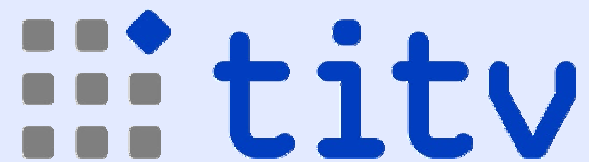
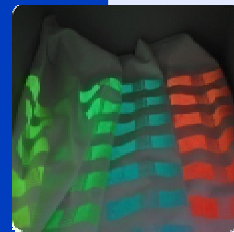


The Institute for Special Textiles  
and Flexible Materials



# Technical Textiles for Automotive Applications

Dr. Uwe Möhring

**23.Textiles Days**

Seoul, 11. November 2009

# Content

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- 1. Introduction of TITV Greiz**
- 2. Textiles in automotive applications**
  - Tire-cord
  - Filter
  - Airbags
  - Safety belts
  - Seats
- 3. Requirements on Interior**
- 4. Outlook - Summary**

# TITV Greiz

The Institute for Special Textiles and Flexible Materials

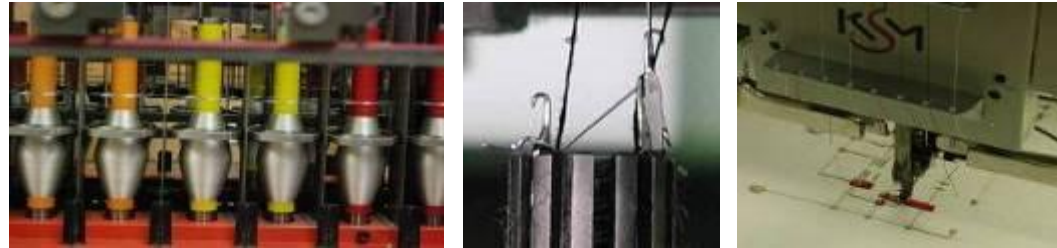
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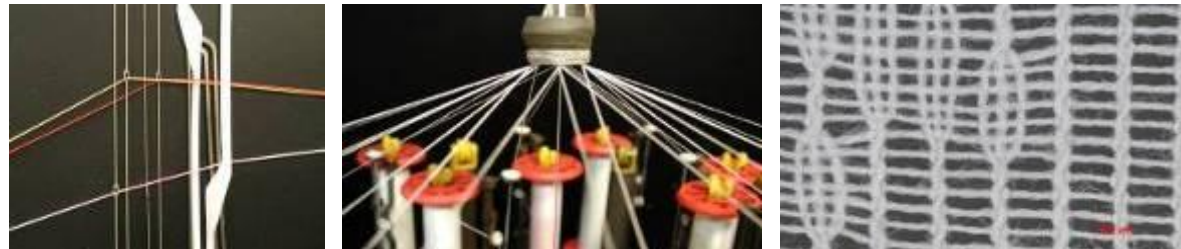
<b>Founded:</b>	1992 in Greiz (Germany)
<b>Employees :</b>	56 (about 30 engineers and scientists)
<b>Turnover :</b>	3,5 Mio. € (2005)
<b>Projects:</b>	over 30 p.a. granted by BMBF, BMWA, AiF, EU ...
<b>Patents:</b>	54

# The Textile Production Chain at TITV Greiz

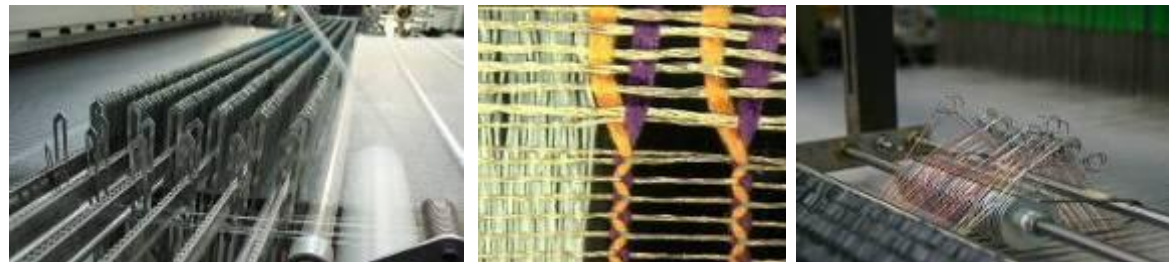
**Thread creation**



**Braiding**



**Fabrics**



**Narrow Fabrics**

**Warp Knitting**



# The Textile Production Chain at TITV Greiz

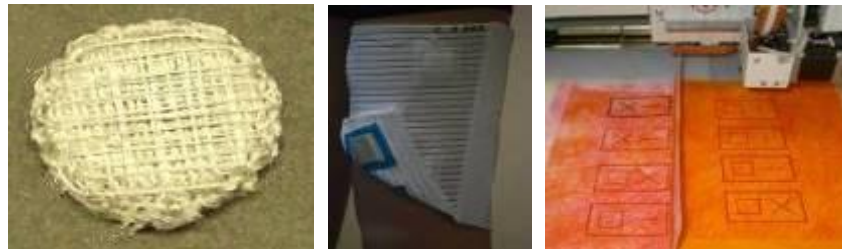
## Dyeing, Finishing, Printing



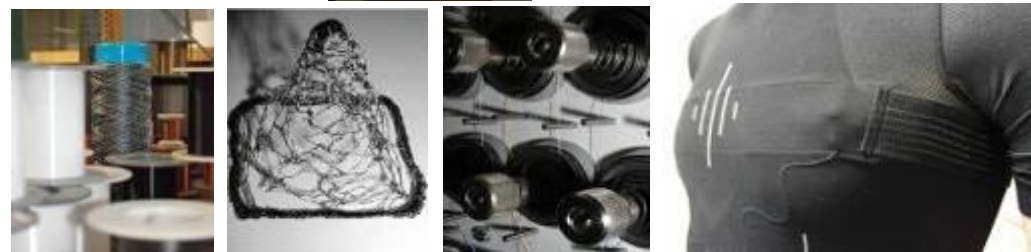
## Galvanics



## Embroidery



## Ready-to-Wear





# Certificated Test Laboratory

*Accredited with  
DIN EN ISO/IEC 17025:2005*

## Physical and chemical tests for textiles

- Tests of Fibres, threads, fabrics
- Colour fastnesses

## Chemical analysis

- Material testing
- Environmental analysis



# Smart Textiles at TITV Greiz

- **Medical Applications**

- Electrodes for EEG, TENS
- Muscle stimulation



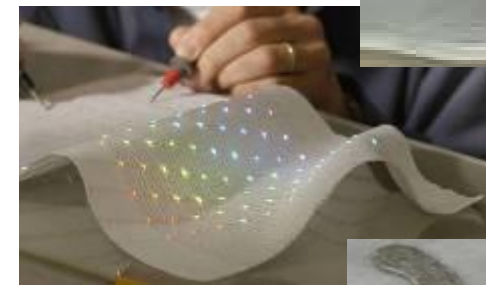
- **Clothing / Automotive**

- Heating textiles
- Illuminating textiles



- **Communication**

- Glove
- RFID-Label





# Topics in Research and Development

---

## Textile Microsystems Technique / Smart Textiles

energy harvesting, textile based micro systems and components, integration in flexible substrates, positioning and connection on flexible substrates, embroidery, sewing, thread technology

## Surface Modification

coating, nano, sol gel, hot melt, rolls, coating knife, galvanisation of thread and fabrics finishing, dyeing, printing

## Flexible Materials / Special Textiles

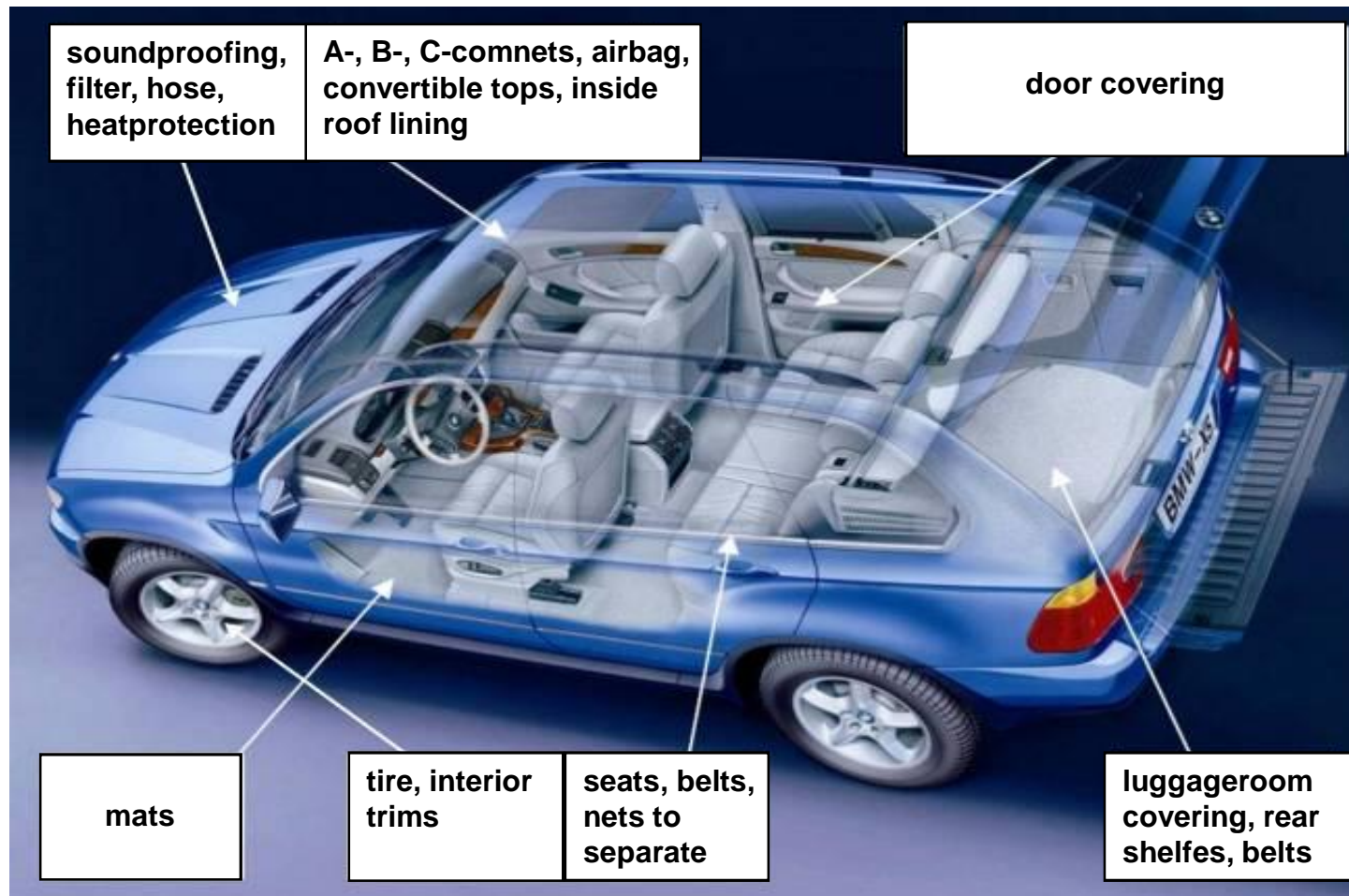
jacquard and shedding weaving technique, leno technology, rapier and air weft insertion, narrow fabrics, warp knitting, spacer fabrics, braiding

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# Textiles in Automotive Applications

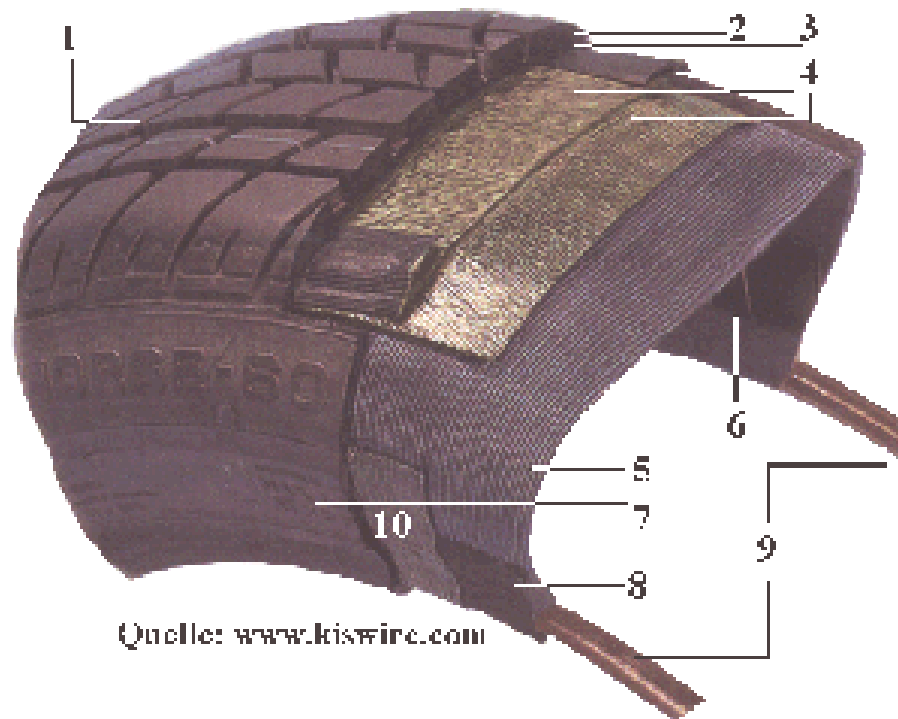


# Tire-cord

## Automobile tire:

about 11 rubber compositions and more than 30 components

- 1 tread
- 2 underrubber
- 3 bandage
- 4 steel cord belt
- 5 carcass
- 6 inner layer
- 7 side
- 8 bead
- 9 core
- 10 bead stripe

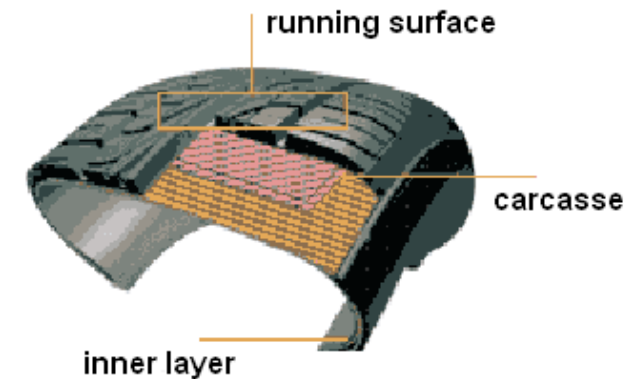


Quelle: [www.kiswire.com](http://www.kiswire.com)

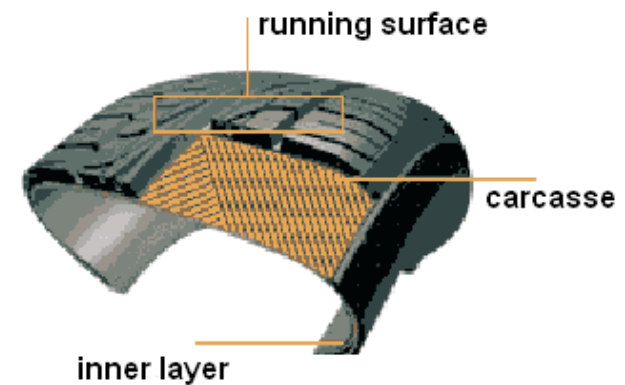
# Carcass

- The carcass is the skeleton of the tire. It is the decisive reinforcement and is completing with belt and treads.
- The carcass consists of 1 or 2 fabrics sheets, which embedded in rubber.
- The fabric obtained of synthetic fibres, rayon and steel cord (in radial tires).

radial ply tire



cross-ply tire



source: [www.reifen.de](http://www.reifen.de)

# Filter – Why?

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- **Motor air- filter**

High-performance engines need clear air to develop their highest performance.

The ambient air comprises naturally (pollen, dust, sand) and industrially (abrasion, rust, emissions) contaminations, these impair the smooth combustion process and get to breakdown. In addition the sensory will be damaged.

- **Air filter**

The inmates breathe the unfiltered pollutants without an air-filter.





# Filter

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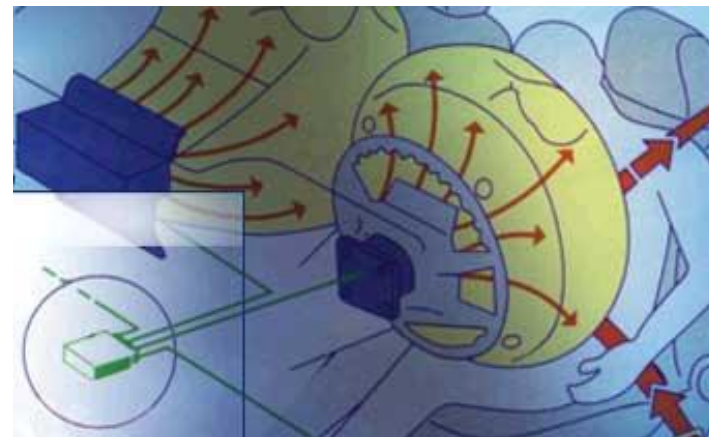
- **Dust Bag**
  - air conditioning and ventilation systems
  - supply and exhaust air arrangements
- **Materials**
  - Polyester
  - Viscose
  - Polyamide
  - Polypropylene
- **Trends**
  - electrical conductivity



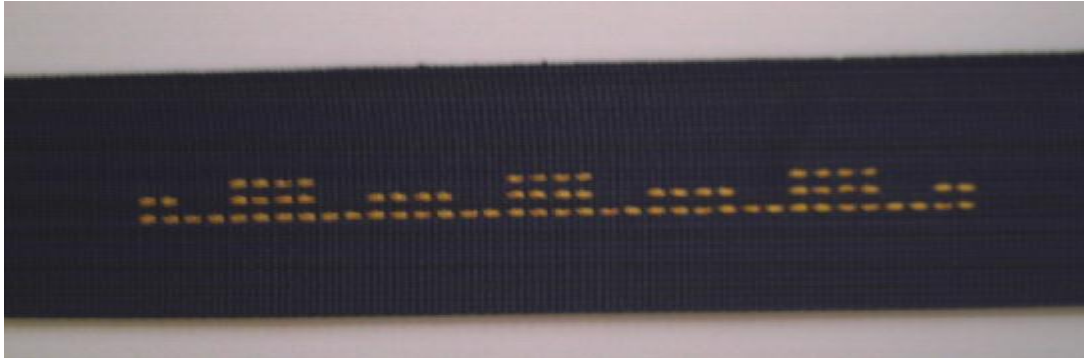
# Airbag

In a car are up to 7 airbag systems, which defeats highest protection-regulations.

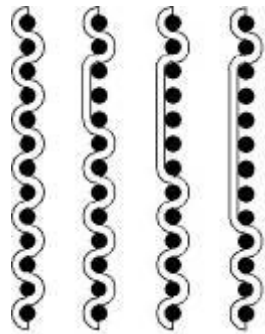
Trend: Welded seams



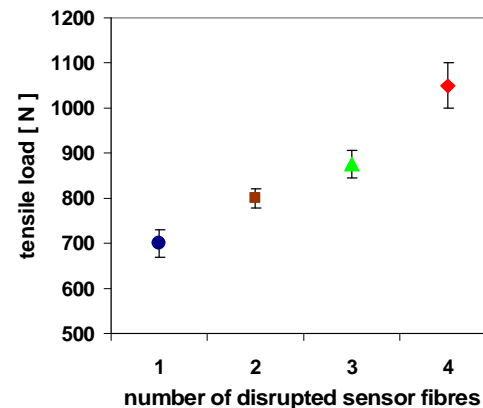
# Safety Belts - Sensor Fibres Indicating Overstress by Rupture



Woven belt with coloured sensor threads for visual inspection to display overstress



Principle: Sensor fibres with varying types of weave



**Tensile load of the sensor fibres**



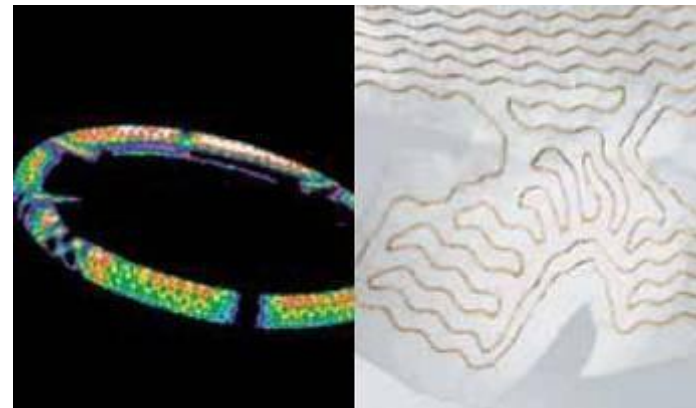
Seat belt

# Seats – Active Air-Conditioning



# Active Heat Management – Automotive

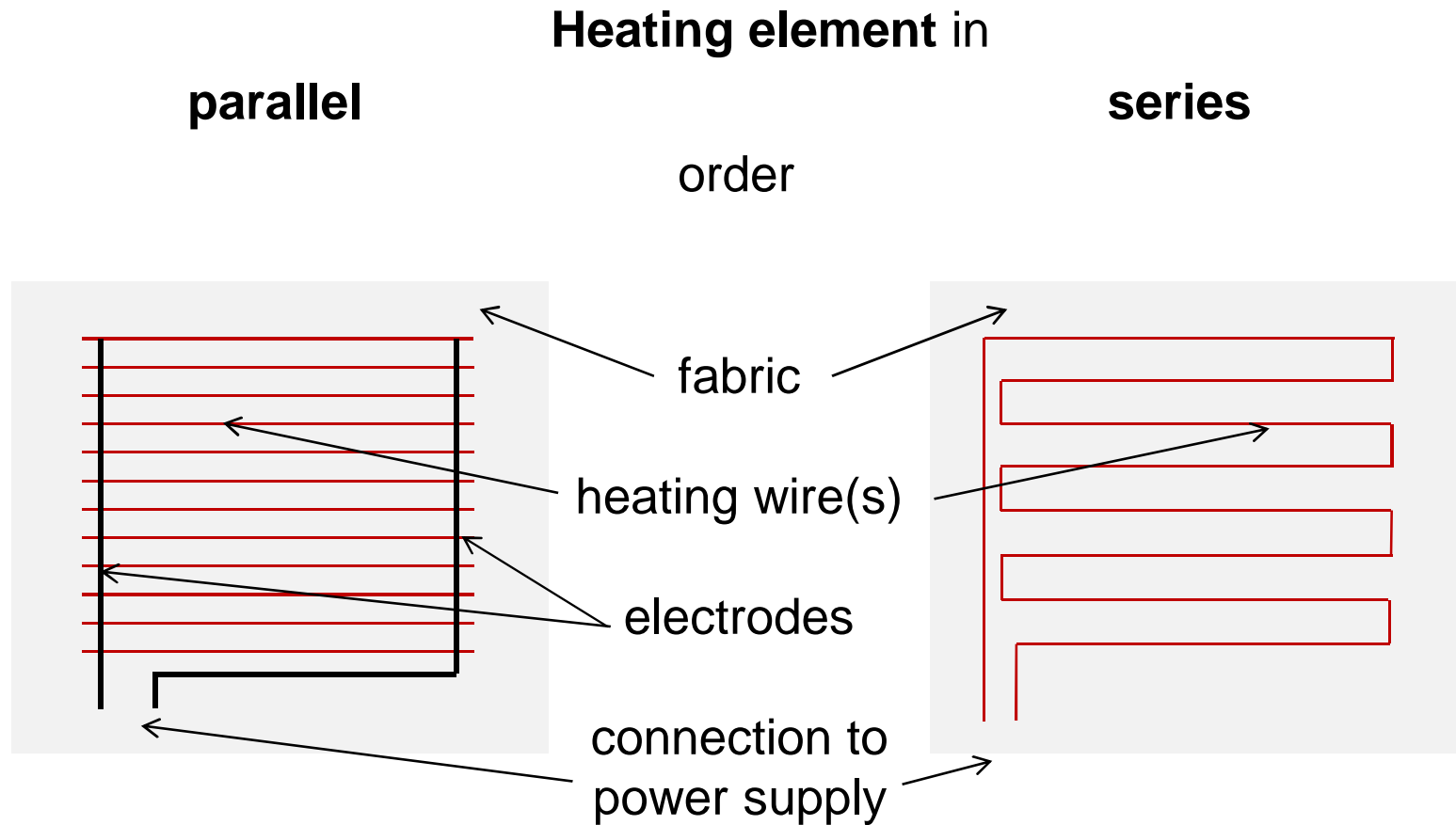
- Car seat heating elements



source: W.E.T. automotive

# Textile Heating Systems

2 principle setups of heating systems





# TITV Greiz solutions

- Heating system for children seat



Using embroidery or weaving technology for development of heating fabrics as inlay



# Active Heat Management – Automotive

## Active Heat and Cooling Systems

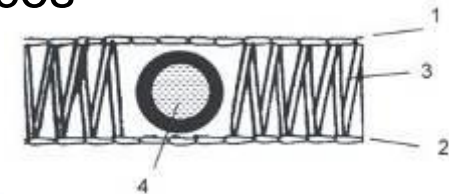
- Defined lanes in a spacer fabric
- Forced air circulation systems
- Forced fluid circulation by application of tubes
- Active heating and cooling



Our partner:  
Kröhnert Chilling & Heating

Spacer fabric with integrated tubes:

- 1,2: knitted surfaces
- 3: pile yarns
- 4: tube



# Silk in Seat Covers

## Features

- New optical characteristic
- New haptics
- Integration of climate functions
- High-grade Silk Image



SILK MADE IN GERMANY

**CarTrim**

# Silk in Seat Covers

**Silk meets the most specifications  
of the car manufacturers**

Burning speed of different silk fabrics:  
0...55 mm/min

DIN 75200 ( $\leq 80$ )

Martindale: 50 000

DIN EN ISO 12947-2 (12kPa)



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# Regulation of heat and moisture transport

---

## **Physiological seat comfort:**

- Breathable through good air and water vapour permeability
- Comfort even when sweating through good moisture absorption and buffering
- Comfortable thermal sensation through textile seat cover and optimal thermal transport behaviour



# Regulation of heat and moisture transport

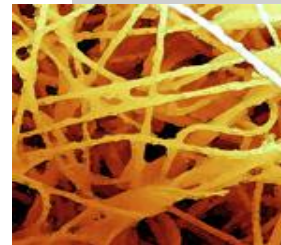
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Interacting components:

Seat cover



Lamination, lining fabric



Layout of seat / Design



Quelle: Johnson Controls, Inc.

# Innovation from TITV Greiz

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Seat cover  
textile fabric



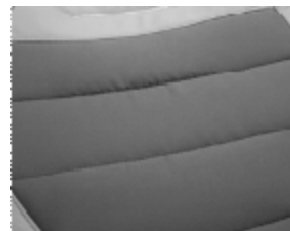
Textile seat cover fabric  
Development and test

Lamination and lining fabric  
hygroscopic



Heat and moisture transport  
with spacer fabrics

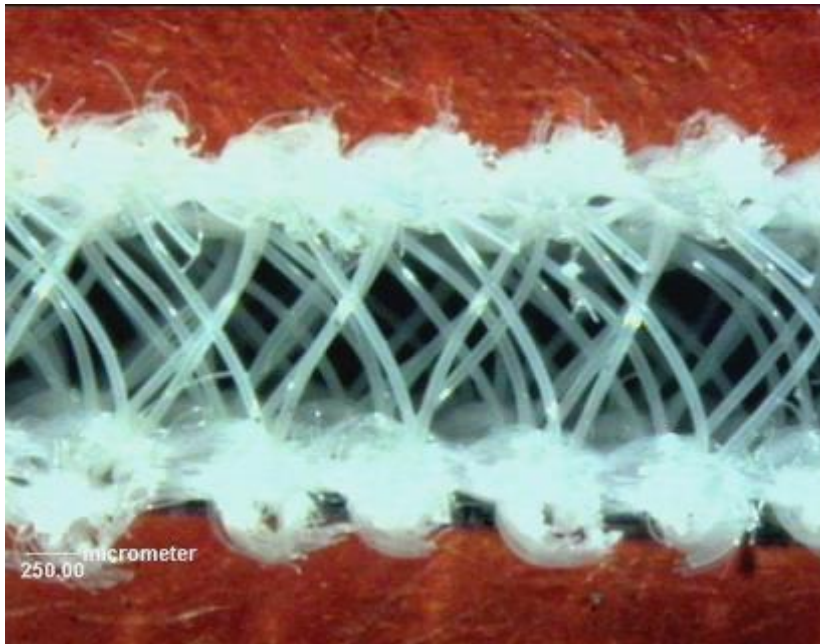
Layout of seat / Design  
Ventilation und additional  
buffers



Layout of seat / Design  
Ready-made solutions and  
adjustment of all components  
for passive or active climate  
seat

# Innovation from TITV Greiz

## Climate effect with the use of three-dimensional spacer fabrics



Spacer fabrics are:

- breathable
- pressure distributing
- thermo-regulating
- the direction of moisture transport can be controlled by the choice of material

# Antistatic Behaviour

The avoidance of electrostatic electrostatic discharge

Problem:

- If the surfaces of materials rub against each other, static charges are produced as a result of charge separation
- Electrostatic discharges when getting out of a car are caused by friction between clothing and seat cover of car seat
- Seat cover of car seat must be electrostatic dissipative to avoid electrostatic discharges
- Electrostatic dissipative fabrics have a surface resistance between  $1 \cdot 10^5$  and  $1 \cdot 10^{11}$  ohm
- The surface resistance according to standard DIN 54345-1 is determined with a special ring electrode and a high-resistance measuring instrument



# Solutions and Services of TITV Greiz

- Design of electrostatic dissipative fabrics
- Application of organic polymers on woven fabric for achieving electrical conductivity for conducting charges
- Measurement of the surface resistivity in accordance with standard DIN 54345-1 for the evaluation of electrostatic properties on woven fabrics



Resistance measurement in the climatic exposure test cabinet



Ring electrode and a high-resistance measurement device

# Soil Release / Easy Cleaning

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## Water-repellence through finishing

- Paraffin wax emulsion
- Fat-modified compounds
- Silicone
- Fluor chemicals



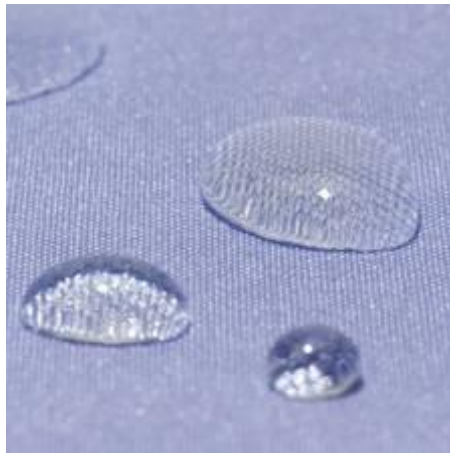


# Soil Release / Easy Cleaning

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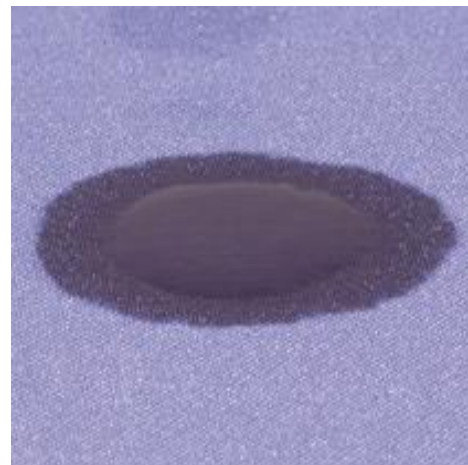
Hydrophobic / Oleophobic finishing

Spreading of an oil drop on:



Fluorine-carbon finishing (FC)

FC - finishing - water and oil-repellent  
HC – finishing water repellent only



Silicone finishing (HC)

# Soil Release / Easy Cleaning

## Test of soiling behavior

Suitable test substances for technical textiles are:

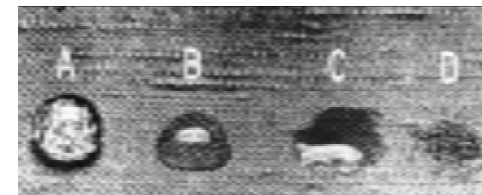
### Water

Spray test (according to DIN EN 24920)



### Oil

Oil note (according to AATCC 118 or DIN EN ISO 14419)



### Standard soiling

AATCC 123 Standard soil

09 W-2 Synthetic standard carpet soiling + vaseline

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# Textile a Lightweight Material

actually: part of textiles in cars  
20 kg  
outlook to 2015: part of textiles  
will increase up to 30 kg

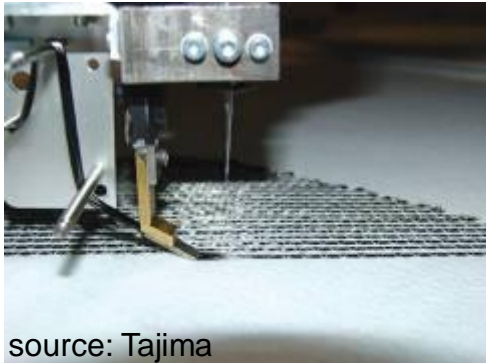
The fuel consumption sink  
amount to 0,5 l /100 km per  
100 kg weight saving.



## Innovations of the future

- Ü Functional textile composites
- Ü Reinforcement of the Interior and the car body parts
- Ü Safety-related extensions

# Tailored Fibre Placement

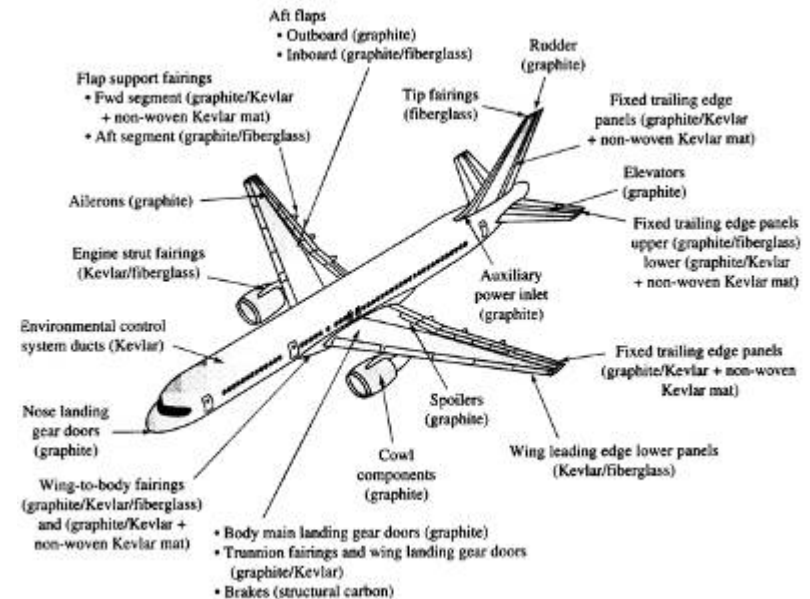


source: Tajima



[www.7-forum.com](http://www.7-forum.com)

cowling  
Mirror caps  
laterally air intakes at the front skirt  
Gurney at the boot lid and rear bumper



Composite in the main structure of the boeing 757-200 aircraft. (Source: Boeing commercial Airplane company)

# Outlook – Smart Textiles

The comfort is to carry out with the integration of electronic functions in textile decorative and reinforcing elements with simultaneous weight reduction, reduced depth and improved flexibility.





# Conductive Materials for Textile Application

TITV's product development  
ELITEX<sup>®</sup> Thread

ELITEX<sup>®</sup> threads are

- High-conductive,
- Textile processable  
polyamide thread materials
- With a coating made of pure silver





# Product Information of ELITEX® Threads

Material	Polyamide
Coating	99,9 % silver
Basic yarn count:	234 dtex / f 34
Yarn count with silver layer:	450 ± 50 dtex
Electrical Resistance:	20 $\Omega$ m <sup>-1</sup>
Melting point:	259 °C
Force-tension behavior	
Tensile strength:	>750 cN
Tensile strength tension:	> 10 %
Processing temperature:	max.180 °C, 5 minutes



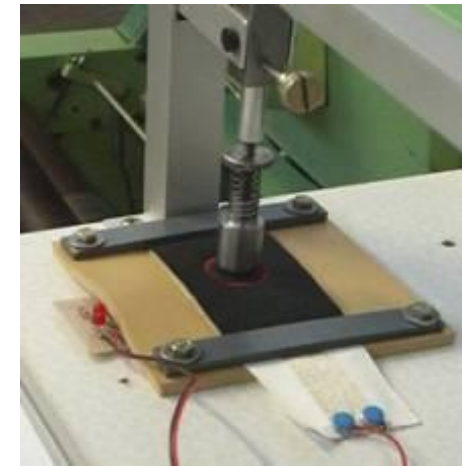
# Textile Switches



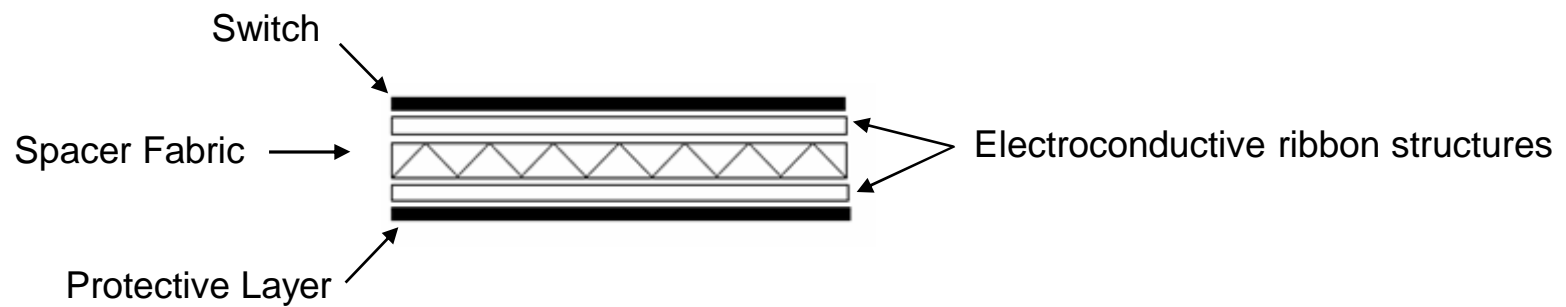
1. Generation



2. Generation  
(with pressure point)



Testing equipment for  
Long-time loading



# Textile Switches – Applications



- Integration in seats, arm rests, side linings, clothing
- Soften switch
- Easy handling
- No reduction of comfort
- Flat - very low height



Our partner: Car Trim, Plauen

# Illumination with Textile Light Sources



Ambient light at the backside of the head-rest



Screenprint (30 cm x 40 cm, 4 colours)

# Electroluminescent Textiles

- EL Textil integrated in a door panel





# Luminescent Textiles



LED on woven fabric



# Trends

---

## Requirements for customer satisfaction

- Quality
  - Velcro resistance
  - Rub off resistance
- Comfort
  - Regulation of heat and moisture transport
- Functionality
  - Antistatic
  - Soil release / easy cleaning
- Elegance / good haptic
- Odor



# Visionary Concepts

- BMW “GINA” project



## The cars of tomorrow . . .

---



. . . textile cars ?

# Acknowledgement

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**Team of TITV Greiz**

**Partners in Industry**

**Financial Support**



# Thank You for Your Attention!

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