

**INDORAMA**  
VENTURES

> *Mobility Group*

**EMPOWERING  
SAFETY AND PERFORMANCE**

PET · PA 6 · PA 6.6 · Rayon · Aramid & Hybrid · PEN

In May 2019, Indorama Ventures Group (IVL) announced the formation of the Indorama Mobility Group which comprises the Tire, Automotive Safety and Functional Materials business segments. The legacy businesses of PHP Fibers, Performance Fibers, Glanzstoff and Kordarna did not come together by coincidence; they had been successively acquired by IVL and consolidated to create a major force in the global Tire reinforcement industry.

## CONNECTING EXPERIENCES FOR TIRE REINFORCEMENT

### PHP

An Indorama Ventures Company

- 1899 Foundation as "Vereinigte Glanzstoff Fabriken AG"
- 1950 Started production of synthetic industrial fibers in Germany
- 1998 Carve-out of industrial fiber activities, re-naming into Accordis
- 2003 Separation of Polyester and Polyamide businesses into two legal entities (Diolen Industrial Fibers & Polyamide High Performance)
- 2006 Manufacturing Joint Venture in Pingdingshan, China
- 2009 Taking over Diolen Polyester business
- 2012 Re-naming to PHP Fibers
- 2014 PHP Fibers acquired by Indorama Ventures (80%)

### Performance Fibers

An Indorama Ventures Company

- 1920 Allied Chemical & Dye Established
- 1950s Introduction of PA 6
- 1971 Started production of Polyester fiber
- 1996 Allied Signal established JV in Kaiping, China
- 1998 Allied Signal formed PF business unit
- 1999 Honeywell and Allied Signal merged
- 2004 PF sold to Sun Capital Partners
- 2005 PF fully owned Kaiping China Plant
- 2012 Kaiping, China Plant expansion
- 2015 PF Asia acquired by IVL & PF AM& EU became Durafiber
- 2017 Durafiber Mexico and France acquired by IVL

### Glanzstoff

An Indorama Ventures Company

- 1904 Erste Österreichische Glanzstoff-Fabrik AG started Rayon Production
- 1929 SASAC Italy started producing rayon
- 1932 Glanzstoff-Fabrik Elberfeld started rayon production (Glanzstoff Bohemia)
- 1939 SASAC became part of Pirelli and subsequently renamed as Sicrem
- 1965 Uniroyal Englebert Textilecord produced PA 6.6 fabric for bias tire
- 1979 Uniroyal Englebert Textilecord became part of Continental AG
- 1992 Pirelli transferred fabric dipping technology to Sicrem Italy
- 1997 Textilecord bought by Glanzstoff Austria to become Textilecord Steinfurt S.A
- 1998 CAG took over Glanzstoff Bohemia & doubled Rayon capacity
- 2007 Glanzstoff Group bought Sicrem Italy
- 2017 Glanzstoff Group acquired by IVL



### KORDÁRNA

KORDÁRNA PLUS A.S.

An Indorama Ventures Company

- 1948 Foundation: Produced Tire Cord Fabrics, Czech Republic
- 1971 Began Production of Conveyor Belt Fabrics
- 1999 Launch of Technical Yarn production in
- 2000 Investment into Twisting Machines
- 2007 Introduction to new dipping lines
- 2012 Start of Polyester yarn in new plant, Senica, Slovakia
- 2017 Enlarging twisting capacities
- 2018 Kordarna acquired by Indorama Ventures

## DESIGNING FOR THE FUTURE KEY TRENDS & TIRE REQUIREMENTS

With the transformation that is underway in Automotive industry, together with the evolving regulations, compliance requirement and sustainability development in the tire industry, tire reinforcement industry is subject to increasing challenges to deliver competitive solutions.

### CO<sub>2</sub> Emission/ Noise Reduction

- RR reduction
- Fuel Economy
- Weight reduction
- Full Electric Vehicle
- Tire labeling (RR & Noise)

### Safety

- High speed Handling
- Run-flat tire
- Tire labeling (wet grip)



### Sustainability

- Renewable rubbers and raw materials
- Sustainability & Performance

### Performance & Comfort

- UHP
- Large size tire/ high torque
- Flat-spotting reduction

### Smart Technology

- Autonomous vehicle-rolling resistance, durability & traction, run-flat tire

# REACHING OUT TO WIDE TIRE MARKET SEGMENTS AND APPLICATIONS

The Indorama Mobility Group currently supply to passenger car and light truck tire as its main market segment in both carcass and cap ply applications. In addition, our range of reinforcement materials find applications in racing, air-craft, agricultural, motorcycle, bicycles, passenger car & light truck, run-flat, all-terrain vehicle, ultra high performance and off-the-road tires.



**PASSENGER CAR  
LIGHT TRUCK**



**RUN-FLAT**



**RACING**



**ALL-TERRAIN VEHICLE**



**AVIATION**



**ULTRA HIGH PERFORMANCE**



**MOTORCYCLE**



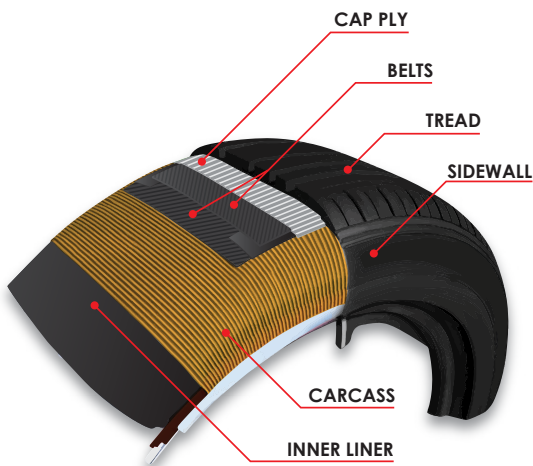
**BICYCLE**



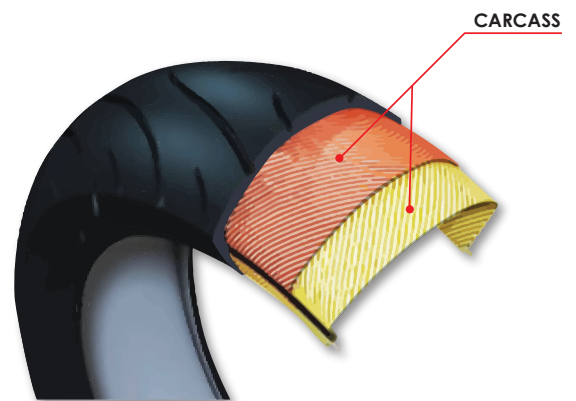
**AGRICULTURE**



**OFF-THE-ROAD**



**Passenger Car Radial Tire**



**Motorcycle Bias Tire**

# IDEAL CORD PROPERTIES FOR TIRE CARCASS & CAP PLY

## CARCASS

Dimensional stability-low shrink during cure, no flat spotting, no long term growth

High durability-fatigue resistance, low heat generation on flexing, high adhesion to rubber, chemical and oxidation resistance, heat resistance

High tensile modulus

Low bending modulus

High toughness-impact and abuse resistance

High tensile strength

Low hysteresis loss at high speed



## CAP PLY

High Tensile Strength

Good resistance to chemical attack

High bending modulus - high stiffness

Ultra-high tensile modulus

High compression modulus

High adhesion to rubber

### Durability (Carcass)

Rayon Advanced PET Nylon Aramid Steel

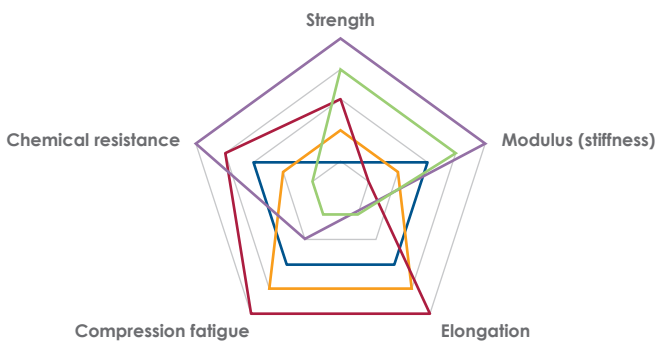
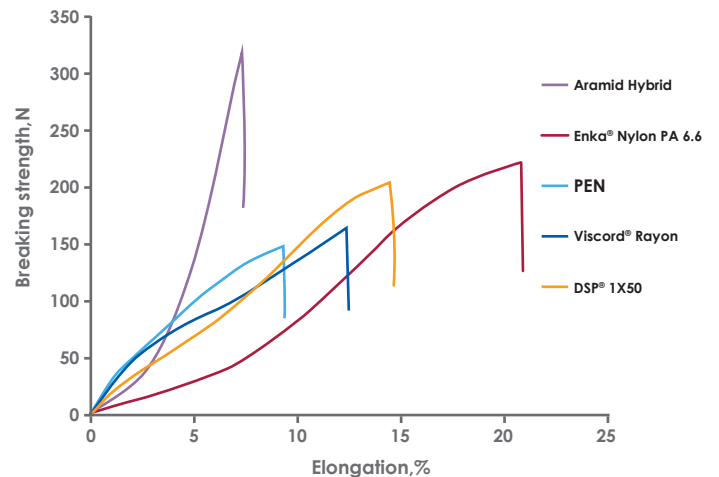
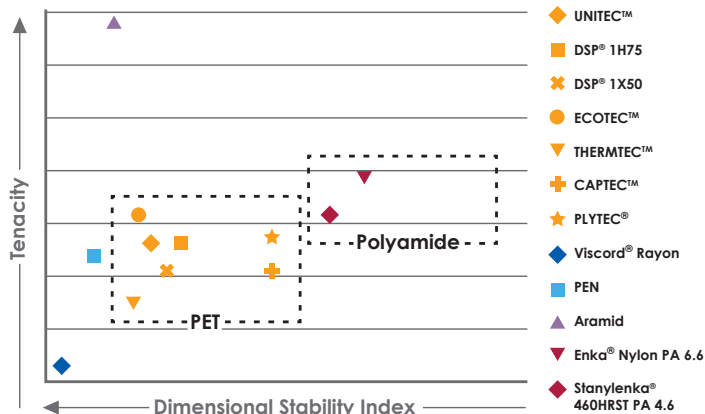


Diagram for illustration, not to scale  
Source information: National Highway Traffic Safety Administration (NHTSA)

### Dimensional stability (Carcass)

Uniformity in curing	Rayon	Advanced Polyester	Nylon
Appearance (sidewall indentation)	Rayon	Advanced Polyester	Nylon
Dynamic stiffness (steering)	Rayon	Advanced Polyester	Nylon
Flat spotting	Rayon	Advanced Polyester	Nylon

# NEW TECHNOLOGY PLATFORMS & NEW PRODUCT DEVELOPMENT

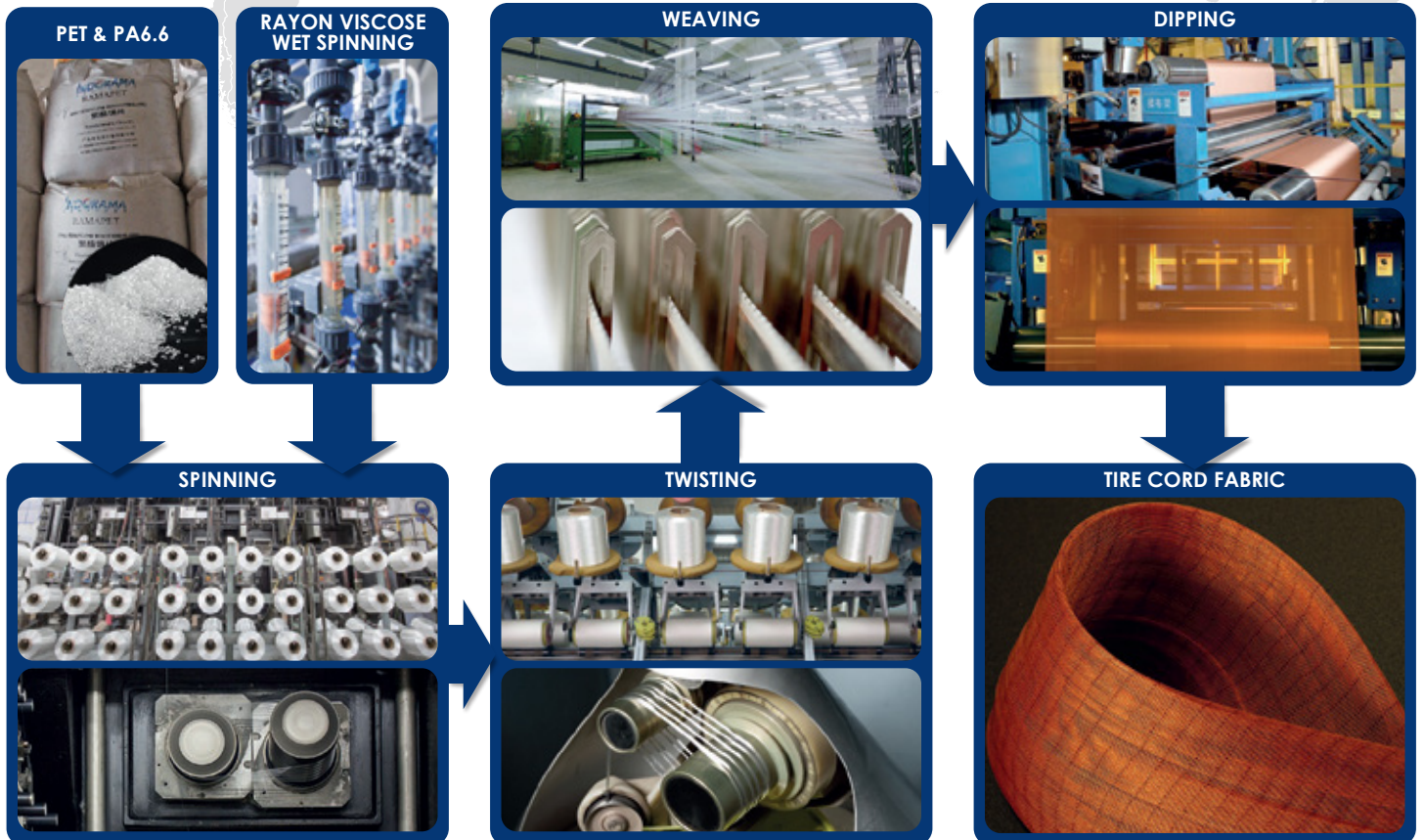


# GLOBAL MANUFACTURING SITES

Indorama Mobility Group has 11 production sites in 9 countries for tire reinforcement materials covering the three geographic markets of Americas, Europe and Asia. With the continued integration of the legacy companies, production capability for full range of production will expand thus reducing lead time for customers. The Group has 4 R&D centers for tire reinforcement each with pre-existing expertise in specific polymer, process and applications. Integration of knowledge and know-how are enhancing product development for market needs.



## PROCESS



# FULL RANGE PRODUCT PORTFOLIO OF VARIOUS POLYMERS AND MATERIAL FORMS

Indorama Mobility Group has in its product range of polyester, polyamide 6.6, polyamide 6, rayon, PEN, aramid and hybrid in such material forms as yarn, tire cord fabric and single end cord. The associated production and R&D capability enables specific product performance proposal and material substitution to meet customers' evolving needs and requirements.

	Mobility group sites (Tire Reinforcement)	PET			PA 6.6			PA 6			Rayon			Aramid Hybrid		
North America	Winnsboro, US															
	Queretaro, MX	☒	☒	☒			☒	☒	☒				☒			☒
Europe	Obernburg, DE				☒	☒	*									
	Lovosice, CZ										☒	☒	☒			
	Pizzighettone, IT			☒			☒					☒	☒		☒	☒
	Steinfurt, LU			☒			☒					☒	☒		☒	☒
	Longlaville, FR	☒														
	Senica, SK	☒														
	Velka nad velickou, CZ			☒			☒			☒			☒			☒
Asia	Kaiping, CN	☒		☒			☒			☒			☒			☒
	Qingdao, CN			☒			☒						☒			☒

■ Kordarna Plus 
 ■ Glanzstoff 
 ■ PF 
 ■ PHP Fibers 
 ☒ Yarn 
 ☒ TCF 
 ☒ SEC 
 \* PA 6.6 & PA 4.6 
 # Regular & FR Rayon



Regular dip TCF



Dipped SEC



Flat Yarn

## EMPOWERING SUSTAINABILITY THROUGH INNOVATION

With the manufacturing industry worldwide, Indorama Mobility group continues to develop sustainable products to help customers to deliver product performance and to reach ambitious sustainability goals.



### ECOTEC™

Light weight tire

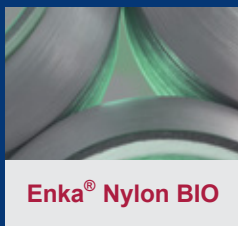
- ECOTEC™ - HT high tenacity polyester tire cord for carcass weight reduction. HD high linear density tire cord for carcass ply reduction
- Reduced rolling resistance for higher fuel economy



### Viscord® CS4

Natural Cellulose for Run-flat Tire

- Rayon tire cord based on renewable cellulose which is a high tenacity biopolymer responsible for mechanical stability in any plant
- Continued investment in new machinery and technologies to reduce energy and water consumption



### Enka® Nylon BIO

Bio-based Nylon

- Enka® Nylon BIO is the sustainable drop-in solution for fossil-based polyamide 6.6 yarns.
- The bio-based and CO<sub>2</sub> neutral yarn polymer provides same melting temperature at reduced moisture pick-up compared to polyamide 6.6.



### Bio-based PET

- Polyester tire cord based on bio-based raw materials
- Contribute to customer's product sustainability content



### DIPTEC™

RF Free

- DIPTEC™ - Resorcinol-Formaldehyde free dipping technology without compromising performance
- Compliance with REACH regulation



### PENTEC™

Low-noise EV tires

- PENTEC™ - PEN based tire cord with extra high modulus and high break strength in one polymer
- Used in cap ply providing low noise performance

# STRONG FOCUS ON SUSTAINABILITY

Sustainable development pervades all industries worldwide. IVL Group is committed to delivering its sustainability goals and has embedded strategy to be at the forefront of sustainable products and processes.

## THE 4 PILLARS FOR STRATEGIC INNOVATION & SUSTAINABILITY



## INDORAMA VENTURES EXTERNAL RECOGNITIONS

MEMBER OF

**Dow Jones Sustainability Indices**

In collaboration with



a RobecoSAM brand

- Ranked no. 2 among the leading of all global chemical companies
- A member of 2019 DJSI World and Emerging Markets Indices: Chemicals Industry



FTSE4Good

ESG RATING **4.6**

ENVIRONMENT SCORE 4.5

SOCIAL SCORE 4.3

GOVERNANCE SCORE 5.0



DRIVING SUSTAINABLE ECONOMIES

- 2019 Climate Change Rating: B
- 2018 Supply Chain Rating: B-



- Gold Recognition
- Top 3% of suppliers in all categories

**Bloomberg**

Leading ESG Disclosure Score in 2019



ESG rating: BB in 2019



Top 10 percentile outperformer

# INSIDE EVERY PRODUCT, THE POTENTIAL TO IMPROVE THE WORLD.

At IVL, we never stop asking  
just how far chemicals can take us.

Because as a global force in sustainable materials, we believe that inside the products that touch our lives every day, there's an even greater potential to make our lives safer. More comfortable. More fulfilling. And kinder to the world we all share.

