo Paris
Her Majesty's Treasury, London
Michaelsen Walkway
Orange Operations Centre
Adshel Headquarters
Solarlux Showroom
DomAquaree Berlin
Oval am Basler Platz
South Cambridge District Council
Festo Budapest
Jean Paul Gaultier
RTL II
MetroCentre Gateshead
Festo Rohrbach
The Mall, Athens

Residential & Zoological:

Hannover Live! 2000
Burger's Zoo - Arnheim
Avifauna
Dresden Zoo
Paignton Zoo Aviary
Hannover Regenwald
Eden Project
Wildscreen World @ Bristol
Bishops Avenue
Copenhagen Seed Silo (Frosilo)
Komodo Dragon Enclosure
Kiel Youth Hostel
Gerdauring 25, Hamburg
Sandtorkai Hafencity, Hamburg

Sport & Leisure:

Splash Landings, Alton Towers
Bad Schmiedeburg Swim Complex
Bahia Swim Centre, Bocholt
Hannover Fair
Hampshire County Cricket Club
Hampshire Tennis & Heath Centre
Nemo Magdeburg
MCC Lords Shop
Kapuzinercarrée
Gießhalle - Landschaftspark Duisburg
Elypso Deggendorf
Atlantis Water Park
Massanutten Aquatic Center
Beijing National Aquatic Centre
Six Flags Great Escape

Medical & Educational:

Chelsea & Westminster Hospital
Bishop Brown School
Magna Science Centre
Earth Science Centre
Duales Pavilion - Hannover Expo 2000

Travel & Transportation:

Manchester Piccadilly Railway Station
Heron Quay Underground Station
Wembley Park Station

Millennium Point Visitors Centre
University of Hertfordshire - Faculty of
Art & Design
Valencia Ozone Research
Saphir Ozone Research
Cumberland Infirmary
Kings College Hospital
Kingsdale School
Garbsen Special School
OCDEMS
Darwin Centre, Natural History Museum
Art Centre College of Design,
Pasadena
South East Essex College
Life Science Building, Technical
University of Munich
Kensington City Academy
Plappersnut Kindergarten
Swinburne University Atrium

Paris Expo

Other:

Andre Heller - Meteorit
Toyota Egg

Example: Project Portfolio, EDEN PROJECT

Location:

Cornwall, UK

Architect:

Sir Nicolas Grimshaw & Partners

Size:

30,000 sqm surface area

When:

2001

Notes:

In his time, Buckminster Fuller, the great pioneer and mentor of innovative architectural and structural visions, dreamed of roofing over entire cities to create new and exciting living spaces.

Today, Texlon Foil Systems can turn this concept into reality, creating breathtaking indoor spaces, like the Eden Project.

Architect Sir Nicholas Grimshaw sought to create an innovative enclosure for a tropical rain forest and Mediterranean biomes more than 80m deep into a clay pit.

The Eden Project is the world's largest self-supported transparent envelope, with individual panels up to 80 sqm in area. The biomes themselves are made up of 625 hexagons, 16 pentagons and 190 triangles. They contain 667 tonnes of steelwork and enclose 536 tonnes of air. The largest biome could enclose the Tower of London. Over 230 panels are intelligently controlled and operable for ventilation.

The Eden project requires maximum light penetration to ensure optimum plant growth around the year. The Texlon cladding system achieves this objective on three fronts. Firstly, Texlon ETFE is much more light transparent than glass - particularly in the UV spectrum that plants require. Secondly, Texlon ETFE self cleanses under the action of rain. Thirdly, the Texlon cladding system can be manufactured in much greater panel sizes therefore minimising structural shading.