LET’S TALK / PULTRUSION
That is why engineering companies, architects and manufacturers of structural parts are choosing to use composite profiles and components for their designs. These components can be easily manufactured through pultrusion processes and assembled into structures that are stiff and strong, while they do resist the toughest environments.

PERFORMANCE THAT LASTS
Traditionally industrial installations like chemical processing plants and offshore platforms were constructed with steel profiles and gratings. Yet painted steel is not resisting well corrosive chemicals and seawater, so increasingly composite profiles are being used. Engineers know that composite structures can better survive harsh conditions, resulting in continued process safety and minimized maintenance cost. Moreover, installing these lightweight materials is easy and requires lighter equipment.

CUSTOMIZED SHAPE
Architects want to design a unique building that is aesthetically pleasing, while it is providing the right functionality and comfort to the final user. Composite profiles and panels have the capability to be manufactured in unique shapes. Combined with the inherent thermal insulation and their high mechanical strength, composites enable creating a great and energy-efficient living environment. Consequently, both for commercial and residential construction composite materials are becoming increasingly popular.

STRENGTH AND STIFFNESS
Manufacturers of large parts like windmill blades, boats, public transportation vehicles, and cable assemblies often require composite components to provide additional structural integrity. Here again, weight savings, dimensional stability, low thermal expansion, and the benefit of integrating multiple functions into one make composites an ideal choice for continued performance.
ENVIRONMENTALLY SOUND

In many cases solutions based on composite materials provide a substantial reduction in carbon and/or Eco-footprint. Composite benefits like ease of part manufacturing, low maintenance, and light weight during use or installation greatly contribute to this result. It has been demonstrated that composites can be easily recycled through co-processing in cement manufacturing, representing a sound end-of-life solution at the end of a life of great performance.
Performance & Innovation

Continued operation and minimized maintenance. Cooling tower (courtesy Fiberline Composites)
Peace-of-mind on concrete strength and stability through reinforcement with composite rebars (courtesy FiReP)

Surface cladding for renovation existing buildings: Coathouse, Kolding (courtesy Fiberline Composites)

Copper wire embedded in carbon fiber reinforced pultruded rods for use in Offshore (courtesy Vello Nordic AS)

Approach lighting system Schiphol Amsterdam airport (courtesy Exel Composites)

Sorig® Glide sliding door from Alu-System, manufactured from slim and high strength composite profiles (courtesy Alusystems and Fiberline Composites)

Peace-of-mind on concrete strength and stability through reinforcement with composite rebars (courtesy FiReP)
PLAYING AN ACTIVE ROLE
By providing innovative technology and materials already for many years, Aliancys has a long history of demonstrated market leadership in the field of pultrusion. Aliancys is pushing the limits of the use of pultrusion with respect to performance, system cost and sustainability. In addition, working with engineers, architects and end customers, Aliancys is actively involved in developing new business in novel markets and applications.

NEW PRODUCT INTRODUCTIONS
With the broadening use of composites in construction and industrial applications, Aliancys has been at the forefront of introducing new resin systems for pultrusion manufacturing processes. These include systems for high speed manufacturing, solutions for use with glass and carbon fibers, low profile systems for superior surface finish, and solutions that can operate in elevated temperature environments.

INCREASED SUSTAINABILITY
Since many years Aliancys has lead the composite industry through introducing products and solutions that combine great performance and environmental benefits. Specific examples include solutions that do not contain styrene as reactive diluent, resins that partly consist of bio-based raw materials, and systems that avoid the use of cobalt accelerators.

GLOBAL SUPPORT CAPABILITIES
Aliancys has 2 R&D centers supporting customers in pultrusion applications, one based in Zwolle (Netherlands) and one in Nanjing (China). Both have state-of-the-art equipment and support facilities, including pultrusion machines (identical type in Zwolle and in Nanjing for global consistency), mechanical property testing capabilities, and an analytical laboratory. For physical property testing equipment like dynamic mechanical analysis (DMA) and differential scanning calorimetry (DSC) is available. In addition, Aliancys has a team of technical experts on the road that can support customers either at their site or at end-customers.

COMPOSITE RECYCLING
Aliancys can help you in finding appropriate outlets for composite end-of-life waste. Together with European composites branch organization EuCIA and cement manufacturer Holcim, Aliancys has been actively involved in the development of solutions for composite recycling through cement co-processing. It has been confirmed that partially replacing coal and raw materials by glass-reinforced composites can result in a significant reduction of the carbon footprint of cement clinker manufacturing.

SUPPORT IN LIFE CYCLE ASSESSMENT
Solutions based on composite materials can often provide a lower carbon footprint or Eco-footprint compared to solutions based on traditional materials like steel, aluminum and concrete. Aliancys has access to the right experts for performing LCAs.
Comparison of windows made in composites and in aluminum. Composite solution has a significantly lower Eco-footprint.
VINYL ESTER RESINS

Vinyl ester resins are most commonly used in industrial applications, especially when the composite part is exposed to aggressive media for a prolonged period of time. Aliancys has performed detailed studies investigating the chemical resistance of Vinyl ester resins. These are documented in Aliancys’ Chemical Resistance Guide.

Atlac® 430 is a medium reactive vinyl ester resin known for its superior alkaline resistance. The resin is also very suitable for use in combination with carbon fiber. Atlac® 590 is a high heat resistant resin, which has good solvent resistance. Atlac® E-Nova FW 2045 is a vinyl ester urethane with very good wetting properties and superior solvent resistance.
DARON® HIGH PERFORMANCE RESINS
Daron® resins feature very good compatibility with a variety of fibers, typically independent of sizing type. Consequently, Daron® resins are used in high end applications with demanding requirements. Daron® 45/B38 is a high reactive resin system with a very high Tg. This makes it very suitable for critical applications that require high temperature resistance. Both resins show very good compatibility with multiple fibers and therefore are very suitable for use in advanced composites with carbon fibers. Daron® resins can be processed at very high speed, yielding significant increases in process output and a reduction in process cost.

FOOD CONTACT
For food contact applications Aliancys has two resins available produced in line with GMP (Good Manufacturing Process). Palatal® A 400-01 FC is a medium reactive isophthalic resin, very suitable for production of highly complicated profiles. Atlac® 5200 FC is a vinyl ester resin with good fiber wetting and high chemical resistance.

IMPROVED SURFACE QUALITY
Palapreg® P 0423-02 is a resin especially developed to create very good surface quality of composite components, when used in combination with Aliancys’ low profile and/or low shrink additives. It is very suitable for Automotive and Transport applications with demanding surface quality specifications.

FIRE RETARDANT CAPABILITY
Synolite™ 5011-N-1 is a resin dissolved in methacrylates. When used in combination with ATH (in high filler loads) composite components with excellent fire retardant properties can be obtained. In addition, because of the high reactivity higher pultrusion speeds are typical.

INCREASED TOUGHNESS
Synolite™ 4120-N-1 is a resin with a very high elongation at break at room temperature. It can be mixed in with other resins in order to increase total system toughness.

DCPD RESINS
DCPD resins are very suitable for high filler and high glass loadings, because of their great wetting properties. Aliancys’ most frequently used DCPD resin for pultrusion is Synolite™ 0175-N-7. Thanks to this high reactivity, pultrusion speeds are very high with conventional curing systems.

ORTHOPHTHALIC RESINS
Orthophthalic resins are the most commonly used resins type in pultrusion, with a good price/performance ratio. Palatal® P 69-02 combines high elongation at break in combination with very good fiber wetting properties. Synolite™ 2155-N-1 is a high reactive resin that can be used for making high surface quality panels in combination with fillers and LPA additives, like Palapreg® H 880-01.

ISOPHTHALIC & ISO/NPG RESINS
Isophthalic and Iso/NPG resins are mainly used in outdoor applications because of their excellent resistance to weathering. Water absorption is low and with these resins also a very good surface quality can be obtained.

Synolite™ 0152-N-2 is a medium reactive, UV stabilized resin, developed for production of high surface quality panels used in outdoor applications. Synolite™ 1717-N-1 is a medium reactive, high temperature resistant resin with very good resistance to water, acids and hydrocarbons. Palatal® A 410-01 is an Iso/NPG resin with superior water, acid and hydrocarbon resistance (medium reactive).

PERFORMANCE AND VERSATILITY
Aliancys has a wide variety of resin solutions available to help you develop great products in a many end-use applications. Evidently the selection of the right resin depends on the application targeted and on the desired performance requirements. Please contact your Aliancys Sales or Technical Service representative to support you in this process.
### PHYSICAL PROPERTIES OF KEY ALIANCYS PULTRUSION RESINS

<table>
<thead>
<tr>
<th></th>
<th>UNIT</th>
<th>TEST METHOD</th>
<th>DARON® GS/836</th>
<th>PALATAL® A400-01/PC</th>
<th>ATLAC® 5300-0°C</th>
<th>SYNOLITE™ 0120-N:1</th>
<th>SYNOLITE™ 0135-N:2</th>
<th>PALATAL® A400-01</th>
<th>ATLAC® 440</th>
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<tr>
<td>SOLID CONTENT</td>
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<td>55-58</td>
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<td>260-290</td>
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**TM 2253:** 100 g resin + 2 g Perkadox® CH50L

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*Can’t be measured in test method
MECHANICAL PERFORMANCE OF UNIDIRECTIONAL E-GLASS STRIP, FIBER VOLUME FRACTION 74%

Flexural strength, MPa (ISO 14125) | ILSS, MPa (ISO 14130) | Flexural modulus, GPa (ISO 14125)

MECHANICAL PERFORMANCE OF UNIDIRECTIONAL CARBON FIBER STRIP (VE Sized), FIBER VOLUME FRACTION 71%

Flexural strength, MPa (ISO 14125) | ILSS, MPa (ISO 14130) | Flexural modulus, GPa (ISO 14125)
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