

**SGL GROUP**  
THE CARBON COMPANY

# Moving Heavy Weights Fast

Technical Feasibility Study

## **CARBOMOTION™**

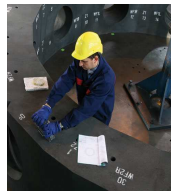
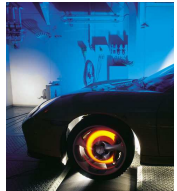
October 18<sup>th</sup>, 2013 – Augsburg (Interlift)

Verband für Aufzugstechnik VFA

**BROAD BASE. BEST SOLUTIONS.**

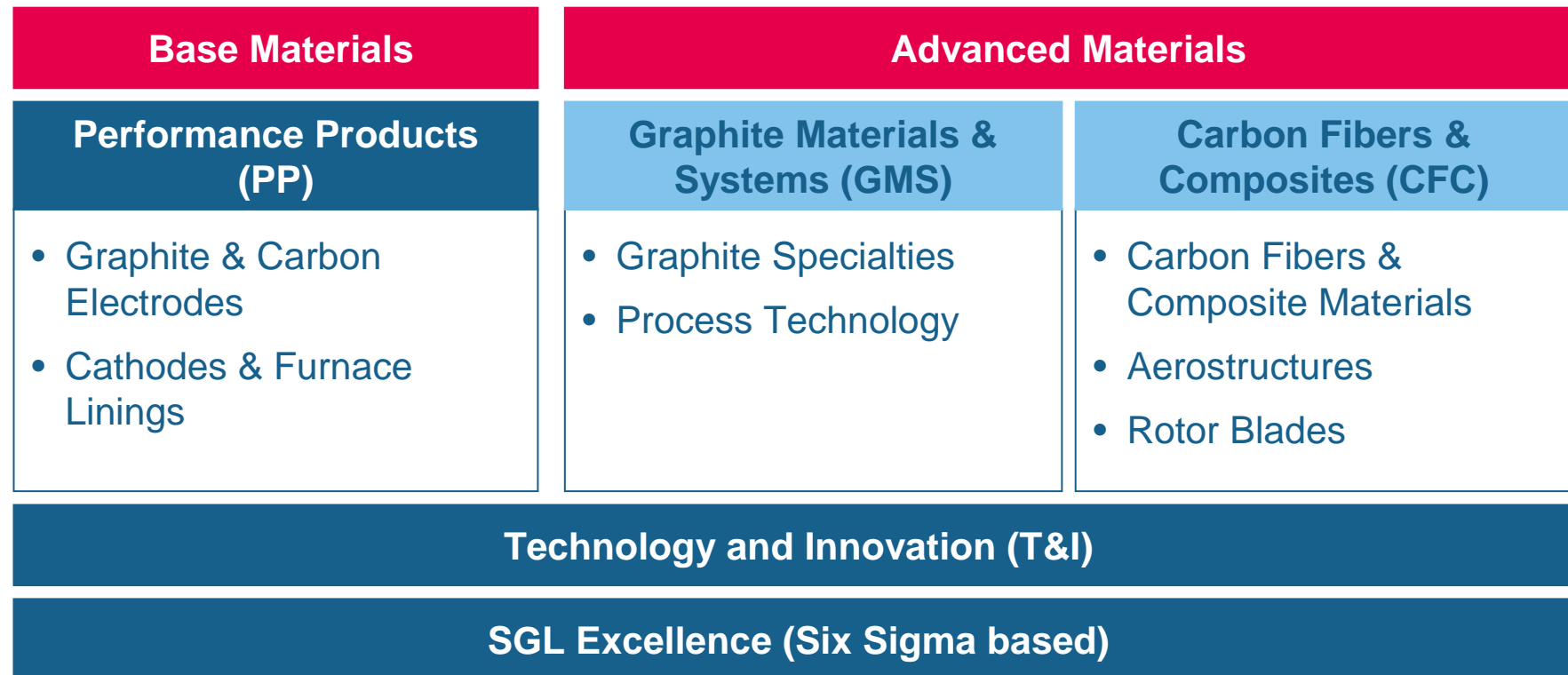
Marcel Remp  
Tobias Schmidt

# SGL Group is one of the world's largest manufacturers of carbon-based products



- Comprehensive portfolio ranging from carbon and graphite products to carbon fibers and composites
- 45 production sites worldwide
- Service network covering more than 100 countries
- Sales of ~ € 1.7 bn in 2012
- Head office in Wiesbaden/Germany
- Approx. 6,700 employees worldwide
- Listed on SDAX

## Business structure



# Global presence

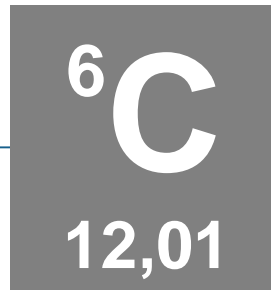
12 production sites  
North America

25 production sites  
Europe

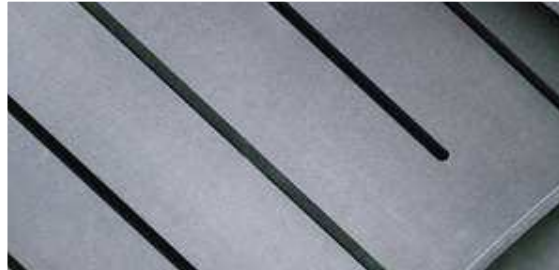
8 production sites  
Asia



# Unique properties of carbon



## Synthetic carbon & graphite



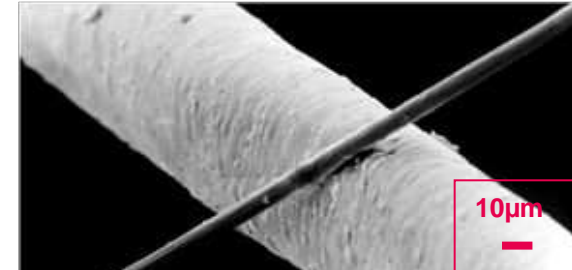
- Heat resistant
- Electrically conductive
- Corrosion resistant
- Environmentally safe

## Natural graphite



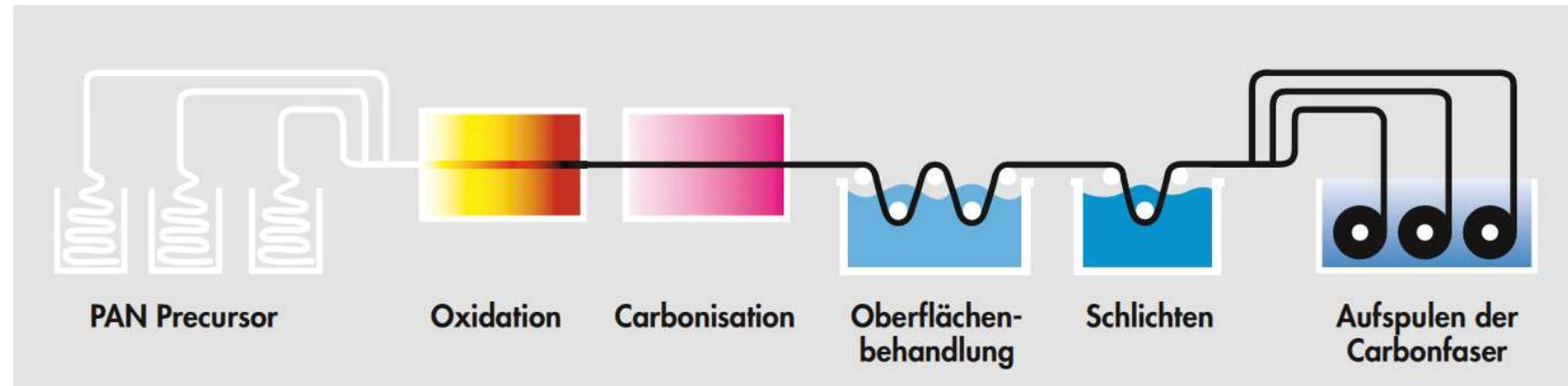
- Thermally conductive
- Dense
- Energy storing

## Carbon fiber



- Light
- Strong
- Stiff

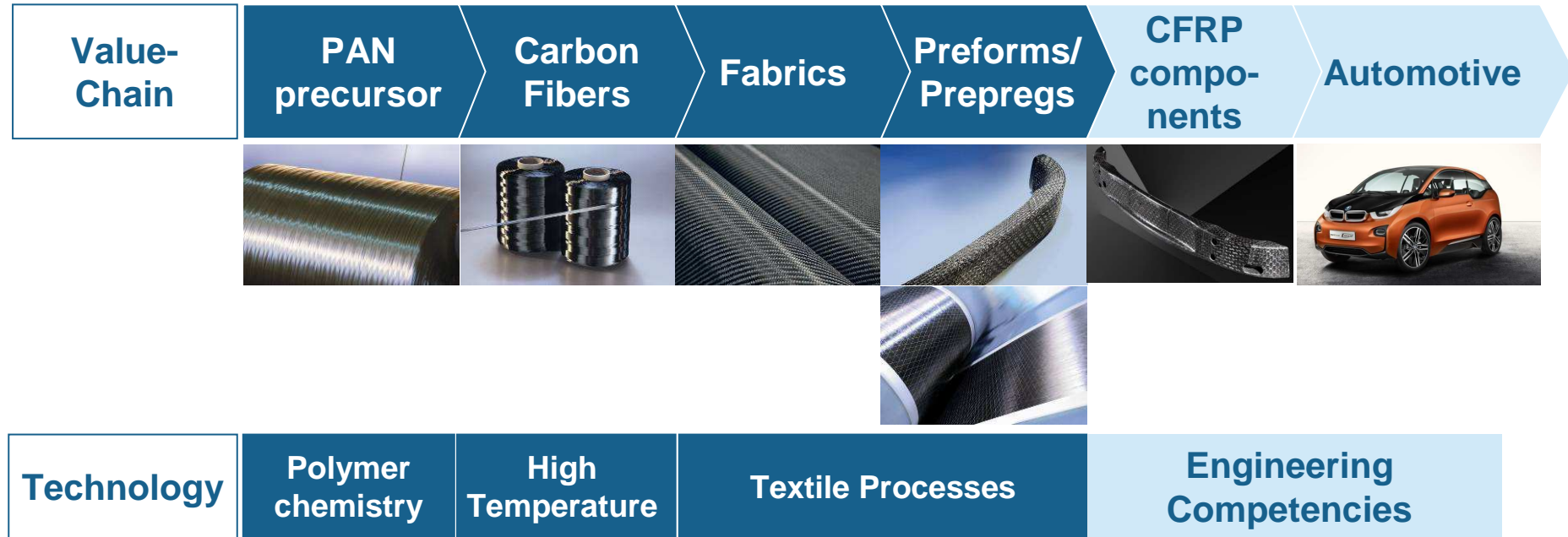
## The carbon fiber production is an industrial serial production and requires temperatures above 1000° C



- **Energy costs → Approximately 30% from the production costs.**
- **Raw material costs > Approximately 50% from the production costs → (Polyacrylnitril (PAN))**



# SGL Group handles the whole carbon fiber value chain



## Core Competencies of



Source: SGL Group, BMW Group

## Carbon fiber belts for elevator Systems

**More than half of the world's population already live in urban areas. By 2050 seven out of every 10 people on the planet will be living in cities.\***



**New Elevator Designs enable new architectural possibilities and space saving concepts**

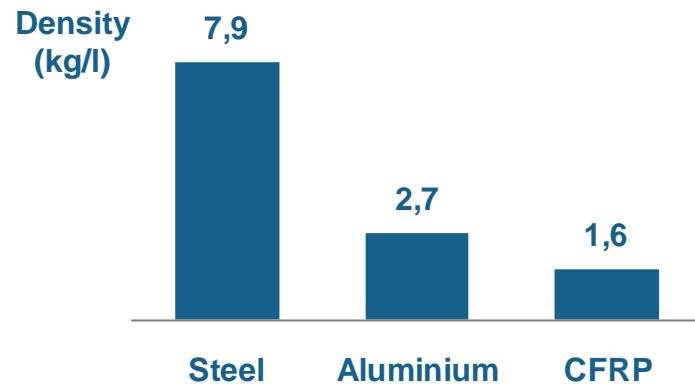
\*) United Nations

Source Photo: Shanghai, China

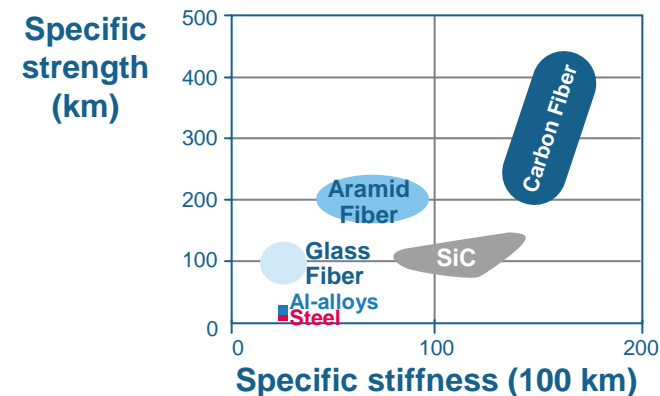


# Fundamental trends manifold competitive advantages of carbon...

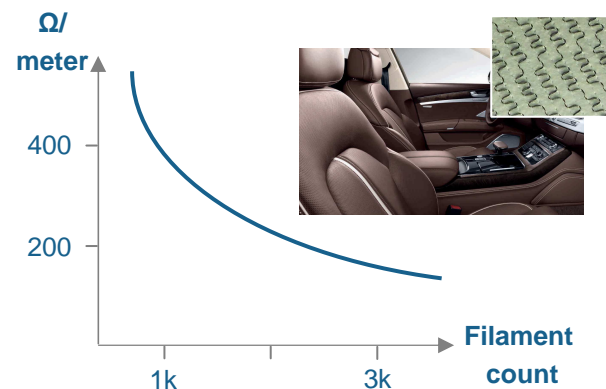
## No other material is lighter ...



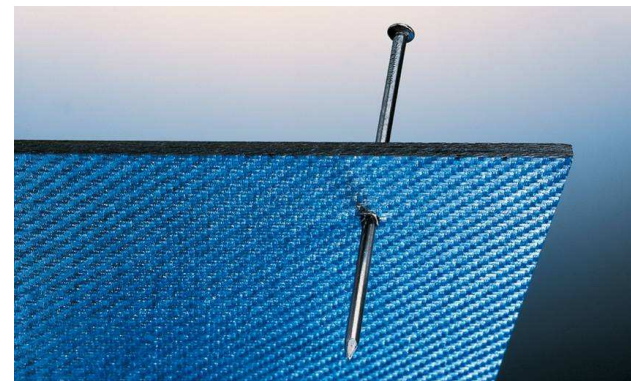
## ... or stronger and stiffer



## Electrically conductive



## Other ceramics would break ...



# Carbon fiber composites part offer new possibilities to reduce energy consumption due to elevator life time

Low Density

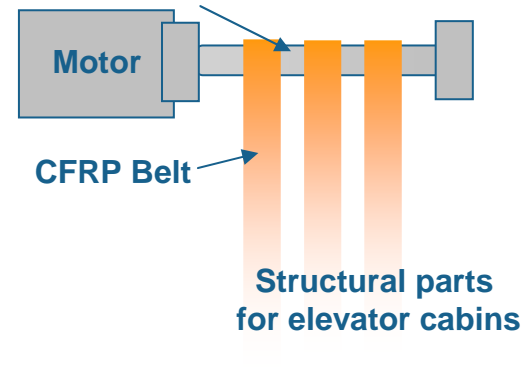
High Strength/  
Stiffness

Electrically  
Conductive

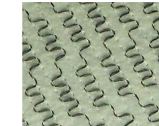
Design

## Ideas for potential elevator applications

CFRP Drive Shaft



Interior parts with  
heating functions



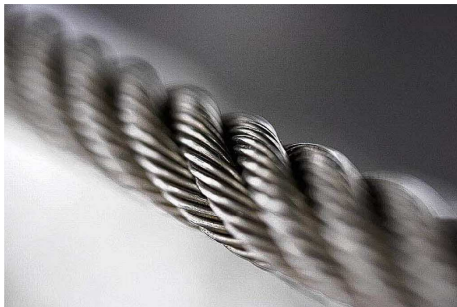
Design  
Interior parts



► Mass reduction of elevator cabins generates further impacts on other system components like motors with lower torque moments, brakes, elevator guidance

## History of innovation

### Since 1853 Steel Ropes



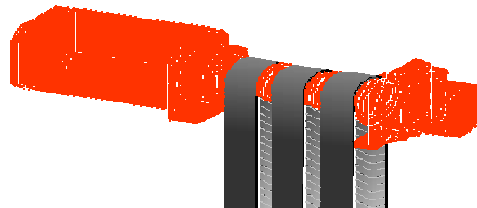
### Since 2001 Steel Cord Belts



### 2013+ Carbon Fiber Belts



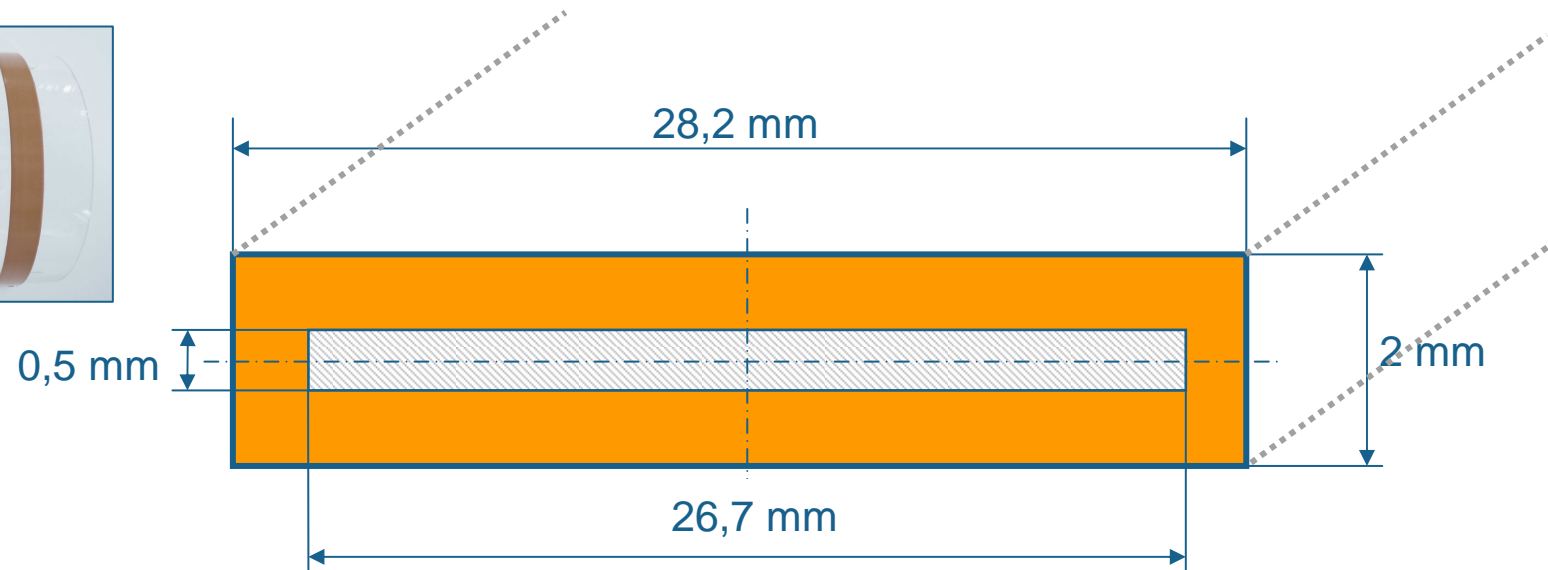
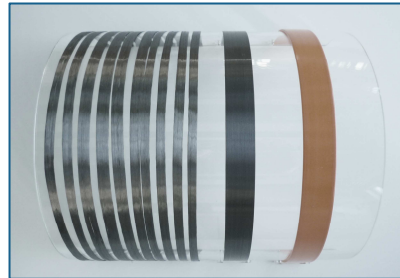
Winding engines  
with traction  
sheave



Reduction of system space and elevator system costs

Source pictures: KONE, OTIS, ContiTech

## The unidirectional design transfers the properties of the carbon fibers directly to the composite elevator belt

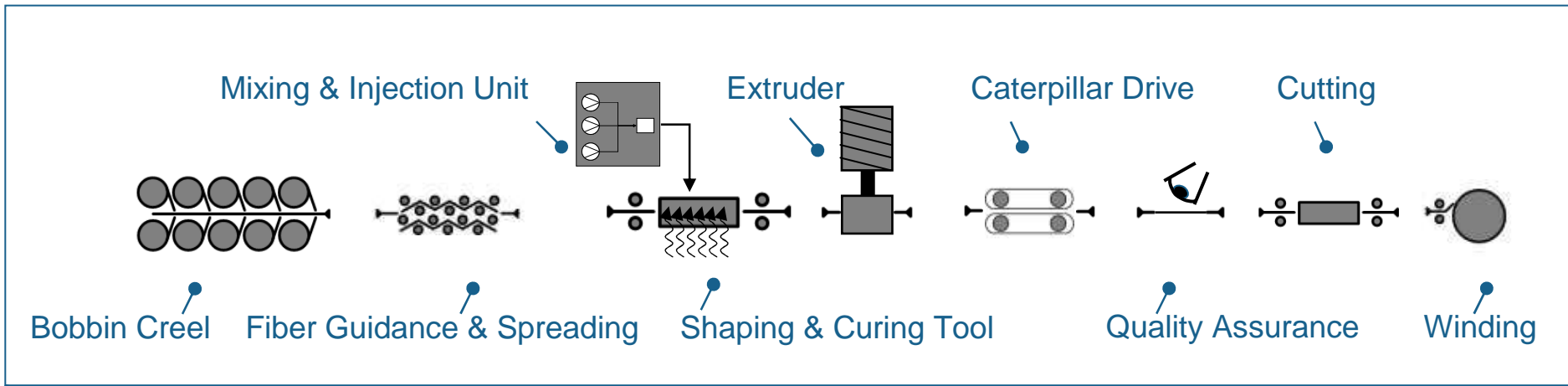


### Belt Properties

Property	Value	Comment
Breaking strength [kN]	> 37	Strength of covering material is included
Youngs modulus [GPa]	> 175	Load carrier YM
Elongation at break [%]	> 1,6	-
Mass per unit length [g/m]	~ 70	-

# Industrial production processes generates competitive CFRP parts


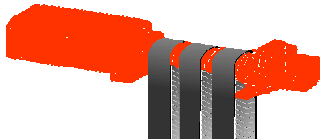

## Pultrusion and Extrusion Process



### Benefits:

- Continuous production process for high volumes
- High fiber volume fraction possible  
→ maximum strength and stiffness at minimal cross sections
- High quality standards
- Use of high volume industrial carbon fibers (automotive)

## Compared to PU coated steel belts CARBOMOTION™ offers new design possibilities for future elevator systems

Customer benefit		Proven properties
<ul style="list-style-type: none"> <li>• New high rise possibilities</li> <li>• Higher loads</li> </ul>		Light weight (70g/m)
Less Energy Consumption		Smaller traction sheaves <ul style="list-style-type: none"> <li>• actual Ø 100 mm</li> <li>• possible Ø 30 mm</li> </ul>
Long life time		Bending cycles > 10 <sup>7</sup>

**CARBOMOTION™ offers possibilities to reduce system space and elevator system costs**

Source pictures: OTIS, SGL Group



# More information @ *lightweightdesign* 5/13



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COMPOSITES SHOW & CONFERENCES  
PARIS, MARCH, 11, 12, 13, 2014

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