

***INSPIRED FROM LIFE
WE REINFORCE LIFE***



About Sabancı Holding & Kordsa “The Reinforcer”

Sabancı Holding manages Sabancı Group’s companies with a strategic portfolio approach and is the parent company of Kordsa. Turkey’s most rapidly growing sectors -including banking, insurance, energy, cement, retail, and industrials -are the main business areas of Sabancı Group.

Kordsa, established in 1973 operates in tire, construction and composite reinforcement technologies. Positioned as “The Reinforcer” with its innovative value-added technologies and expertise on reinforcement technologies, Kordsa has approximately 4,800 employees in 13 facilities throughout 4 continents.

In tire reinforcement technologies, Kordsa contributes to the manufacturing of environmentally friendly tires that reduce fuel use and sustain better grip. Thanks to its durable and practical reinforcement solutions in the construction industry, Kordsa continues to touch every aspect of life. Kordsa develops composite technologies mainly for aerospace and automotive industries to reduce fuel consumption and carbon emission.

Pursuing its growth strategy, Kordsa has stepped in Advanced Composites with the Composites Technology Center of Excellence, one of the few integrated production centers in the world. Composite Technologies Center of Excellence is a technology hub driven by collaborative research and production, and it was conjointly established by Kordsa and Sabancı University in 2016. Thanks to this collaborative ecosystem, Kordsa offers tailor-made services to its customer by involving the stakeholder in all stages of research and development, from basic research to the production of a prototype and finally, to mass production.

Kordsa is continuing its growth by having integrated its affiliates; Fabric Development Inc., Textile Products Inc., Advanced Honeycomb Technologies, Axiom Materials and Microtex Composites.

GLOBAL PLAYER OF COMPOSITE TECHNOLOGIES



What is UHMWPE fiber?

Ultra-High Molecular Weight Polyethylene (UHMWPE) is a type of polyolefin that is composed of very long chains of polyethylene molecules with exceptionally high accuracy of parallel orientation and profound levels of crystallinity.

Due to these long overlapping chains, every molecule of UHMWPE attract each other with multiple Van Der Waals bonds, which results in fibers with great strenght. Enhanced chemical properties such as low moisture absorption and inertness to other chemicals and agents can be attributed to the fact that UHMWPE molecules do not have any polar groups.

UHMWPE fibers are one of the most superior fibers compared to other fibers due to its low density whilst having the strongest physical properties. This in turn makes superior physical properties and makes these fibers attractive for several industrial and life protection applications.

Key features

- » Ultra-high tensile strength and modulus
- » Excellent strength-to-weight ratio
- » Exceptional toughness
- » Water and moisture resistance
- » Resistance to microorganisms and most corrosive chemicals
- » UV stability
- » Resistance to fatigue and internal friction



What is UHMWPE UD sheet?

UHMWPE UD sheet is a roll product consisting of layers of unidirectional (UD) fibers cross plied in 0°/90° orientation and consolidated with matrix which is developed in-house. These materials are used in a wide range of protective and industrial applications.

Our technology covers not only solution based coating but also thin film coating to make UHMWPE UD sheets available for customer preferences.

Kordsa UHMWPE UD sheets can be tailored according to specific customer requirements and applications. Quantity of 0°/90° cross plies can be adjusted and consolidated with a unique matrix system to achieve the highest performance. Different areal weights and roll lengths are available upon customer requests.

Last but not least, the products are subjected to an intensive quality control process. In-line product control, visual inspection and lot-based release tests are performed to ensure that the product quality is maintained.

Kordsa strives to reinforce life in accordance with AS9100D quality management system requirements. It creates sustainable value for its customers with UHMWPE UD sheet products, as it does with all products within its product portfolio.

Key features

- » Enhanced performance-to-weight ratio
- » Superior kinetic energy absorption than woven products
- » High temperature stability and rigidity
- » High resistance to moisture
- » Excellent heat resistance
- » Chemical Resistance

- » Outstanding toughness with minimal deformation
- » Superior resilience with Kordsa's unique binder resin systems
- » High abrasion resistance, exceptional cut resistance
- » Excellent stiffness and outstanding protection
- » Multi-hit capability
- » Low defect rate
- » Can be "tailored to fit" for specific requirements



KEF 30 HB	
Product Name	KEF 30 HB
Description	A roll product consisting of four layers* of UD fibers cross plied at 0°/90°/0°/90° and consolidated with matrix
Roll length	100 m**
Roll width	1.60 m
Applications	Hard protective clothing (helmet), spill liner, platform protection plates (air, naval and land vehicles) and rigid life protection plates

* can be tailored to 2 / 4 / 6 layers according to customer demand
** can be tailored according to customer demand

KEF 35 HB	
Product Name	KEF 35 HB
Description	A roll product consisting of four layers* of UD fibers cross plied at 0°/90°/0°/90° and consolidated with matrix
Roll length	100 m**
Roll width	1.60 m
Applications	Hard protective clothing (body protection)

* can be tailored to 2 / 4 / 6 layers according to customer demand
** can be tailored according to customer demand

KEF 85 HB	
Product Name	KEF 85 SB
Description	A roll product consisting of four layers* of UD UHMWPE fibers cross plied at 0°/90°/0°/90° and consolidated with matrix, covered with low density polyethylene film
Roll length	100 m**
Roll width	1.60 m
Applications	Protective clothing (soft vest)

* can be tailored to 2 / 4 / 6 layers according to customer demand
** can be tailored according to customer demand

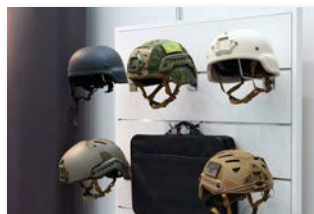
KEF 95 HB	
Product Name	KEF 95 SB
Description	A roll product consisting of six layers* of UD UHMWPE fibers cross plied at 0°/90°/0°/90°/0°/90° and consolidated with matrix, covered with low density polyethylene film
Roll length	100 m**
Roll width	1.60 m
Applications	Protective clothing (soft vest)

* can be tailored to 2 / 4 / 6 layers according to customer demand
** can be tailored according to customer demand

Areas where Kordsa UHMWPE UD sheet is applied?

These materials are used in a wide range of protective and industrial applications.

- » UHMWPE composite plates are used in life protection products, personal protective clothing and platform protection purposes



- » UHMWPE material is widely used in soft protective clothing (soft vest) as undergarment and concealable armour for its stab resistance and protection against secondary fragments, without compromising on comfort and mobility.



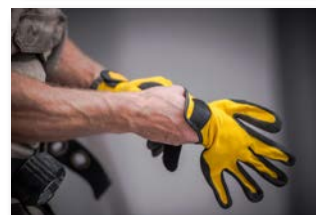
- » Thanks to its excellent strength-to-weight ratio, it is used in creep free and highly durable sail cloths.



- » The material is puncture-resistant, breathable, flexible and environmentally friendly, it is used in safety shoes, labor shoes, climbing shoes etc.



- » Due to the extreme abrasion resistance, UHMWPE UD sheet is also used in the production of high-strength, ultra-high-strength, super-strong, cut-resistant clothes such as insoles, sleeves, uniforms, shirts etc.



- » It is also used in outdoor sports equipments. UHMWPE has a very low coefficient of friction, is self-lubricating, breathable, water-proof and wind-proof. It is suitable to be used in motorcycle helmet, skiing board, skiing helmet, parachute etc.



- » Material shows low dielectric constant and high electromagnetic wave transmittance allowing military, civil and telecommunications organizations to realize the full potential of their advanced antenna, radar, radio astronomy or communications systems.



OVERVIEW OF KORDSA'S ADVANCE COMPOSITE TECHNOLOGIES PRODUCTS

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	Key Features	Market / Applications
OM10	Epoxy Hotmelt	Toughened Structural, 120 °C 1 hour Autoclave Cure, Opaque, High Tack	Life Protection, Industrial, Marine, Automotive
OM11	Epoxy Hotmelt	Fatigue Resistant, Low Exotherm, Hot-Demoldable, Press Cure, Translucent, Medium Tack	Life Protection, Leaf Spring, Thick Parts
OM12	Epoxy Hotmelt	Toughened Structural, 120 °C 2 hour Oven Cure, Opaque, High Tack	Life Protection, Industrial, Marine, Automotive
CM11	Epoxy Hotmelt	Snap Cure-Press, Hot-Demoldable, Transparent, Low Tack	Life Protection, Automotive, Visual
EF12	Epoxy Hotmelt	220 °C Tg, Toughened Structural, Autoclave Cure, Medium Tack	Life Protection, Aviation, Industrial
AX-201XL	Epoxy Hotmelt	Life Protection, Cosmetic Carbon Look, Variable Temperature Cure, Oven or Autoclave Cure, Low, Medium, High Tack	Automotive, Marine, Industrial, Visual, Life Protection
AX-180	Epoxy Hotmelt	Low FST/HR, 120 °C 1 hour Autoclave Cure, Excellent Surface Quality, Low and Medium Tack	Aircraft Cabin Interior & Seat, Automotive, Industrial, Life Protection
AX-180SC	Epoxy Hotmelt	Low FST/HR, Snap Cure-Press, Hot-Demoldable, Excellent Surface Quality, Low Tack	Aircraft Cabin Interior & Seat, Automotive, Industrial, Life Protection
AX-170	Cyanate Ester Hotmelt	High temp. prepreg for structural composites (operating temp. up to 315 °C), Oven/ Autoclave/ Press Cure, Inherently Flame Retardant	Structures for Motorsport, Life Protection applications requiring service temp. up to 315 °C

ADHESIVE / SURFACE FILMS

Resin Code	Resin Type	Key Features	Market / Applications
AX2114	Epoxy Hotmelt	High peel and high lap shear strength- Oven/ Autoclave/ Press Cure, High toughness, Flame Retardant	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	Metal to metal bonding
KY01	Epoxy Hotmelt	Autoclave Cure, Perfect surface finish for painting process	Automotive painted body panels

LIFE PROTECTION PREPREGS

Resin Code	Resin Type	Key Features	Market / Applications
EF14	Phenolic Modified PVB	Flame Retardant, High Toughness, High Energy Transfer, Press Cure, Very Low Tack	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	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	Hard protective clothing (body protection)

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	Processing Temperature (°C)	Format	Usage Area
High crystalline polypropylene (PP)	195-215	Roll / OS	Industrial, Sports & Leisure, Automotive
Polyamide 6.6 (PA6.6)	275-300	OS	Industrial, Sports & Leisure, Automotive

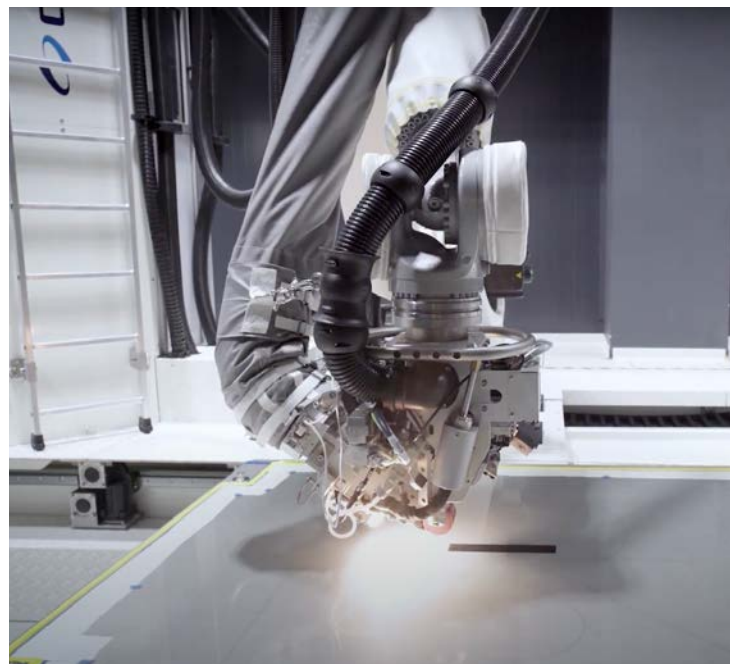
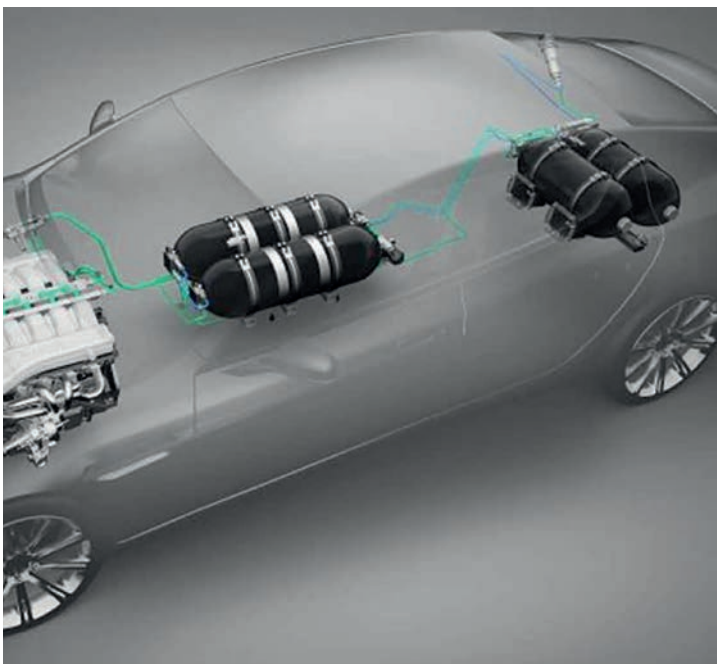


Slittape & Towpreg

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

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



Fabrics

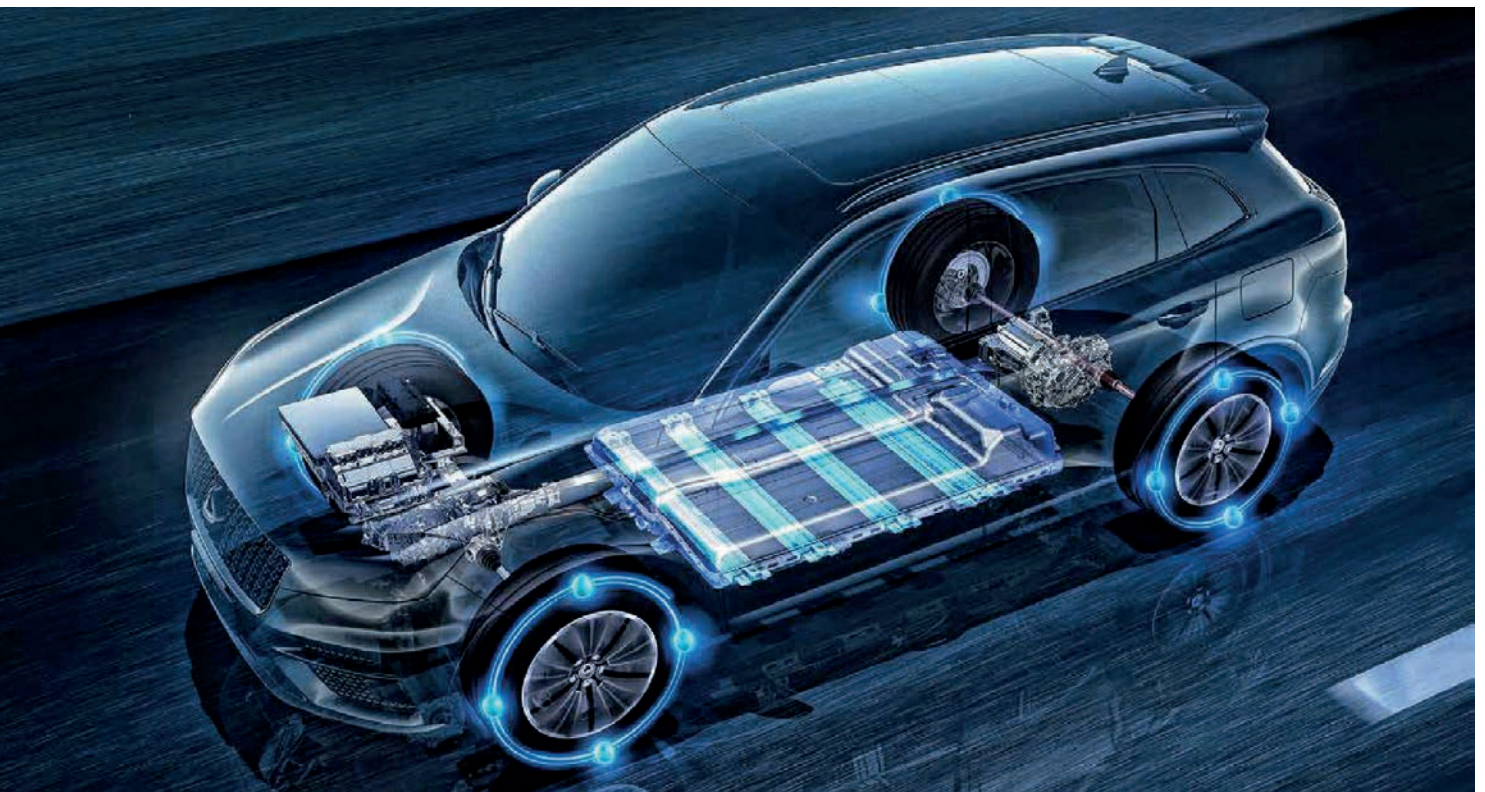
Kordsa has a wide range of unidirectional and bidirectional fabrics (plain, twill, harness satin and basket) carbon, aramid, UHMWPE, glass and quartz fibers can be used as reinforcement materials in traditional and hybrid fabrics. Woven fabrics can be suitable for prepreg production, vacuum infusion,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

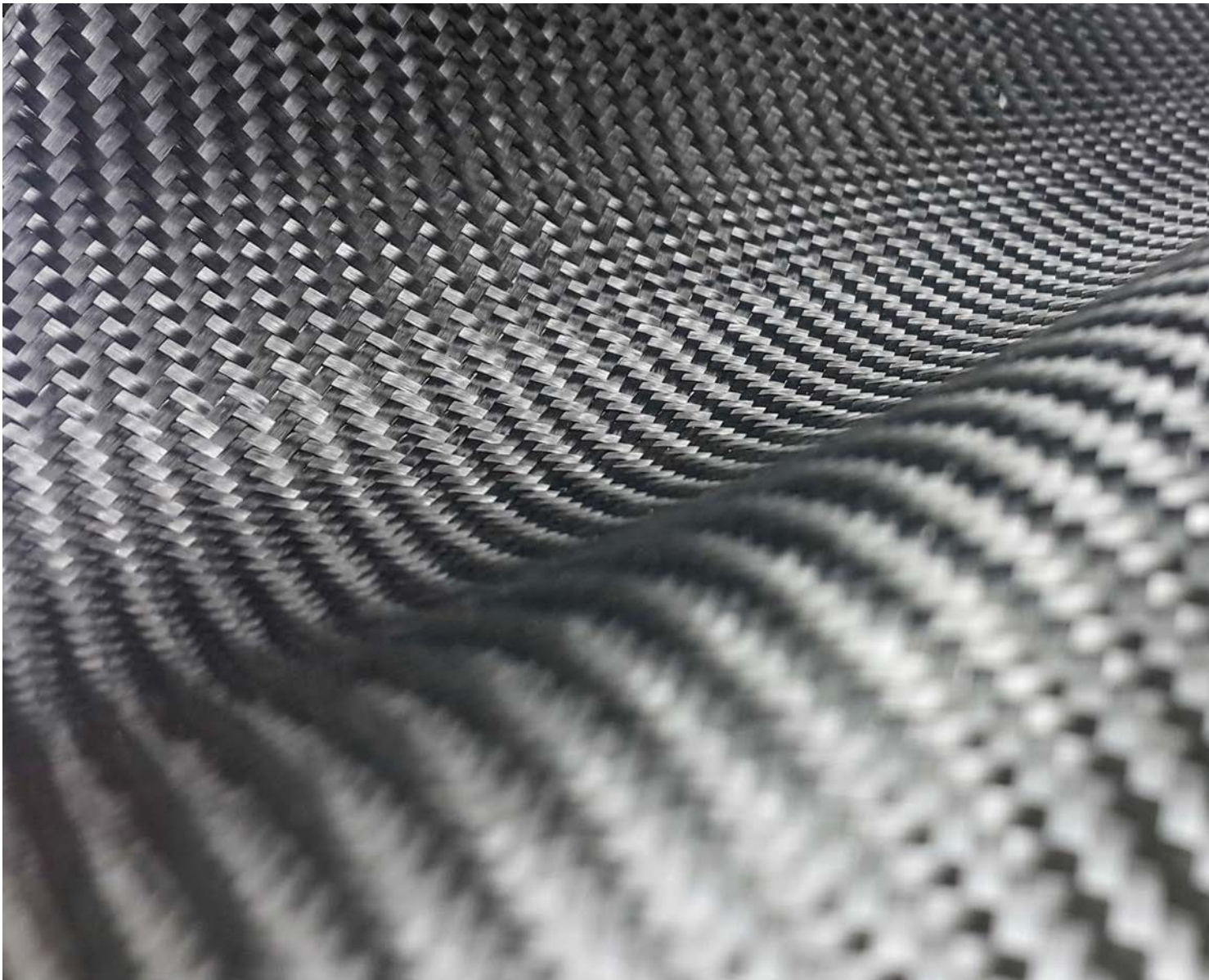
UNI-DIRECTIONAL FABRIC CAPABILITIES

Weaving Styles	Fabric Weight [gsm] (min. - max.)	Fiber Types	Width [mm]
UD	200 - 1000	3K to 48K	100 - 300 - 500 - 1000



CARBON FABRIC PORTFOLIO

Weaving Styles	Fabric Weight [gsm] (min. - max.)	Filament Count	Width [mm] (min. - max.)
Plain / Twill	160 - 288	3K	1000 - 1250
Plain / Twill	288 / 380	6K	1250
Plain / Twill	400 - 650	12K	1000 - 1250
Plain / Twill	800 - 1200	24K	1000 - 1600
UD	200 - 600	12K / 24K	500/1000



Composite Sandwich Panels

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.

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.

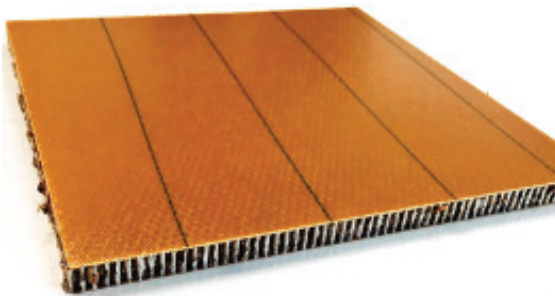
Skins

- Low FST/HR Epoxy AX-180 SC (Snap Cure) – Glass or Carbon pre-preg
- Phenolic pre-preg
- CM11 Snap Cure Carbon Pre-preg

Cores

- Nomex Cores ANH4120 (Aeropsace grade) and AHN7800 (Commercial grade)
- Aluminum Core
- Foam Core – PVC or PU

Sandwich Panels



Up to 1.5m x 3m dimensions



High flexural & shear & peel strength



Excellent fire-smoke-toxicity and heat release characteristics (AX-180 – Phenolic prepreg)



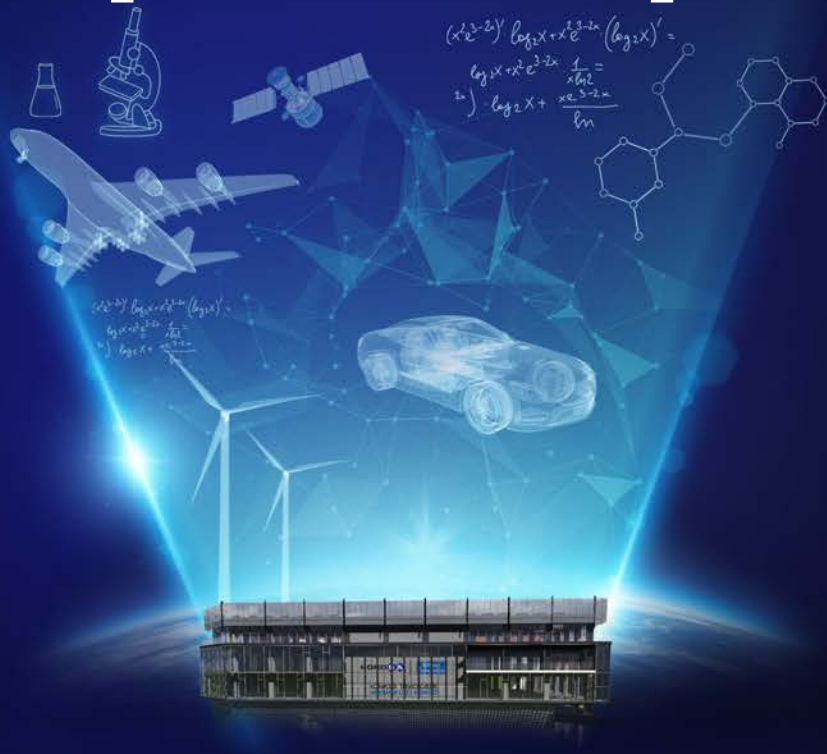
Eco-friendly production allowed by water based phenolic AHN4120 & AHN7800 Nomex Cores



KORDSA

Sabancı
Universitesi

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.





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