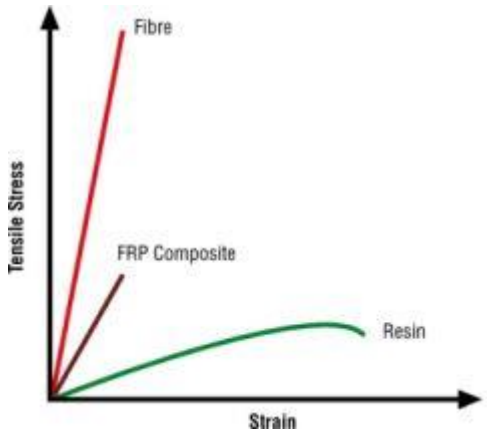
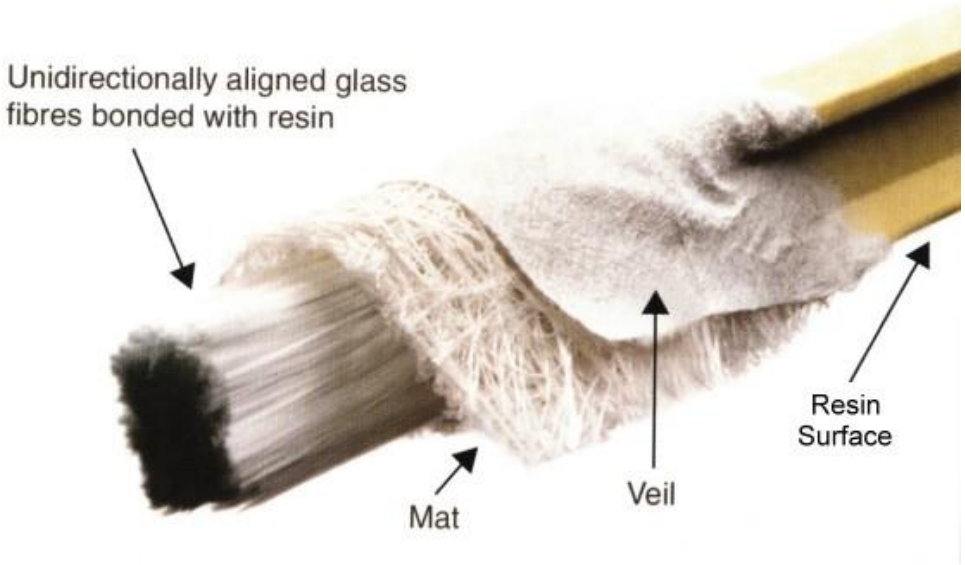
DEFINITIONS

“An advanced material technology that combine two or more materials of different properties and characteristics to produce a superior material properties of those materials on their own”





COMPOSITES

FIBER (REINFORCEMENT)

GLASS FIBER

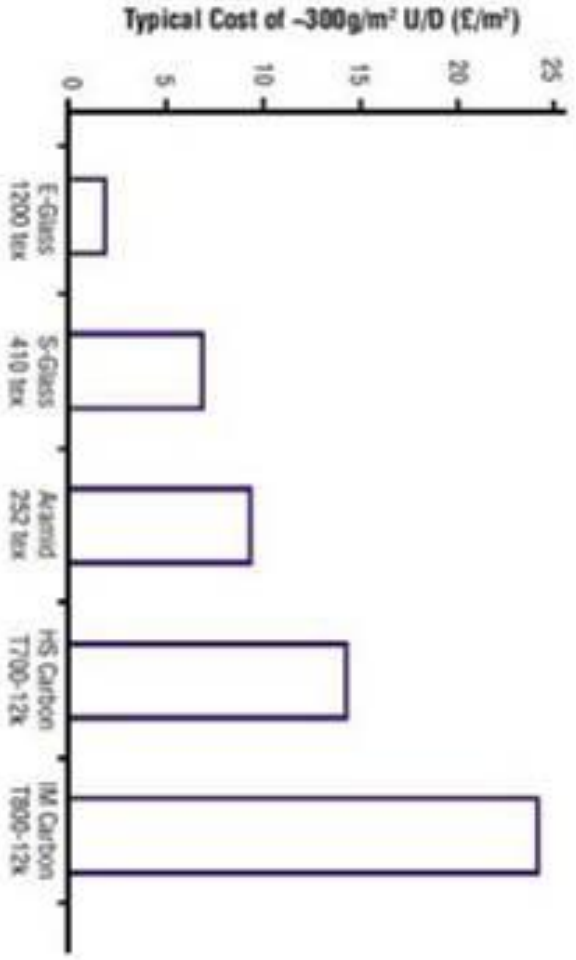
Low cost reinforcement for general application. Widely used in corrosion resistance.

ARAMID FIBER

High end impact absorption application such as ballistic protection

CARBON FIBER

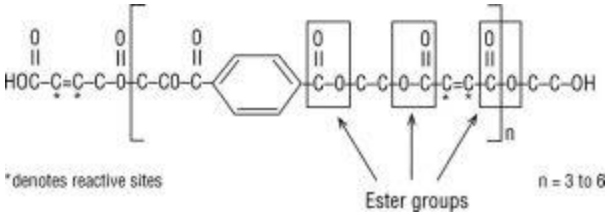
High end low weight high strength application such as structural reinforcement and aerospace parts



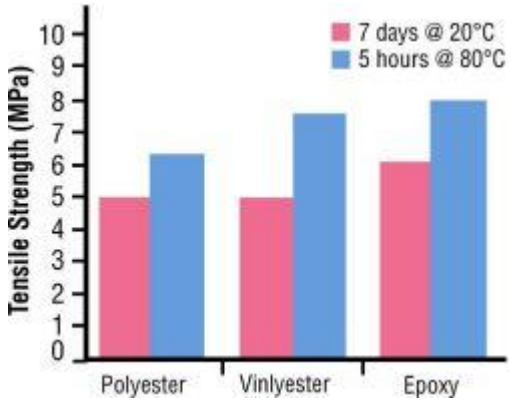
COMPOSITES

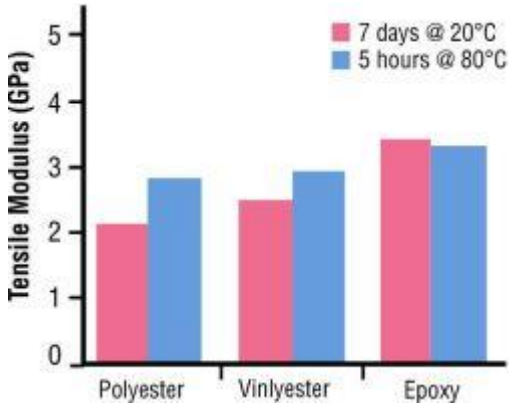
RESIN (BINDING MATRIX)

“ Resins is a polymer based material that bind the reinforcement i.e. fibers. ”



RESINS	APPLICATION
POLYESTER	General corrosion resistant application.
VINYLESTER	Heavily corrosive environment
EPOXY	High strength and fire rating performance

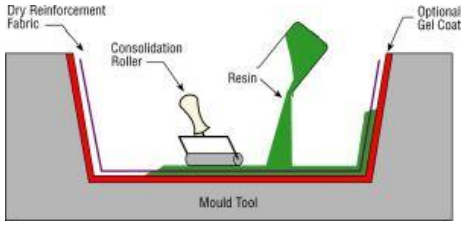


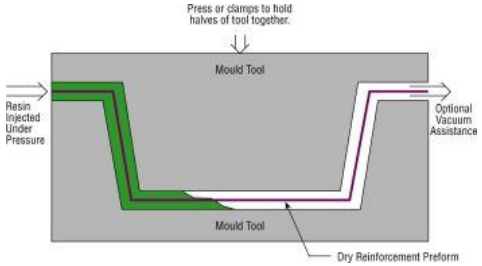


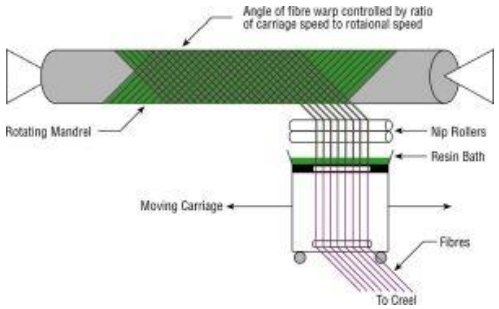
PROCESSING

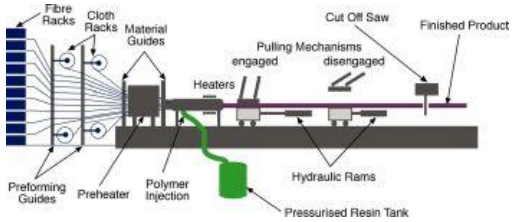
> “Various processing method to suit end product design and properties requirements”

PROCESS	APPLICATION
OPEN MOLD	Economic processing method for non-structural or tolerance critical application
CLOSE MOLD	Complex 3-dimensional requirements with close tolerance
FILAMENT WINDING	Tubular high pressure rating application such as pipe.
PULTRUSION	Profile based end product









COMPOSITES

BENEFITS

- CORROSION RESISTANT *Unaffected by a wide range of corrosive chemicals and environments. Minimal maintenance costs.*
- HIGH STRENGHT, LIGHT WEIGHT *Density of composite is 20% of steel and 60% of aluminum. Higher performance at less weight costs.*
- MAINTENANCE FREE *Non corrosive. No repainting cost.*
- DIMENSIONAL STABILITY *Stretch-, warp-, and swell-resistant over a wide range of temperatures and physical stresses. Close tolerances*
- THERMAL INSULATION *Low thermal conductivity rating of 1/250 of aluminum; 1/60 of steel. No condensation problems*
- HIGH DIELECTRIC STRENGHT *Excellent electrical insulating properties. Non conductive.*
- DESIGN FLEXIBILITY *Many individual components can be combined into one large profile. Reduced assembly costs.*
- THEFT FREE *ZERO recycle value. Help reduce theft for public facility and infrastructure i.e. signage*

COMPOSITES

TYPICAL PROPERTIES COMPARISON

PROPERTY	COMPOSITE PULTRUDED GRP/PE	CARBON STEEL (M1020)	STAINLESS STEEL (316)	ALUMINUM (6061-T61)	RIGID PVC	PONDEROSA PINE (WOOD)
Tensile Strength (ksi)	**30.00** (axial) **7.00** (transverse)	**60.00**	**80.00**	**45.00**	**6.20**	**0.42**
Tensile Modulus (Msi)	**2.60** (axial) **1.00** (transverse)	**30.00**	**28.00**	**10.00**	**0.39**	-
Flexural Strenght (ksi)	**30.00** (axial) **10.0** (transverse)	**60.00**	**80.00**	**45.00**	**11.00**	**15.40** (axial) **9.40** (transverse)
Flexural Modulus (Msi)	**2.20** (axial) **0.80** (transverse)	**30.00**	**28.00**	**10.00**	**0.35**	**1.00**
Izod Impact (ft-lb/in)	**25.0** (axial) **4.0** (transverse)	**N/A**	**8.5-11.0**	-	**1.6**	-
Density (lb/in2)	**0.062-0.070**	**0.284**	**0.290**	**0.092**	**0.052**	**0.019**
Thermal Conductivity (Btu/ft^2/hr/^{o}F/in)	**4.0**	**260-460**	**96-185**	**1200**	**1.3**	**0.08**
Coefficient of Linear Expansion (10^{-6} in/in/^{o}F)	**4.4**	**6-8**	**9-10**	**13.5**	**37.0**	

COMPOSITES

MARKET AREAS

> “As a material driven indsustry, application of composites are not only limited to certain sectors, but limited to designers imagination and capability”

- AUTOMOTIVE *Front end, fender, doors, rocker cover, tail gate, etc.*
- MARITIME *Boat, jetty, sheet pile, etc.*
- INFRASTRUCTURE *Bridges, railing, grating, pipe, façade & facia facelift, lighting poles, signage, shed, mosque dome, etc.*
- AEROSPACE *Body parts component.*
- MILITARY *Ballistic protection, missile launcher, etc.*
- CORROSION RESISTANT *Water treatment infrastructure, Jetty infrastructure, offshore platform, etc..*
- ELECTRICAL *Feeder pillar cabinets, insulation, doors, cable management system, etc.*
- OTHERS

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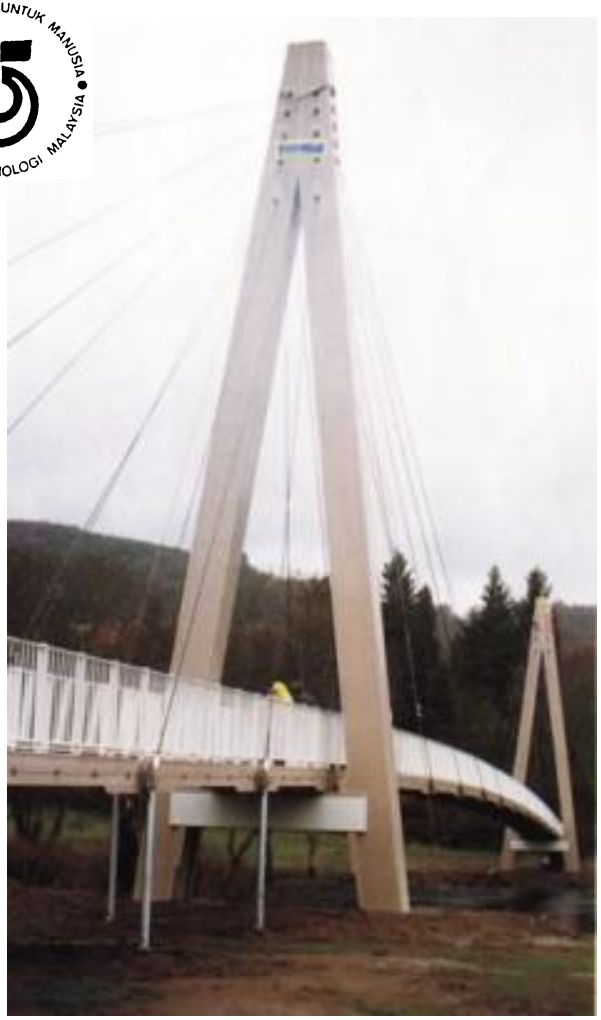
COMPOSITES

PEDESTRIAN BRIDGE APPLICATION



ABERFELDY, UK

The Laroin footbridge is the very first in France to use carbon-fibre composites.

LAROIN, France

WASHINGTON NATIONAL PARK, US

COMPOSITES

VEHICLE BRIDGE

KOLDING, Denmark

Steel flange beams were replaced by pultruded FRP beams, reinforced with carbon fibres in the flanges to increase stiffness to over 6 million psi, in this bridge upgrade in Blacksburg, Virginia.

“ KOLDING bridge is all composite apart from the nuts ”

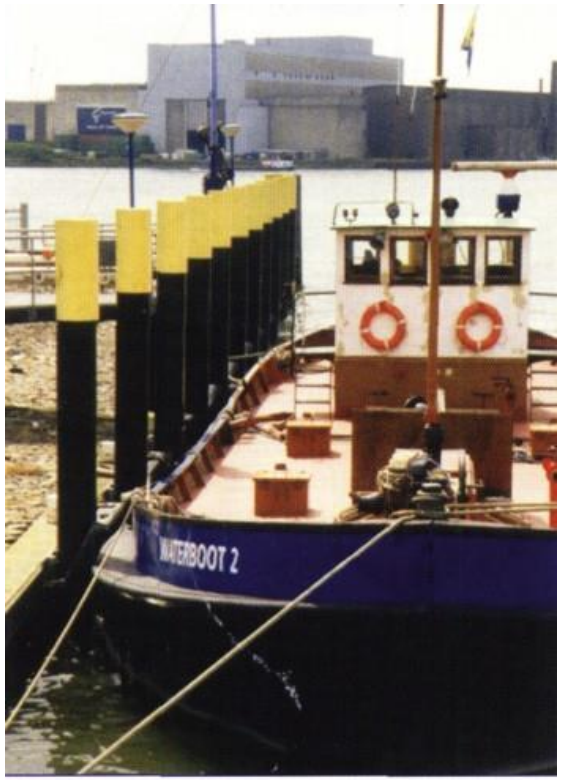
and bolts holding it together

COMPOSITES

MARINE PILE & SHEET PILE

Complete composite sheetpile installation, including SuperLoc™ sheetpile and composite top cap. (Picture courtesy of Creative Pultrusions.)

Navy pier structure made using pultrusion. (Picture courtesy of Owens Corning: www.owenscorning.com.)



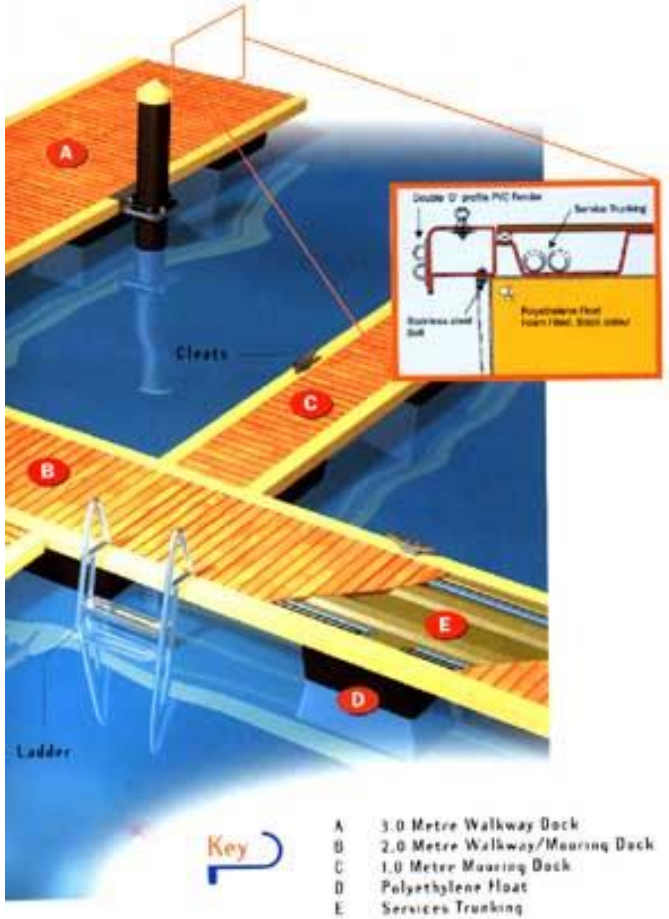
Composite piling being used for a dock installation in Rotterdam. (Picture courtesy of Seaward International/PC Jansen Marine Agencies.)

“ Excellent corrosion resistant properties put composites as the most preferred material choice ”

in marine applications

COMPOSITES

MARINE JETTY



"The Composite Dock System incorporates an intrinsically strong and stiff structural twin box composites beam platform design which takes advantage of the incomparable strength and non-corrosive nature of the material to provide the best possible performance in terms of endurance and resistance to the harsh and unforgiving marine environment."

OTHER APPLICATIONS

FRP light poles and GRP shading and seating at Jeddah Corniche, Saudi Arabia.

Suspended Access platform made of Pultex® standard structurals and Supergrate™ grating.
(Picture courtesy of Creative Pultrusions.)