COMPOSITES TECHNOLOGY

CORECORK

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AMORIM CORK COMPOSITES

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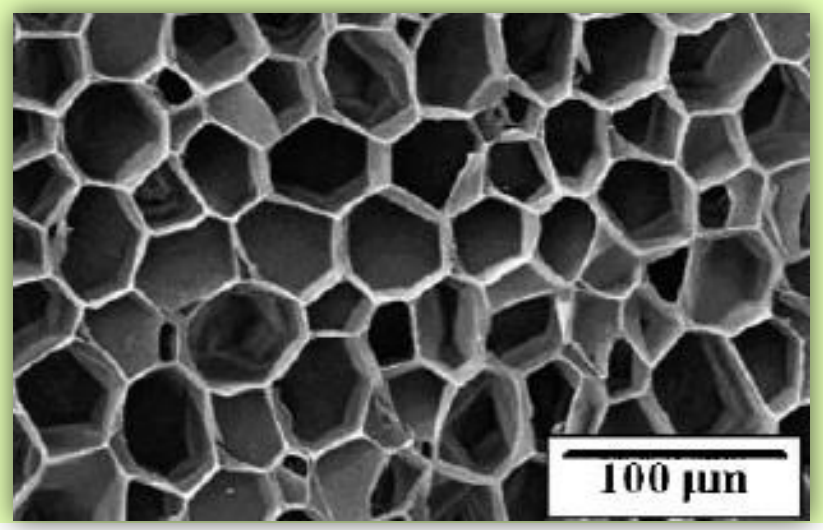
CORECORK

Perfection, by Nature

"Cork is the bark of the Cork Oak tree (*Quercus suber*), is nature's foam, a foam with a unique combination of properties"

In NASA Report.



Cork cells structure

A cork Oak tree being harvested

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Our History

Amorim Cork Composites has been manufacturing and supplying Cork based materials since 130 years, for technical applications.
ACC has a long tracking experience in innovative materials and applications based on cork, expanding the limits of this unique material.

Amorim Cork Composites is part of Amorim Group, world leader in cork products, dedicated to industrial customers, with production sites in Portugal, Spain and the United States.

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Perfection, by Nature

Cork cells are small, irregular pentagonal or hexagonal prisms.
Fifty per cent of cork is an air-like gas enclosed in the cork cells.
Cork retains unique qualities of flexibility, elasticity and compressibility.

Suberin makes the cork cell membrane impermeable and the cell airtight

Main Properties:

- High compressibility
- Low solid fraction
- Air enclosed in the cells has low conductivity
- No convection between cell struture
- Radiation is reduced through the repeated absorption and reflection at the cell walls

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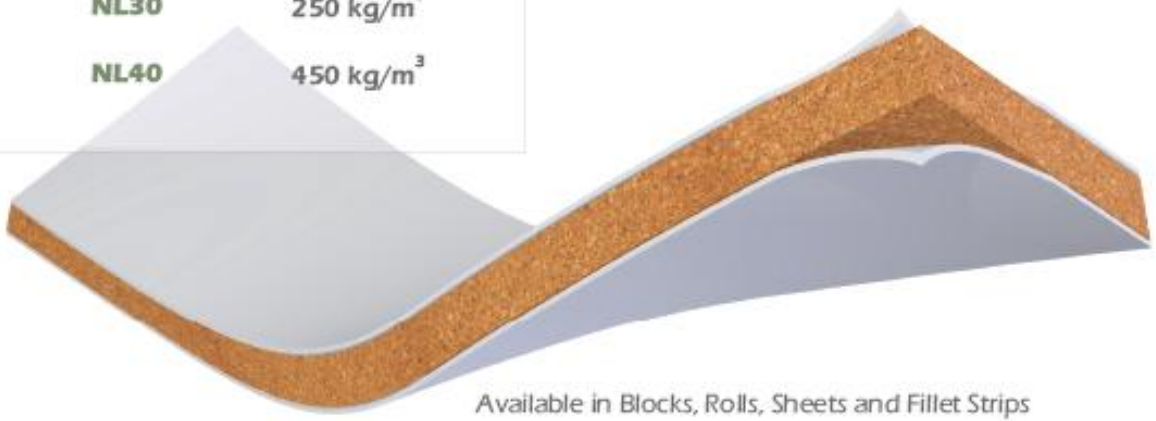
Product range

Cork chemical constituents and structure, make it a material with excellent mechanical properties, maintaining low weight and low thermal conductivity values.

PRODUCTS	DENSITY
NL10	140 kg/m^3
NL30	250 kg/m^3
NL40	450 kg/m^3



Available in Blocks, Rolls, Sheets and Fillet Strips

NL-10

General use lightweight Corecork

NL-30

Higher Mechanical resistance

NL-40

High Temperature and flexible applications

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Product range

Best Good Not available

	Density	Mechanical Characteristics	Thermal	Damping	Sheets	Rolls
NL-10	Best	Good	Good	Good	Best	Best
NL-30	Good	Best	Good	Good	Best	Not available
NL-40	Good	Good	Best	Best	Best	Not available

Main Advantages - Natural

Cork is harvested without harming the trees

Each ton of natural cork fixes about 1,8 t of CO_2

46% of our Amorim's energy needs are supplied by renewable sources

More than 80% of Amorim's wastes are valorized

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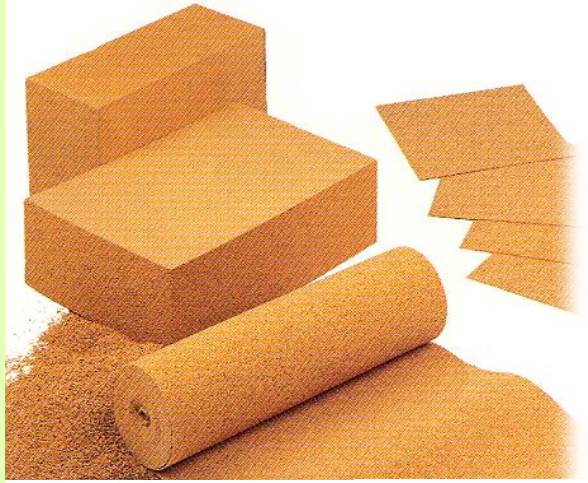
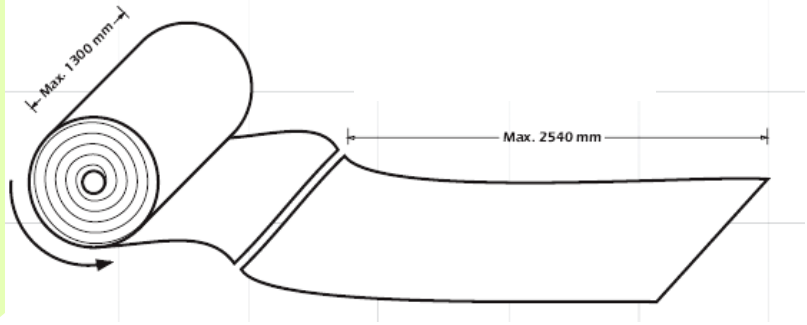
Main Advantages – Flexible Supply

- Materials are made of cork granules and specific binders
- The formulation can be tailored to suit any particular application (fire-proof, anti-fungi, etc.)
- CORECOK is available in Blocks, Sheets, Rolls and Strips
- Dimensions according customer requirements
- Orders shipped worldwide from our two production sites (Europe and North America)





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Main Advantages - Process

Easy to fabricate

Fast operation times without handling damage

Improved cycle times

Savings on resin consuption and high curing temperatures

Compatible to all resins

Suitable for most of the resins (polyester, vinylester and epoxy)

Multiple Processes

Can be used in most of common manufacturing process

Less Waste

Reduced joints and recyclable trimmings

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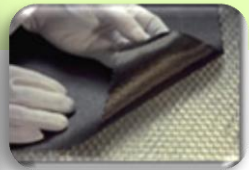
Processes

Best Good Not suitable

	Wet/Hand Lay-up	Vacuum Bagging	Resin Infusion	RTM Resin Transfer Moulding	Prepregs Pre-impregnated	RFI Resin Film Infusion
NL-10	●	●	●	●	●	●
NL-30	●	●	●	●	●	●
NL-40	●	●	●	●	●	●





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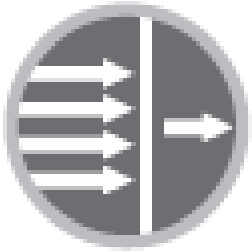
Main Advantages

Design Friendly

Easy to adapt to sharp angles



Acoustic & Thermal Insulation

High loss factor and low thermal conductivity

Compression & Recovery

In an impact situation, will recover up to 85% of the original thickness

Stable material

Low water absorption and wider service temperature range

Eco Design

Designing composites and contributing to nature preservation

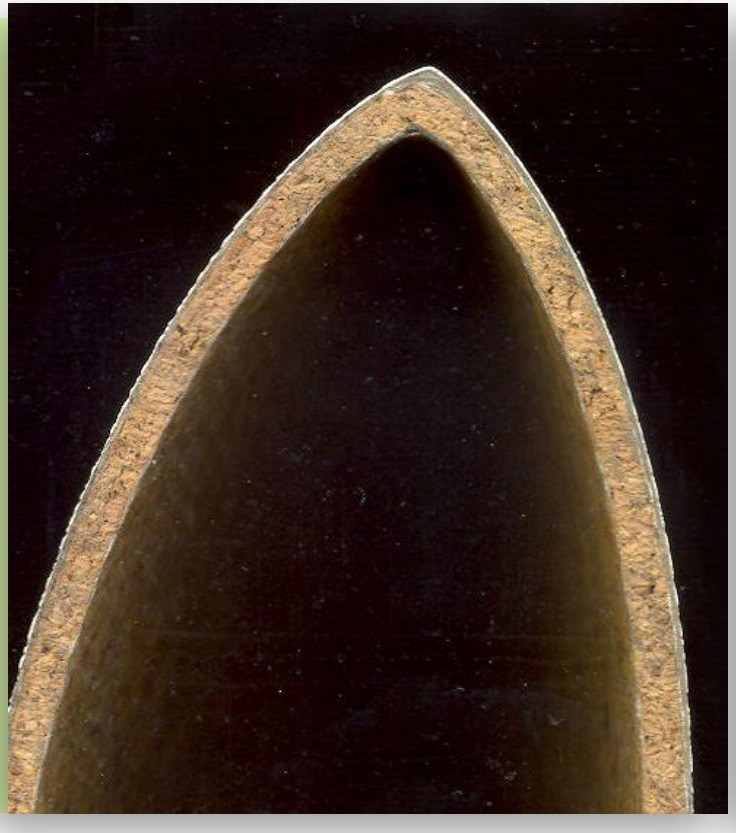
Main Advantages - Product

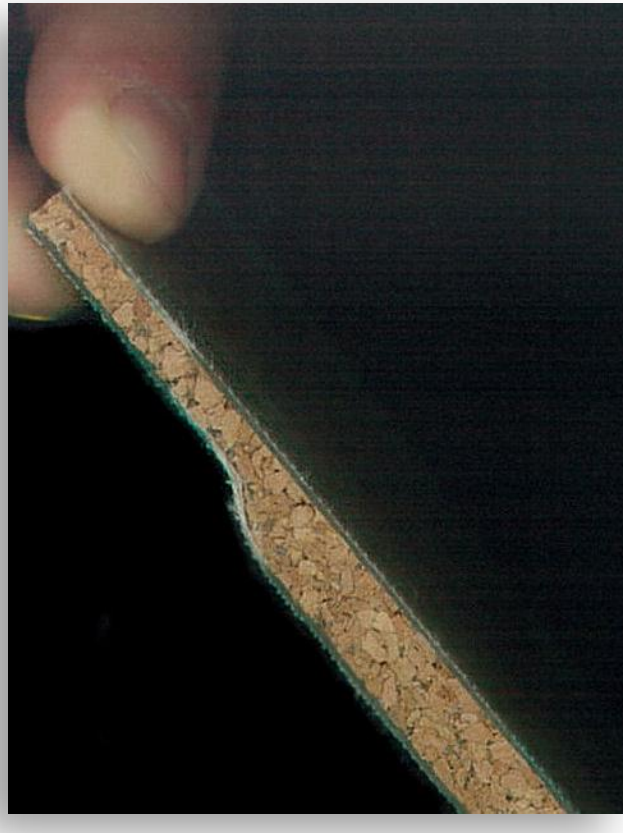
Sheets/rolls:

- Sharp corners made with one single piece of core material

Different thicknesses in the final part:

- Multilayer construction
- Compression moulding





Main Advantages - Product

Fillet strips (Edge strips):

- Machinable to sharp edges
- Excellent bending properties

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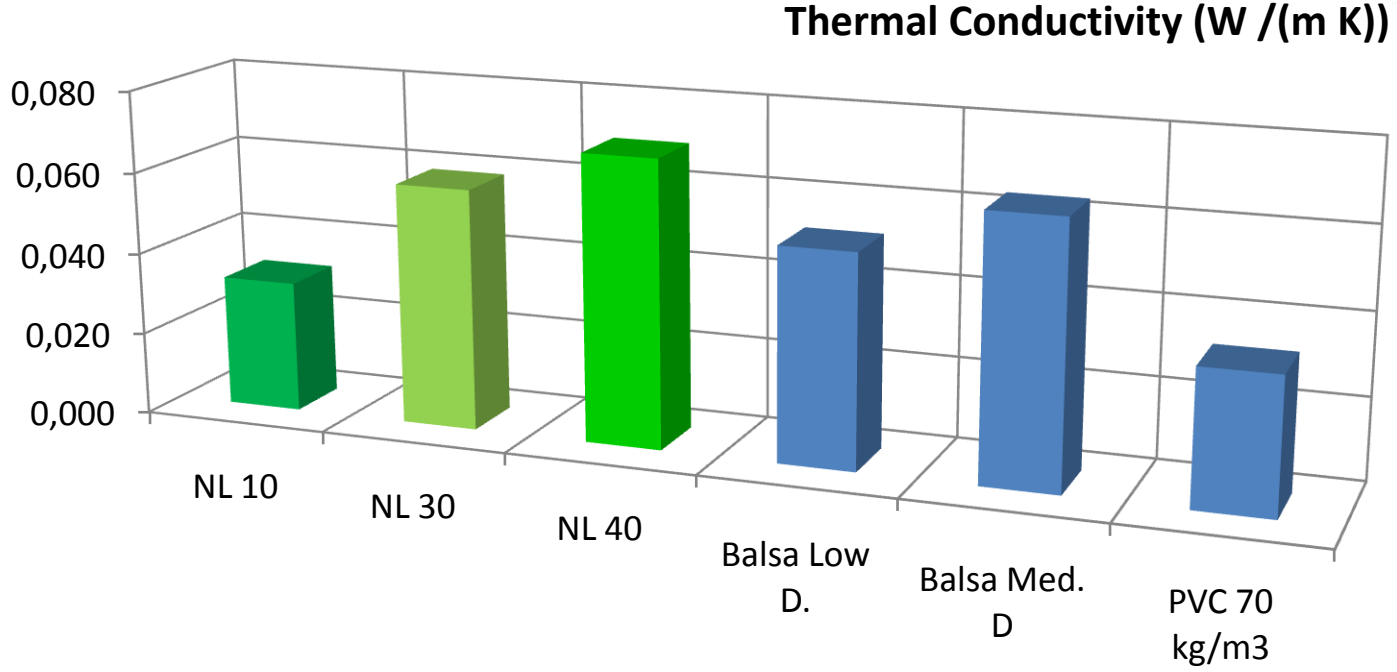
CORECORK products have low Thermal Conductivity values due to it's closed cell structure.



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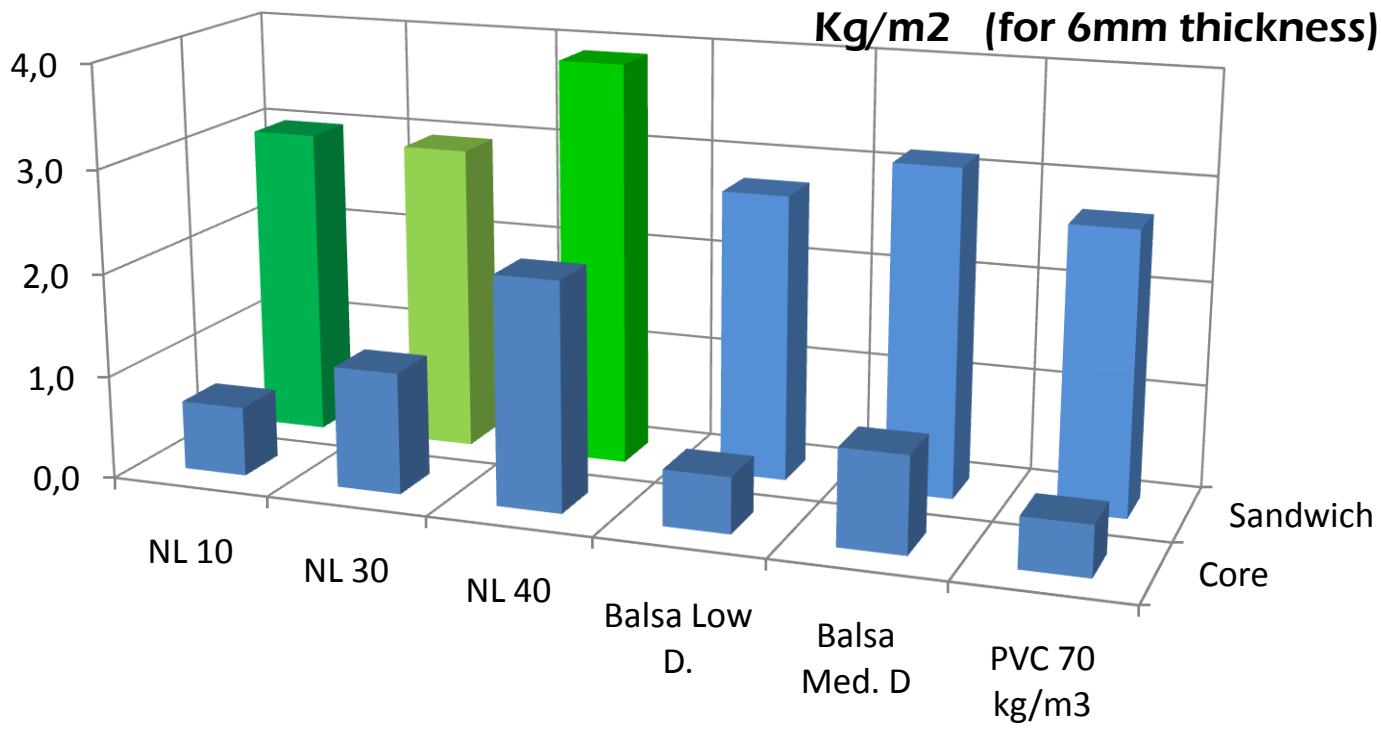
Cork cells have a constant cell dimension and geometry, minimizing resin absorption and resulting in lower sandwich weight and improved performance between core and skin.



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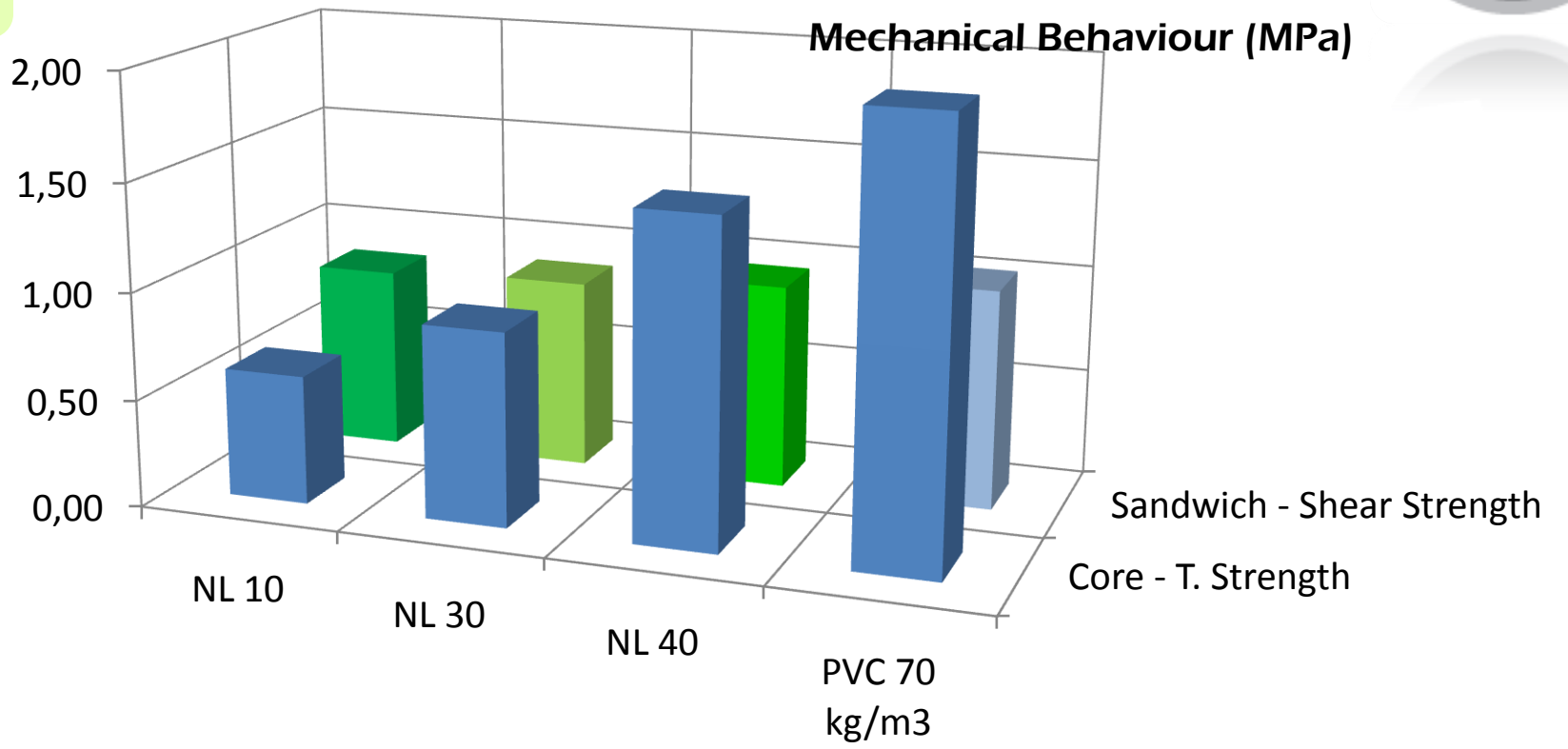
CORECORK material are suited for sandwich constructions, where the final assembly achieves the expected mechanical performance.



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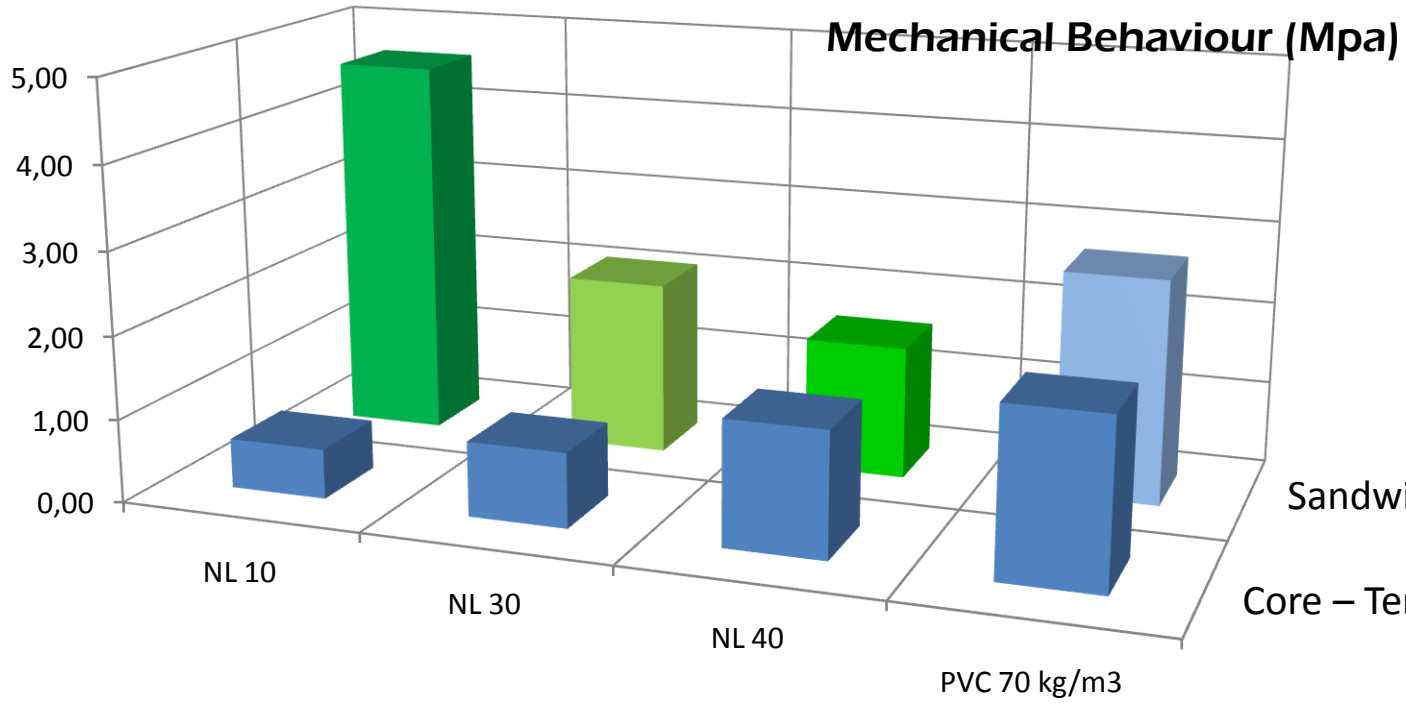
CORECORK product range has an excellent elongation at break value compared with other core materials, result of high resistance against shear and compression loads.



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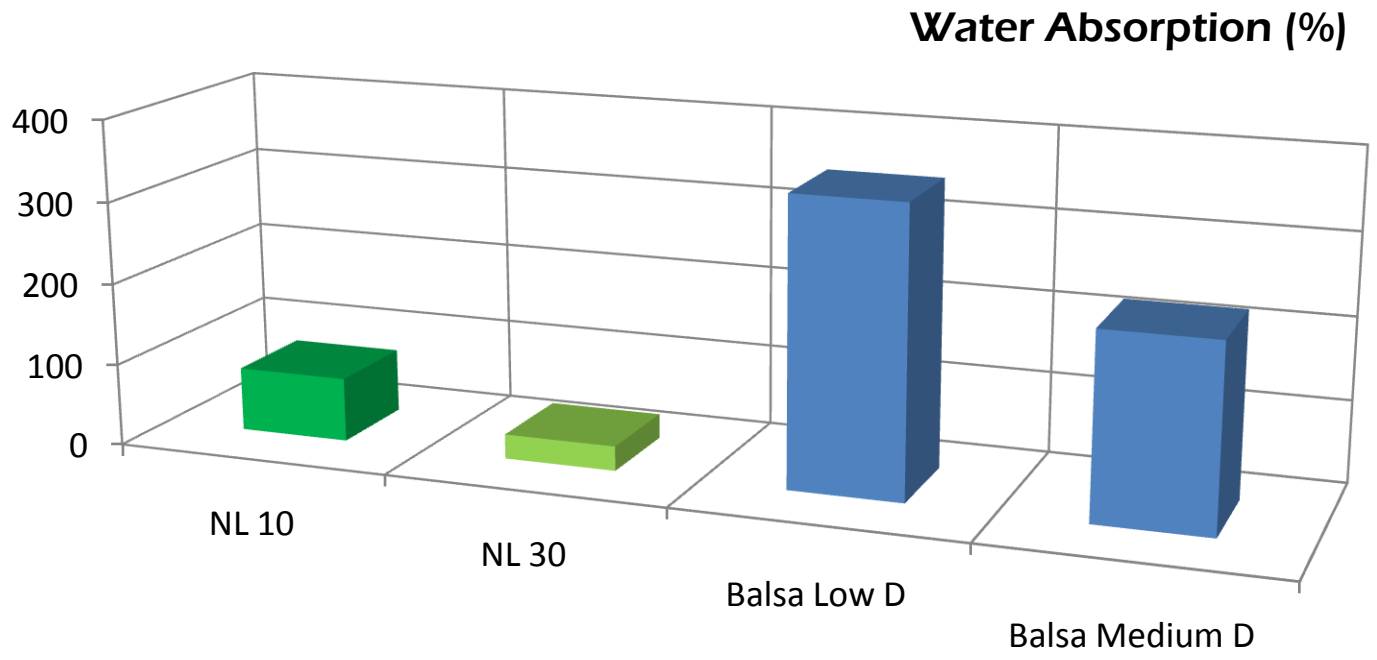
For the naval Industry, operative and environmental conditions need reliable materials. CORECORK almost does not absorb water maintaining it's strength and stiffness.



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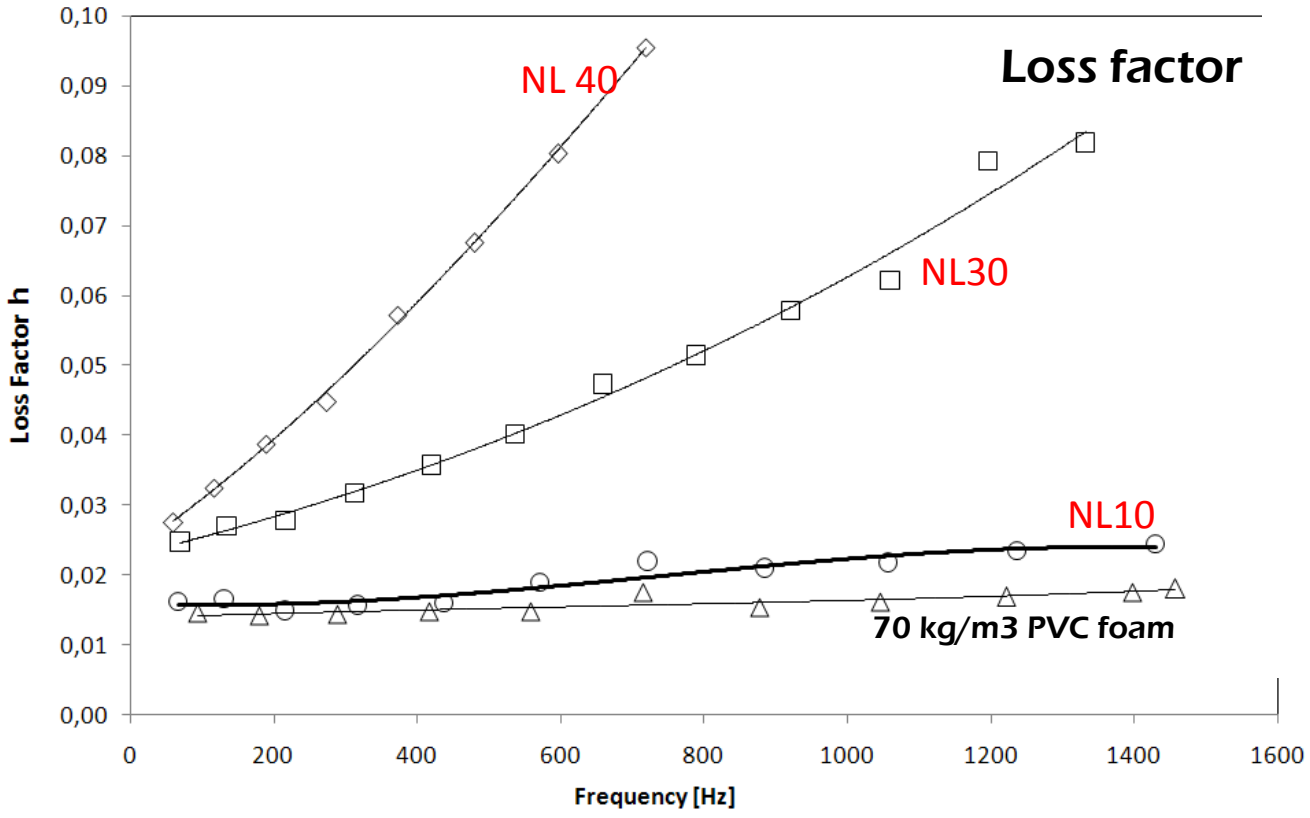
CORECORK materials present excellent damping behavior due to cork's viscoelastic properties, playing a key role in the component vibro acoustic performance.



CASE STUDIES

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CASE I – Touring & Competition Kayaks

- Hand Layup + Vacuum bagging
- Improved manufacturing cycle times (10 to 30%)
- Reduction of environmental impact during production and end-of-life disposal (usage of 60% in volume of natural core material)
- Reduction of total CO_2 emmisions (LCA)
- Reduction of waste disposal costs (-18%)
- Improved work conditions, with no VOC's and HAC from the core material

CASE I – Touring & Competition Kayaks

- CORECORK NL10 is flexible and adapts easily to narrow cavities and sharp radius
- No changes on construction methods
- Fast sheet positioning with easy trimming operation
- Reduced hand lay-up times
- Lower resin usage
- Core waste is 100% recyclable

CASE II – Floating raised floors - Ceramic

- Hand lay up
- Ceramic Tile construction meets High Traffic class
- Replacement of nonwoven fabric
- Improved manufacturing cycle times (25 to 40%)
- Savings of1 kg of resin per 500x500 tile (less 4 Kg per square meter)

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CASE II – Floating raised floors - Ceramic

- Supply of customized CORECORK NL30 pre-cutted kit
- Reduction of waste disposal costs (-14%)
- CORECORK waste is 100% recyclable

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CASE III – Surf Board

- Green surf board
- Superb aesthetics
- CORECORK NL10 blanks with customized length
- Pre-assembled string optional
- Improved impact resistance

CASE III – Surf Board

- Hollow design for weight savings
- Easy CNC machining and sanding operations
- Improved working conditions with much less VOC's and HAC
- Reduction of waste disposal costs (-23%)

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CASE IV – Darrius Windmill

- Hand lay up + Resin Infusion
- Windmill blades designed using CORECORK NL10
- Green, sustainable raw material
- Reduced CO_2 fingerprint, green materials for green energy production
- Faster production cycles
- Very good mechanical properties
- Improved damping behavior with reduction of structural vibration and noise generation

CASE IV – Darrius Windmill

- No delamination even if the surface is damaged
- CORECORK is a long lasting product with no rotting, shrinking and very little water absorption
- Easy to work with
- No danger for the workers in the production (no dangerous dust or VOC's)

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CASE V – Light Aircraft Applications

"AeroCork" main goals:

- To replace up to 20% of the aircraft weight by CORECORK materials
- To replace PVC foams and non-woven fabrics in the manufacturing of the aircraft by CORECORK

Focus on non-critical structural applications

AEROCORK

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CASE V – Light Aircraft Applications

- Seats made by vacuum bagging or by infusion
- Fabric replaced by CORECORK NL10
- Easy contouring and trimming operations
- Weight savings due to less resin uptake
- Structural stiffness improvements (60% less reinforcement ribs)
- Improved manufacturing cycles

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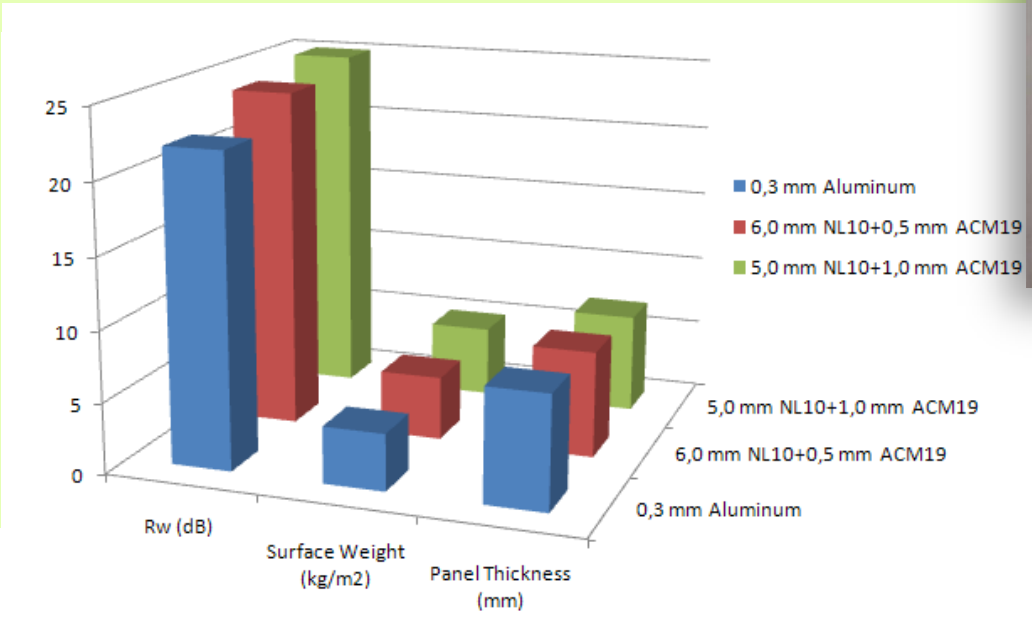
CASE V – Light Aircraft Applications

Fabric strips replaced in winglets by CORECORK NL10

Structural application in the cockpit replacing PVC foam by CORECORK NL10

CASE VI – Aluminium sandwich Panels

- 0,5 mm Aluminium sandwich panels with NL10, NL30 CORECORK & ACM19
- 3 dB reduction of airborne noise isolation
- Improved damping performance
- Panel thickness can be reduced



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TECHNOLOGY
CORECORK

ENVIRONMENTAL RESPONSABILITY

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Environmental Responsability

Several Amorim Divisions are FSC (Forest Stewardship Council) certified. Recent studies in the Iberian Peninsula state that cork oak forest contributes with more than 20 Millions tons of CO_2 sequestration, making it a significant world resource for the environmental balance.

Each time cork is harvested, cork bark regenerates itself. Cork oak trees store CO_2 in order to regenerate, and therefore a harvested cork oak tree absorbs 3 to 5 times more than one which is not harvested, thus benefiting the atmosphere.

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Environmentally Friendly

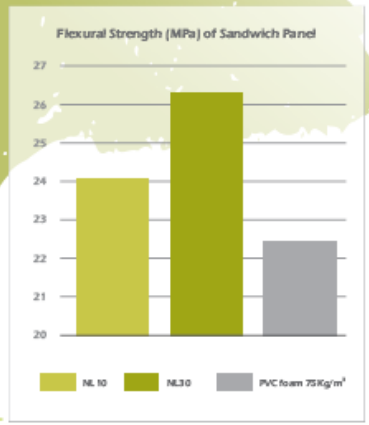
Performance-Driven

CORECORK is the new family of products for the composites industry, made from a renewable resource, sustainable and recyclable with zero waste stream: cork.

DON'T SACRIFICE PERFORMANCE TO GO GREEN

When properly designed, sandwich panels made with **CORECORK** materials will meet the structural resistance needed, but your design will now incorporate up to 85% in volume of natural renewable materials.

Our core materials will improve your productivity by allowing faster manufacturing cycles with less resin usage, reduce waste and VOC/HAP emissions, while contributing definitly to reduce your carbon footprint.

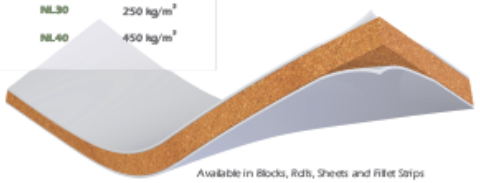


The data provided in this brochure represent typical values. Amorim Cork Composites reserves the right to change the material specification without notice or obligation. This information is not intended to be used as a post hasing specification and does not imply suitability for use in a specific application. Failure to select the proper product may result in either equipment damage or personal injury. Please contact Amorim Cork Composites regarding specific application recommendations. Amorim Cork Composites expressly disclaims all warranties, including any implied warranties or merchantability or of fitness for a particular purpose. Amorim Cork Composites is not liable for any indirect, special, incidental, consequential, or punitive damages as a result of using the information listed in this brochure, any of its material specification sheets, its products or any future use or re-use of them by any person or entity.

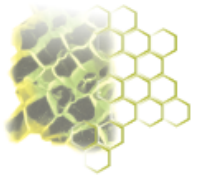
CORECORK

THE TRULY GREEN CORE TECHNOLOGY

PRODUCTS	DENSITY
NL10	140 kg/m³
NL30	250 kg/m³
NL40	450 kg/m³



Available in Blocks, Rolls, Sheets and Fillet Strips



Cork, the bark of the Oak tree it's "nature foam", harvested every nine years.

It's a unique structure of pentagonal or hexagonal prisms in a closed cell arrangement.

PRODUCT DESIGN

Freedom of Design
Easy to adapt to complex surfaces

Acoustic and Thermal Insulation
High loss factor and low thermal conductivity

Compression and recovery
In an impact situation, corecork will recover up to 85% of the original thickness

Stable Material
Low water absorption with wider temperature service range

Eco Design
Designing composites and contributing for nature preservation

PROCESS FRIENDLY

Easy to fabricate
Fast operation times without handling damage

Improved cycle times
Savings on resin consumption and high curing temperatures

Compatible to all resins
Suitable for polyester, vinylester and epoxy resins

Multiple Processes
Can be used in most of common manufacturing process

Less Waste
Reduced joints and recyclable trimmings

Several Amorim divisions are FSC (Forest Stewardship Council) certified. Recent studies in the Iberian Peninsula state that cork oak forest contributes with more than 20 Million tons of CO2 retention, making it a significant world resource for the environmental balance.

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Your Challenge.
Our Cork Solution.

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NL10

CORECORK NL-10 is a composite core material made from controlled density cork granules and specific binder. The cork closed cells have a natural honeycomb structure offering low density, high compressibility and excellent recovery characteristics.

When properly designed, FRP made with this core material will meet or exceed the performance of similar FRP's made with non sustainable materials.

POSSIBLE APPLICATIONS INCLUDE:

- ✓ Sports equipment
- ✓ Marine construction
- ✓ Industrial applications
- ✓ Building Industry
- ✓ Aeronautics

PROPERTY	STANDARD	VALUE
Density@20ºC (Kg/m³)	ASTM C271	140
Compressive Strength (MPa)	ASTM C365	0,16
Compressive Moduls (MPa)	ASTM C365	51
Tensile Strength (MPa)	ASTM C297	0,6
Shear Strength (MPa)	ASTM C273	0,85
Shear Modulus (MPa)	ASTM C273	5,9
Thermal Conductivity (W/mK)	ASTMC C377	0,032
Nominal Moisture Content (%)	ASTM D4444	6
Water Absorption Testing (%)	ASTM C272	78
Coeffident Linear Expansion (ζ x 10⁻⁶/K)	DIN 53752	5,6

Standard Tolerances

SHEETS			
Lenght	+/-	1	%
Width	+/-	1	%
Thickness			
Maximum Thickness		200	mm
Up to 20mm	+/-	0,1	mm
20 to 40mm	+/-	0,2	mm
40 to 100mm	+/-	0,3	mm
100 to 300mm	+/-	0,5	mm
above 300mm	+/-	1,0	mm

STANDARD DIMENSIONS FOR SHEETS	mm	1000 x 500	1000 x 1000	1000 x 1500
NL 10		•	•	•

• Standard dimension

CORECORK product range is free of:

- PVC (Poly Vinil Chloride)
- Heavy Metals (Pb, Cd, Hg and Cr(VI))
- Polycyclic Aromatic Hydrocarbons (PAH)
- Formaldehyde, and comply with RoHS and ELV 2000/53/EC.

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Your challenge.
Our Cork Solution.

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