
ADVANCED
COMPOSITE
TECHNOLOGIES
KORDSA
THE REINFORCER

KORDSA

THE REINFORCER

KORDSA THE REINFORCER

About Kordsa

Founded in 1973 as a Sabancı Holding subsidiary, Kordsa today is a global player in tire and construction reinforcement, composite technologies, and compounding. Kordsa operates in 4 continents, 7 countries, Turkey, Brazil, Germany, Indonesia, Thailand, Italy, and the U.S. with more than 5,000 employees. By offering high-value-added, innovative reinforcement solutions, Kordsa aims to create sustainable value for its customers, employees, stakeholders, and communities with a vision to "Reinforce Life."

Reinforcing 1 out of every 3 automobile tires and 2 out of every 3 aircraft tires in the World with its tire reinforcement technologies, Kordsa is now in a position to reinforce landing tracks of aircraft with its construction reinforcement technologies, and aircraft fuselage, engine, wings, and interior with its composite technologies. Providing environmentally friendly products in the tire industry that reduce fuel consumption and provide better-wet grip, Kordsa develops technologies that allow for vehicle light weighting, performing with lower fuel consumption and lower carbon emissions in the composite industry. With its more durable and practical reinforcement solutions for infrastructure and superstructure projects in the construction reinforcement industry, it offers a unique touch to every aspect of life.

R&D and innovation are an integral part of Kordsa's corporate culture. Kordsa's first R&D center, established in Izmit in 2007, serves as an innovation center for tire and construction reinforcement technologies for both the global and Turkish markets. Kordsa's second R&D center is in the Composite Technologies Center of Excellence (CTCE) with Sabancı University which brings R&D, innovation, and production together under one roof. CTCE, one of the very few test centers globally, hosts basic and applied research, prototype production, technology and product development, entrepreneurship, and production processes as well as researchers, designers, engineers, production process managers and workers, PhD students, post-doctoral fellows, faculty members, and incubation center entrepreneurs. With an open innovation approach, Kordsa cooperates with several universities and institutions, thus extending its R&D and innovation efforts to develop technologies that create differences and value.

GLOBAL PLAYER OF COMPOSITE TECHNOLOGIES

ADVANCED COMPOSITE MATERIALS WITH INNOVATION

High-Temperature Materials Center

Sole Supplier of Oxide-Oxide Ceramic Matrix Composites (CMC) Prepregs

Aesthetic & A-Class Surface Prepregs

Tailoring Resin Chemistry Upon Customer Demand

Pioneer in Open Innovation

- 1973 Tire
- 2014 Composite
- 2015 Construction
- 2019 Thin Films & Flexible Electronics
- 2021 Compounding

CompositeTechnologies Center of Excellence

-Cooperation with Universities & Institutions

-Certificated EcoSystem with AS9100

Green Chemistry for Aerospace Interior & Railway Applications

Kordsa develops innovative and unique intermediate products and applications for composites technologies for a variety of industries, notably aerospace, aircraft interior, urban air mobility, automotive, motorsports, railway interiors, marine, medical, sports & leisure, life protection as well as industrial applications.

Aerospace

With great experience, our experts continue to innovate and optimize material solutions supporting our customers throughout the entire development cycle, from design and certification to production industrialization. Kordsa offers FST prepregs, high precision narrow width slit tapes, Nomex honeycomb sandwich panels and adhesives for special needs of our customers in the aircraft interior and urban air mobility (UAM).

Automotive & Railway

50 years of expertise in automotive industry in the reinforcement technologies places Kordsa's composite materials at the core of auto manufacturers needs to develop sustainable and efficient mobility systems.
Kordsa provides high-performing solutions, extensive knowledge and exceptional customization to facilitate current and next-generation automotive and railway applications. Our product portfolio is designed for the latest automotive and railway interior trends and includes snap cure, high-fatigue resistance and FST prepregs, cosmetic range materials, surfacing films, adhesive films and bio composites as well.

KORDSA THE REINFORCER

Marine

Kordsa meets marine industry requirements with a wide range of product portfolio and with a great capability to produce high qualified reinforcing materials. Kordsa is reinforcing the marine applications by carbon prepregs, glass prepregs and hybrid prepreg systems which are developed by specific resin matrix systems in house.

Sports & Leisure

Lightweighting plays an ever more important role in high performance Sports & Leisure applications. Carbon fibers are the natural choice for the lightweighting of many sports applications where high performance is required. Kordsa reinforces sports & leisure industries with our high performance carbon fabrics, carbon & glass prepregs as well as high precision narrow width slit tapes with regular or high temperature resin systems.

Medical & Prosthetics

In every part of our lives, our body functions are quite important. Kordsa is supporting medical prosthetics manufacturers with innovative and qualified materials solutions. Carbon prepregs and carbon fabrics are the main players of those application. Kordsa reinforcing prosthetics industry with its own weaving capability and developed resin systems.

Life Protection

UHMWPE UD sheet materials are used in a wide range of protective and industrial applications where layers of unidirectional (UD) fibers cross plied in 0°/90° orientations are used by consolidating with matrix systems. Kordsa has the capability to reinforce protective applications by developing its own resin matrixs in-house.

ADVANCED COMPOSITE MATERIALS WITH SUSTAINABILITY

2050 Net Zero Emission Target

SBTi Approved

KORDSA'S HOLISTIC APPROACHON SUSTAINABLE PRODUCT PORTFOLIO

- Honeycomb
- Flame Retardant Prepregs
- Natural Fibers Reinforced Prepregs
- Slit Tape & Towpreg
- Out of Autoclave Prepregs
- Ceramic Matrix Composites Prepregs

Thermoset Prepregs

Kordsa produces thermoset UD, woven and multiaxial prepregs. The reinforcement material used in prepregs can be carbon, aramid, UHMWPE, E-glass, S-glass, S2-glass and quartz fiber. Hybrid forms are also available. The primary resin matrix used is epoxy for thermoset prepregs. Cyanate ester prepregs are also available. Kordsa formulated develops and qualifies its resin systems in the Composite Technologies Center of Excellence.

Kordsa prepregs are used in a wide range of markets and tailored to meet specific performance requirements such as: low temperature cure; snap cure; fatigue resistance; mechanical performance; cosmetic; fire, smoke and toxicity.

In addition, Kordsa has the capability to produce prepregs with following technical specifications;

- Prepreg width - Fabric : 1000 mm – 1300 mm
- Prepreg width - UD : 300 mm – 600 mm
- Fabric areal weight: 193 gsm – 1000 gsm
- Resin content: 34% – 48%

THERMOSET PREPREGS

Resin Code	Resin Type	Value Proposition	Recommended Curing Method			Market / Applications
			Oven	Auto clave	Press	
0M10	Epoxy Hotmelt	Toughened Structural, 120 °C 1 hour Cure Profile, Opaque, High Tack		x	x	Industrial, Marine, Automotive, Life Protection
0M11	Epoxy Hotmelt	Fatigue Resistant, Low Exotherm, Hot-Demoldable, Translucent, Medium Tack		x	x	Life Protection, Leaf Spring, Thick Parts, Sports&Leisure
0M12	Epoxy Hotmelt	Toughened Structural, 120 °C 2 hour Cure Profile, Opaque, High Tack	x			Industrial, Marine, Automotive,Life Protection
0M13	Epoxy Hotmelt	Structural;120 °C 1 hour Cure Profile, Translucent; Tacky version is available; Press curable		x	x	Industrial Composites, Automotive, Medical
CM11	Epoxy Hotmelt	Snap Cure-Press, Hot-Demoldable, Transparent, Low Tack			x	Automotive, Visual Applications,Life Protection, Sport&Leisure
EF12	Epoxy Hotmelt	220 °C Tg, Toughened Structural, Medium Tack		x		Aviation, Industrial,Life Protection
AX-201XL	Epoxy Hotmelt	Life Protection, Cosmetic Carbon Look, Variable Temperature Cure Profiles, Low, Medium, High Tack	x	x		Automotive, Marine , Industrial, Visual, Life Protection
AX-180	Epoxy Hotmelt	Low FST/HR, 120 °C 1 hour Cure Profile, Excellent Surface Quality, Low and Medium Tack		x		Aircraft Cabin Interior & Seat, Automotive/Transportation, Industrial, Life Protection
AX-180SC	Epoxy Hotmelt	Low FST/HR, Snap Cure-Press, Hot-Demoldable, , Excellent Surface Quality, Low Tack			x	Aircraft Cabin Interior & Seat, Automotive/Transportation, Industrial, Life Protection
AX-170	Cyanate Ester Hotmelt	High temp. prepreg for structural composites (operating temp. up to 315 oC), Inherently flame retardant	x	x	x	Structures for motorsport and life protection applications requiring service temp. up to 315 °C
KY10(L)	Epoxy Hotmelt	High Performance Toughened, Out-of-Autoclave (OOA) Curable, Dual Cure Options, Good Impact Resistance, Great Resistance to Hot/Wet Conditions, (L) Version is Optional	x			Aviation, Industrial
KY14	PFA Biobased	Polyfurfuryl Alcohol Biobased, Flame-Retardant,Non-toxic, Excellent Temperature and Chemical Resistance, Autoclave,Press or VBO Curable, 130 °C 1 hour Autoclave Cure	x	x	x	Aircraft & Transportation Cabin Interiors, Structures and sandwich panels requiring low porosity and excellent surface finish

ADHESIVE / SURFACE FILMS

AX2114	Epoxy Hotmelt	High peel and high lap shear strength- Oven/ Autoclave/ Press Cure, High toughness, flame retardant	x	x	x	Ceramic bonding
AX2116	Epoxy Hotmelt	High peel and high lap shear strength, Oven/ Autoclave/ Press Cure, Excellent resistance to high moisture, Excellent tack and handling	x	x	x	Metal to metal bonding
KY01	Epoxy Hotmelt	Autoclave Cure, Perfect surface finish for painting process		x		Automotive painted body panels

LIFE PROTECTION PREPREGS

EF14	Phenolic Modified PVB	Flame Retardant, High Toughness, High Energy Transfer, Press Cure, Very Low Tack			x	Life Protection (helmet, vehicle armor, ceramic backing applications)
EF30	Undisclosed	"Enhanced performance-to-weight ratio, Better kinetic energy absorption than woven products, High temperature stability and high rigidity, Press Cure, No Tack"			x	"Hard protective clothing (helmet), spall liner, platform protection plates (air, naval and land vehicles) and rigid life protection plates"
EF35	Undisclosed	"Enhanced performance-to-weight ratio, Better kinetic energy absorption than woven products, High temperature stability and high rigidity, Press Cure, No Tack"			x	Hard protective clothing (body protection)
EF60	Undisclosed	Enhanced performance-to-weight ratio, Better kinetic energy absorption than woven products, High temperature stability and high rigidity, Press Cure, No Tack"			x	Hard protective clothing (body protection)

*DMA Storage Modulus Onset **Values from Recommended curing profile from TDS ***DSC Storage Modulus Onset

Thermoplastic Prepregs

Kordsa's product range for polymer matrices is PP and PA6.6. The resin systems are specially formulated by Kordsa, which has excellent compatibility with E-glass woven fabrics with the fiber volume content of 45-55% . Kordsa's woven glass fabric based PP thermoplastic prepreg exhibit 25% better flexural properties compared to its counterparts. Thermoplastic prepregs are available as rolls or organo sheet (OS) form.

THERMOPLASTIC PREPREGS

Polymer Type	Fiber	Fabric Type	Fiber Volume Content (%)	Processing Temperature (°C)	Format	Usage Area
High crystalline polypropylene (PP)	195-215	Woven	45-55	195-215	Roll / OS	Industrial, Sports & Leisure, Automotive
Polyamide 6.6 (PA6.6)	275-300	Woven	45-55	275-300	OS	Industrial, Sports & Leisure, Automotive

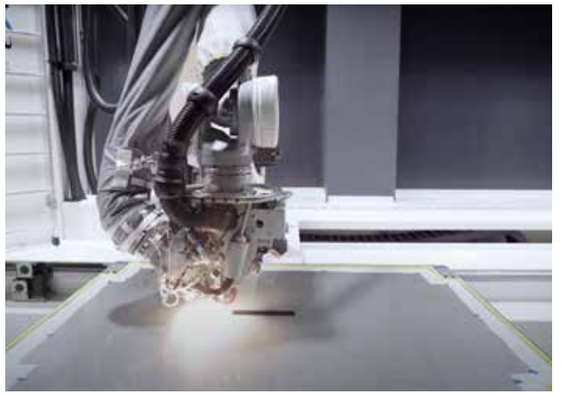
*Number of layers can be changed depending on customer requirements.

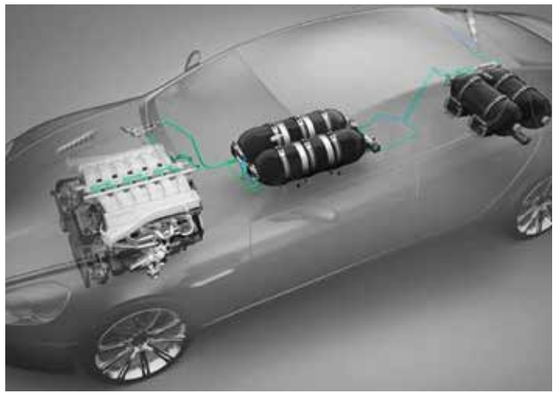
Slittape & Towpreg

Kordsa offers slittape and towpreg products with 3K/ 12K/ 24K carbon fibers and glass fibers. These products are designed for automated fiber placement (AFP) or for machine-supported winding techniques used in the preparation of round, cylindrical and rectangular 3D vessels and structures. These narrow products are mainly used to improve passenger safety, enhance fuel efficiency, reduce waste, all the while enabling lower cost, higher performance and more environmentally-benign transportation. By offering these products Kordsa is placing sustainability at the core of its activities. Compared to traditional composite counterparts, these products are designed to withstand high temperatures, enabling their use in transportation applications including electric, compressed natural gas (CNG) and hydrogen-powered aircraft and vehicles.

SLITTAPE & TOWPREG

Product Type	Resin Code	Resin Type	Fabric Weight [gsm] (min. - max.)	Width (inches)	Value Proposition	Market/ Applications
UD Slit Tape	OM12 AX201XL AX170	Epoxy Hotmelt Epoxy Hotmelt Cyanate Ester Hotmelt	132-200	1/2" - 1/4" - 1/8"	Optimal impregnation, highly precise areal weight and width	Aerospace, Automotive, Wind
Towpreg	AV14	Epoxy Hotmelt	N/A	N/A	Optimal impregnation, stable tow width, wrinkle-free	Oil and Gas, Aerospace, Automotive & Transportation, Sports and Leisure
	AX201XL	Epoxy Hotmelt				





Fabrics

Kordsa has a wide range of unidirectional and bidirectional fabrics (plain, twill, harness satin and basket) carbon, aramid, UHMWPE, glass and quartz fibers can be used as reinforcement materials in traditional and hybrid fabrics. Woven fabrics can be suitable for prepreg production, vacuum infusion, RTM an wet layup.

WOVEN FABRIC CAPABILITIES

Weaving Styles	Fabric Weight [gsm] (min. - max.)	Fiber Types	Width [mm] (min. - max.)
Plain, Twill, Satin	160 - 1200	3K to 24K	1000-1600

UNI-DIRECTIONAL FABRIC CAPABILITIES

Weaving Styles	Fabric Weight [gsm] (min. - max.)	Fiber Types	Width [mm] (min.-max.)
UD	200 - 1000	3K to 48K	100-1500

CARBON FABRIC PORTFOLIO

	Weaving Type	Fabric Weight [gsm]	Filament Count	Width [mm]	Warp Density [picks/cm]	Weft Density [picks/cm]
	Plain/Twill	160	3K	1250	4	4
*	Plain	193	3K	1255	4,8	4,8
*	Plain/Twill	200	3K	1250	5	5
*	Plain	224	3K	1255	5,6	5,6
*	Twill	240	3K	1000	6	6
*	Twill	245	3K	1250	6,1	6,1
	Plain/Twill	280	3K	1250	7	7
*	Plain	288	3K	1250	7,2	7,2
	Plain	288	6K	1250	3,6	3,6
	Plain/Twill	380	6K	1250	4,7	4,7
*	Plain/Twill	400	12K	1250	2,5	2,5
*	Plain	445	12K	1255	2,7	2,7
*	Plain/Twill	600	12K	1250	3,7	3,7
*	Twill	630	12K	1000	3,9	3,9
*	Plain/Twill	650	12K	1250	4	4
	Plain/Twill	800	24K	1600	2,5	2,5
*	Plain/Twill	1000	24K	1000	3,1	3,1
	Plain/Twill	1200	24K	1600	3,7	3,7
	UD	200	12K	500/1000	2,5	-
	UD	230	12K	500/1000	2,8	-
*	UD	300	12K	500/1000	3,6	-
*	UD	300	24K	500/1000	1,8	-
	UD	400	12K	500/1000	5	-
	UD	400	24K	500/1000	2,5	-
*	UD	500	24K	500/1000	3,1	-
	UD	600	24K	500/1000	3,7	-

* Standard fabrics can be supplied with shorter lead times.

Composite Sandwich Panels

Thanks to their advanced mechanical properties and light weight, composite sandwich panels are of great importance in the aerospace, automotive, railway, mass transportation, marine, sports and leisure, logistics and construction industries.

Kordsa's composite sandwich panels are available in flat geometry, with dimensions up to 1.5 m x 3.0 m. Areal weights and dimensions of panels can be tailored according to customer needs, as can the core material and its thickness.

Typical features of standard sandwich panel products are flame-retardancy with high flexural strength, stiffness, and a lightweight structure.

Typical **core materials** and their attributes are:

- **Aerospace or Commercial Grade Nomex®** This material possesses high strength, high flame-retardancy, excellent thermal insulation and dielectric properties, as well as high moisture resistance.
- **Aluminum honeycomb** has high strength and enables weight reduction.
- **Foam cores** are generally made from PVC and PU polymers. They are cost-effective, they can be used in lightweight structures and possess advanced mechanical properties.
- The industrial uses for composite sandwich panels include floors, doors, flat bulkhead, roofs, containers, shelters, crash absorbers, furniture, and facing panels for high-rise construction.

Sandwich Panel Portfolio

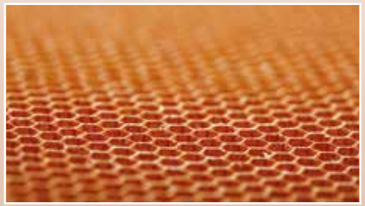
Skins

- Low FST/HR Epoxy AX-180SC Snap Cure Glass or Carbon Prepreg
- Epoxy CM11 Snap Cure Glass or Carbon Prepreg
- Phenolic Glass prepreg

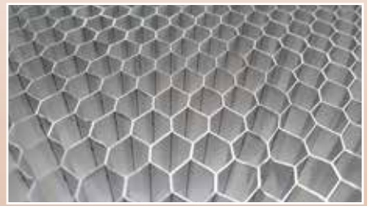
Adhesive Films

- High Performance Toughened Epoxy Film Adhesive AX-2114 used in applications for metallic and composite substrates
- Highest Performance Toughened Epoxy Film Adhesive AX-2116 specifically designed for aerospace grade bonding applications for metallic and composite substrates

Cores



Nomex Cores ANH4120 (Aeropsace grade) and AHN7800 (Commercial grade)

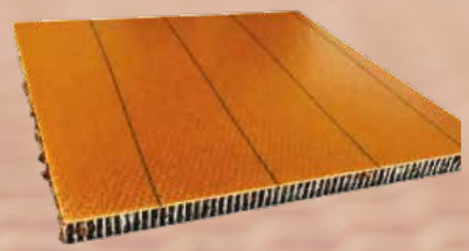


Aluminum Core

Foam Core – PVC or PU

Please visit Axiom Materials, Inc. for our core materials
https://axiommaterials.com/

Sandwich Panels



- Up to 1.5m x 3m dimensions
- High flexural & shear & peel strength
- Excellent fire-smoke-toxicity and heat release characteristics (AX-180 or Phenolic prepreg) (AX-180SC Epoxy prepreg & Phenolic pregreg)
- Eco-friendly production allowed by water based phenolic AHN4120 & AHN7800 Nomex Cores

Characterization

ASTM C393 (Short Beam): 4-Point-Bending

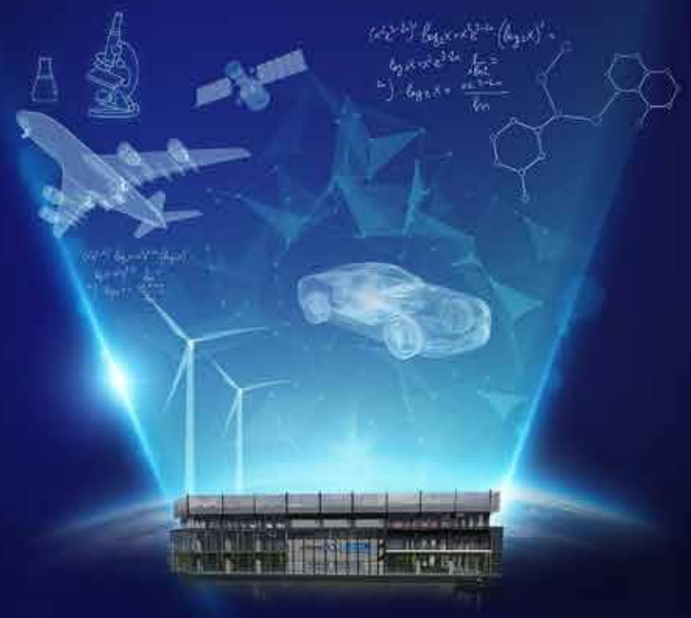
ASTM D1781: Drum-Peel

FAR25.853 Flammability Test

KORDSA THE REINFORCER

KORDSA | Sabancı Üniversitesi

COMPOSITE TECHNOLOGIES CENTER OF EXCELLENCE



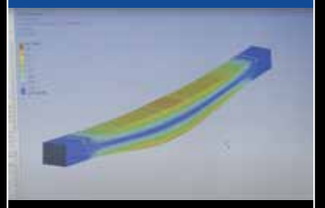
Composite Technologies Center of Excellence is the key development facility in composite industry in collaboration with Sabancı University to bring together engineers, researchers, faculty members, students, entrepreneurs and designers under one roof.

End to end approach

Material Development

- Global product development teams for innovations
- New Resin Development
- Benchmarking
- Material Characterization for CAE modelling
- Material Cards

Modelling & Simulation



- Thermal Modelling
- Failure Analysis
- DoE Statistical Analysis
- FE Calculation on material and components

Mechanical Validation

- Durability Testing
- Static & Dynamic Tests
- Thermal
- Structural
- Climate Chamber
- Investigation on Customized Components

Application & Processing

- Prepreg Cutter
- Clean Room
- Automatic Fiber Placement
- Additive Manufacturing
- Application engineering with core and strategic partners

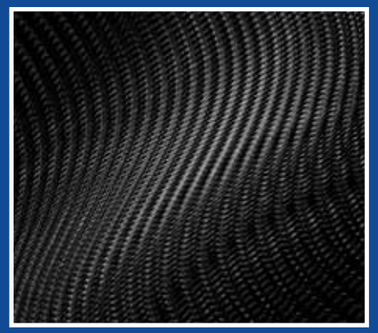
Prototype Production

- Compression molding with press
- Autoclave curing
- Oven

GLOBAL PLAYER OF

COMPOSITE REINFORCEMENT TECHNOLOGIES

We reinforce our future by developing advanced composite technologies for space, aviation, automotive industry as well as industrial and sports & leisureapplications.



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About Kordsa Affiliates

Fabric Development, Inc.

Fabric Development Inc. was established in 1972 to manufacture specialty woven fabrics to meet specialty end use requirements. In time, FDI has greatly expanded its capabilities to work with all high performance fibers, including Carbon (standard to ultra-high modulus), Aramid (Kevlar&Twaron), Spectra, Ceramics, Quartz, Teflon, Nomex and Vectran. FDI has manufactured these fibers in a variety of fabric geometries, hybrid structures, polar weaves and multilayer fabric structures. This capability allows FDI to serve the expanding needs of specialty fabric applications.
www.fabricdevelopment.com

Textile Products, Inc.

Textile Products Inc. operating as a Kordsa company, is a specialty textile manufacturer, experienced in the development and production of custom fabrics. TPI offers a wide range of standard fabrics as well as custom design textiles engineered to meet specific requirements including: Uni-directional, Bi-directional, Multi-directional and Hybrid fabrics and tapes. TPI also has considerable experience with all available yarns, including Carbon-Standard, Intermediate and High Modulus, Aramid-KevlarTM & TwaronTM, Ceramic-NextelTM & NicalonTM, Quartz, Metallic Wires, Nickel Coated Carbon and Commingled Thermoplastics.
www.textileproducts.com

Axiom Materials, Inc.

Axiom Materials, Inc., is a progressive composite materials manufacturer founded with the intention of combining a quality prepreg, adhesive, and ancillary composite products platform with customer focused service and forward-thinking design. Axiom Materials, Inc. has recently merged with Advanced Honeycomb Technologies, which manufactures a wide range of honeycomb core used in products as diverse as commercial and military aircraft, communications and transportation equipment, space vehicles, construction materials and recreational and sporting goods. Axiom Materials manufactures an unrivaled range of composite materials and engineered products, including ceramic prepregs, epoxy unidirectional carbon prepregs, tooling prepregs and film adhesives.
www.axiommaterials.com

Microtex Composites S.r.l.

Microtex Composites S.r.l. is a vertically integrated manufacturer of advanced composites from weaving of carbon fiber to producing prepregs. Today the company is a European excellence for carbon fiber widely used for structural and aesthetic composites, carbon look interiors for motorsports, automotive, rail, sport & leisure, marine, industrial and interior design sectors. Furthermore, performing continuous R&D activities, the company boasts cutting-edge technologies.
www.microtexcomposites.com

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