

# **European Best Practices in Water consumption, Energy saving and Sustainable Company Organisation**

## ***UV-LED curable coatings for technical textiles***

**Ralf Lungwitz / Romy Naumann  
(Saxon Textile Research Institute)**

iTechStyle Summit - 1<sup>st</sup> International Conference of Textile and Clothing  
2<sup>nd</sup> RESET Seminar on "Water consumption & energy saving"  
Porto/Matosinhos, 14<sup>th</sup> February 2017

# Saxon Textile Research Institute (STFI)

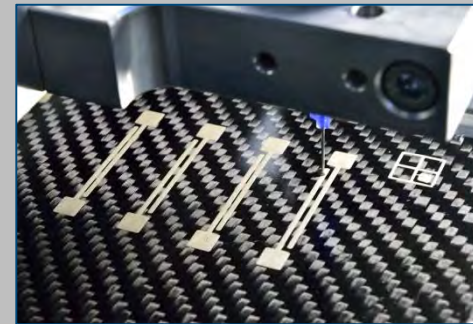
Affiliated institute of Chemnitz University of Technology



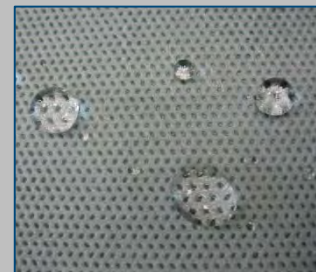
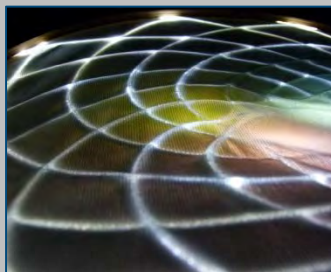
SÄCHSISCHES  
TEXTIL  
FORSCHUNGS  
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TECHNISCHE UNIVERSITÄT  
CHEMNITZ



**International Competence  
in Nonwovens – Textile Lightweight Engineering –  
Technical Textiles**



# Saxon Textile Research Institute (STFI)

Affiliated institute of Chemnitz University of Technology

- non-profit, founded in 1992
- since 2006 associated to Chemnitz University of Technology
- about **150 employees** (researchers, laboratory assistants and technicians)
- more than **100 R&D projects** on regional, and national level are carried out each year (BMW, BMBF, AiF, SMWA, SMWK, ...)
- 5 to 10 **patent applications** are submitted per year
- member of TEXTRANET, EDANA, European Technology Platform, Euro Textile Region, standardisation working groups, etc.



The institute is located in Saxony.

RESET  
Interreg Europe



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# Profile of STFI – Competencies

## Center of Excellence in Nonwovens

- Fibre nonwovens
- Extrusion nonwovens
- Textile recycling



## Center for Textile Lightweight Engineering

- Processing of glass, carbon, aramid, basalt
- Manufacturing of composites and pre-forms
- carbon recycling



## Innovation Center of Technical Textiles

- Technical Woven & Knitted Fabrics/Reinforcing Structures
- *Finishing/Coating/Lamination / Ecology*
- Development of materials and testing methods



## Services

- Accredited Test Laboratory
- Certification Department for PPE
- Certification Body Geosynthetics



CE 0516

## Transfer Center

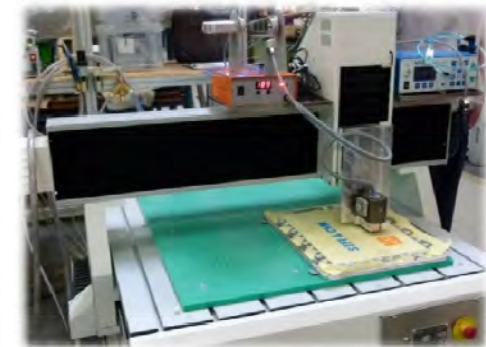
- Communication and process management
- International cooperation



# Innovation Center of Technical Textiles

## Finishing / Coating / Laminating and Ecology

- textile functionalisation by finishing, coating, printing
- yarn finishing and coating
- composites from textile and non-textile materials
- hotmelt technology; compounding and coating
- ecology and environmental protection
- chemical analysis



# RESET – 2<sup>nd</sup> Thematic Seminar



## **“Water consumption and energy saving” Presentation of Good Practice (GP)**

### ***UV-LED curable coatings for technical textiles***

Ralf Lungwitz / Romy Naumann  
(Saxon Textile Research Institute)

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Porto/Matosinhos, 14<sup>th</sup> February 2017



# UV-LED curable coatings

## Background for the implementation of the GP

### *State of the art – textile coating with thermal drying*

- *solvent based systems (org., DMF, MEK, toluene)*
- *water based systems*
- *high-solid systems (80 – 100 % solid)*
- *thermoplastic polyurethanes*

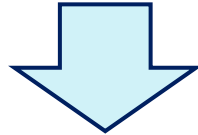


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- *explosion protected plants (org. solvents)*
- *solvent residues (DMF - REACH)*
- *exhaust air treatment (org. solvents)*
- *application of the **valuable resource water as solvents***
- *high drying and application temperatures → **energy intensive***
- *high and long plants → **high space requirement***



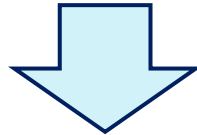


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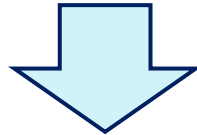


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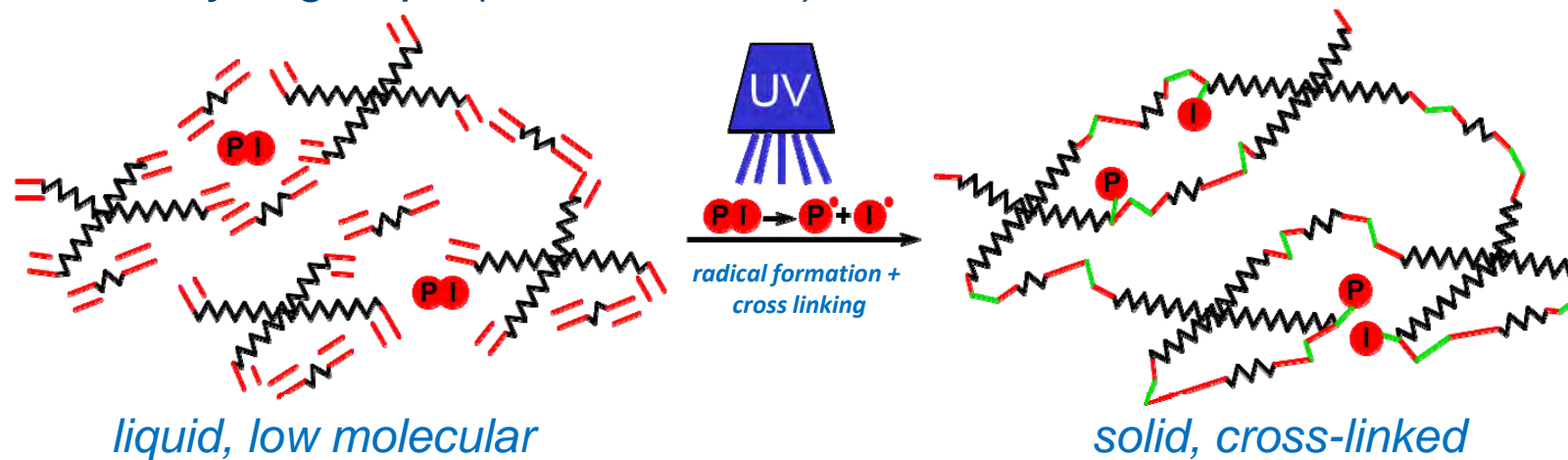
***UV-curing***

# UV-LED curable coatings

## Background for the implementation of the GP

### *General principle of UV-curing*

- *based on photo-initiated radical cross-linking/polymerisation of acrylic groups (double bonds)*

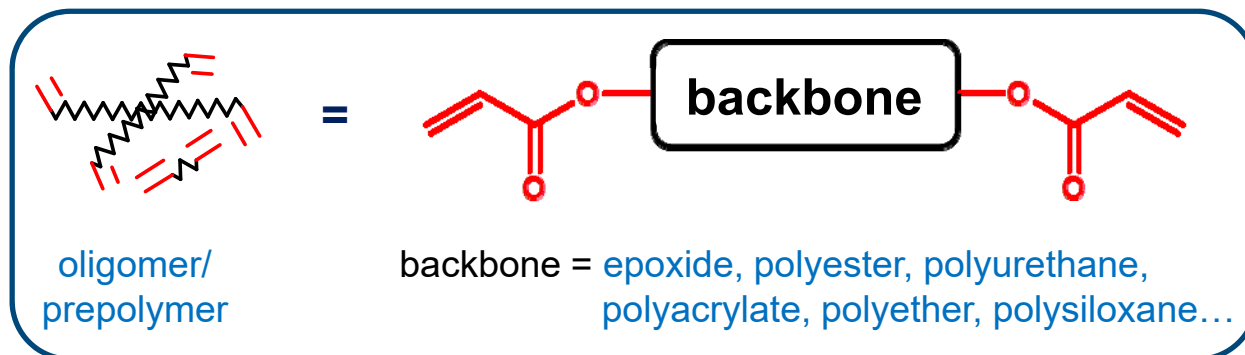
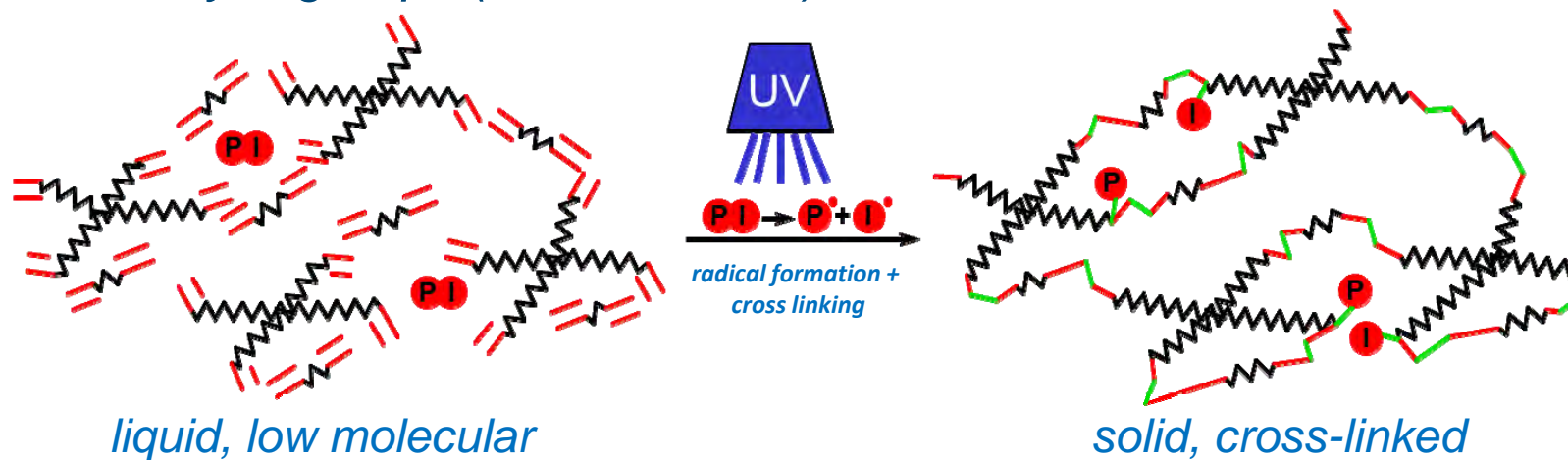


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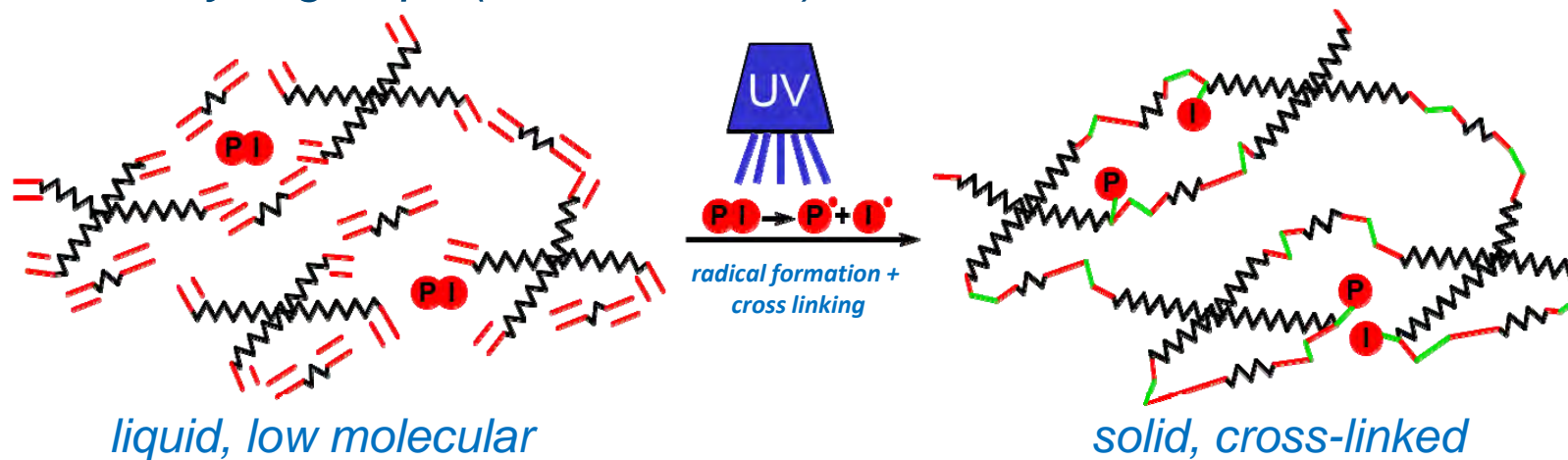
**PI** = photo-initiator

# UV-LED curable coatings

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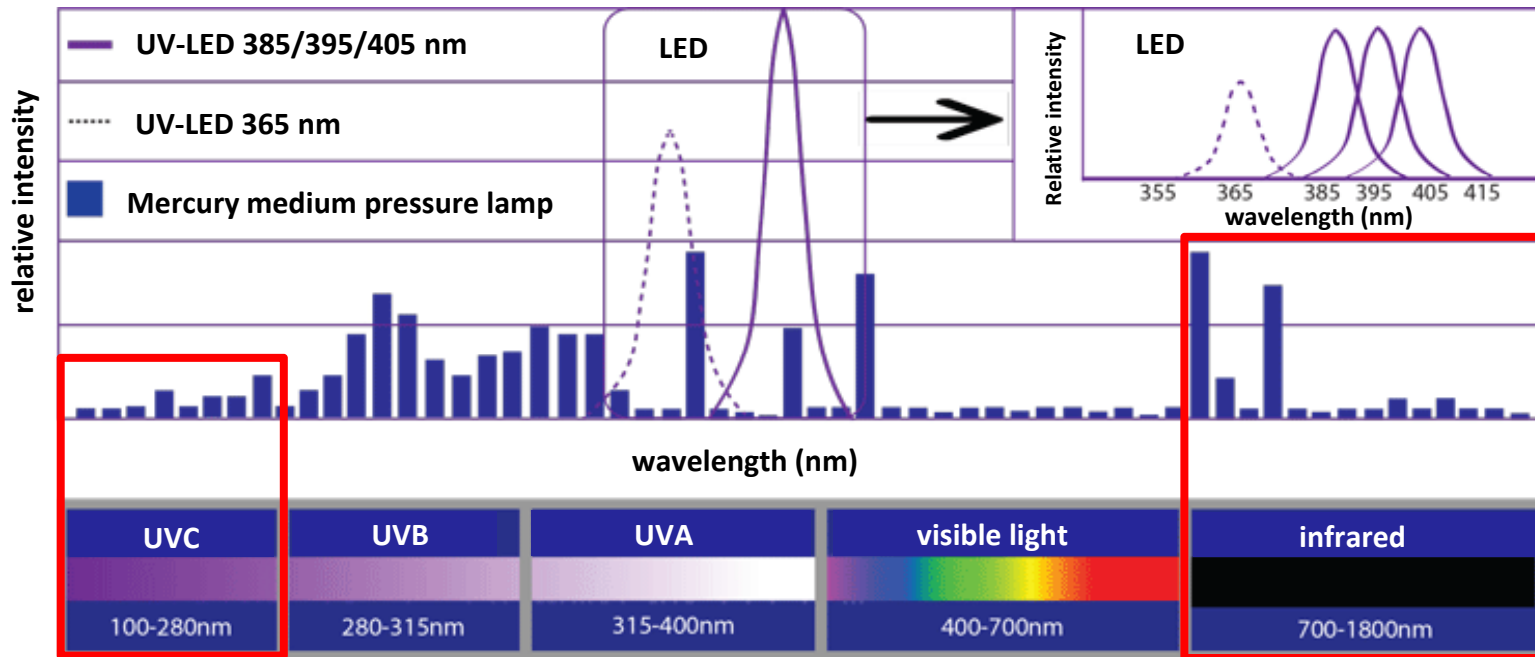
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# UV-LED curable coatings

## Background for the implementation of the GP

### *Comparison of UV-sources*



*formation of toxic ozone*

*heating of the material*

### Further drawbacks of UV-Hg-lamps:

- *contains mercury* → *Disposal and safety at work*

# UV-LED curable coatings

## Background for the implementation of the GP

### *Advantages of the UV-LED-curing*

- **eco-friendly** 100 % formulations
- **low energy consumption** → *energy saving up to 75 %*
- **low space requirement** → *1 – 2 m instead of up to 150 m*
- **short curing time** – *operating speed up to 90 m/min (wood coating) and 900 m/min (printing)*

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### *Advantages of the LED as an UV-source*

- narrow band and intensive emission spectrum in the UV-A range (315 – 400 nm) → **no formation of toxic ozone**
- no emission of IR-radiation → **very gentle to the material**
- long operating life (> 50000 h)
- no power-up time → **on-off operation**
- contains no toxic mercury
- small size and variable in form



# UV-LED curable coatings

## Background for the implementation of the GP Legal framework

### ***Directive 2008/1/EC of European Parliament and Council***

- about Integrated Pollution Prevention and Control (IPPC)

### ***Directive 2010/75/EC “Industrial Emissions Directive – IED”***

- measures for prevention and reduction of emissions and waste for different industrial sectors
- use of the Best Available Techniques (BAT)

### ***Trail “Reduction of Mercury Emission” incorporated into the United Nations Environment Programme (UNEP) was concluded in 2013***

- aim → replacement of mercury containing products

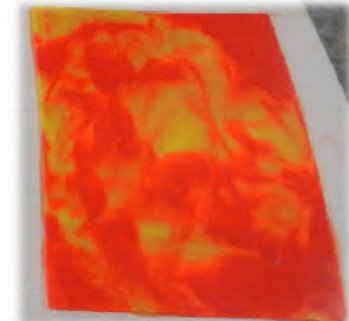
### ***Further legislation to be taken into consideration***

- waste disposal and occupational safety of mercury
- occupational safety concerning UV-radiation

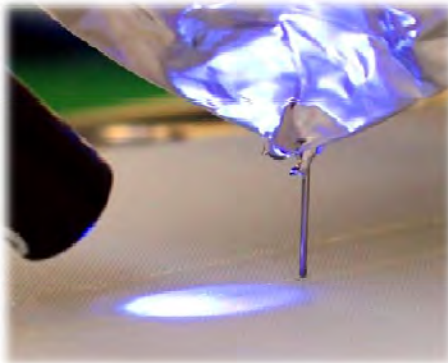
# UV-LED curable coatings

## UV-LED curing at STFI

*Functional coating of technical textiles*



*3D printing on textiles*



*Composites in light-weight engineering*



# UV-LED curable coatings

## UV-LED curing at STFI - machinery

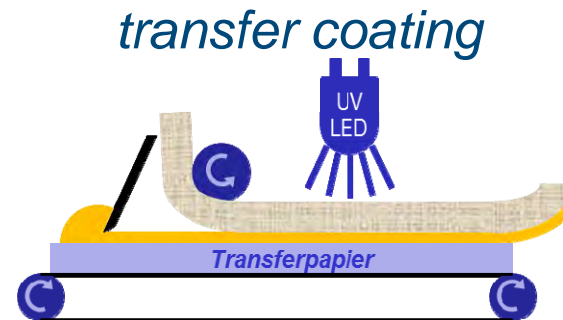
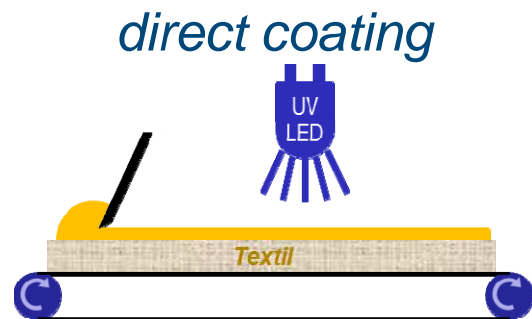
- UV-Hg-unit (with various lamps)
  - UV-LED-lamp (395 nm)
  - both integrated into a lab-scale coating plant
  - UV-LED-lamp (385 nm) @ 3D printer
- 
- 50 cm working width
  - direct and transfer coating
  - foulard
  - reverse-roll-coater
  - slot die
  - jetronica print head
  - corona pre-treatment
  - *N<sub>2</sub>-inertisation chamber*



# UV-LED curable coatings

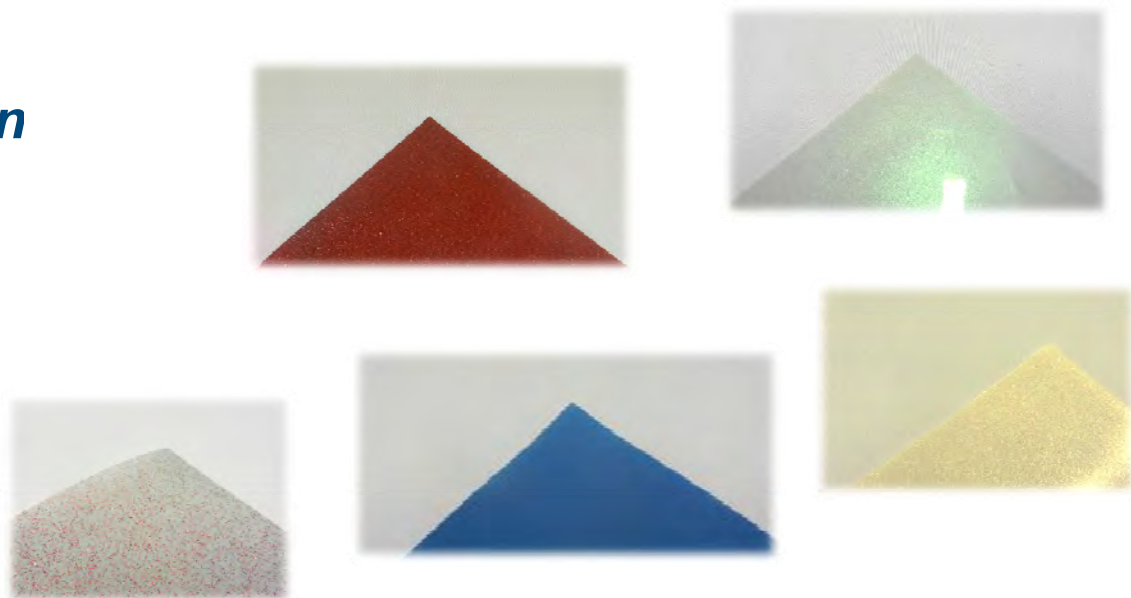
## UV-LED curing at STFI – functional textile coating

*Binder:* polyurethane- and siliconacrylate



### Functionalities

- *non-fade/UV-protection*
- *flame retardant*
- *abrasion resistance*
- *anti microbial*
- *colouration*



# UV-LED curable coatings

## UV-LED curing at STFI – functional textile coating



# UV-LED curable coatings

## Transferability of GP - Success factors

- from a technological point of view, the described GP is transferable to other regions provided that the requested investment for machinery is available
- development of innovative products (technical textiles)
- development of processes with high economic efficiency (*material, water, and energy saving*)
- reduced energy costs

2



3



7



6

conveyor belts



6



# UV-LED curable coatings

## Impact on “Water consumption and energy saving, sustainable company organisation”

*Increasing energy costs (2007 - 2013 electricity ~ 42 %, oil ~ 80 %, gas ~ 28 %)\**

- **energy saving:**
  - short processing time
  - using UV-LED-source (75 % energy saving vs. thermal curing)
- **water consumption:**
  - water and solvent free 100 % formulations
- **space saving (~ 2 % space requirement vs. stender frame)**
- **reputation as an ecological technology**



# UV-LED curable coatings

## Good Practice value added at regional and transregional (EU) levels

- Gaining expertise in a specialized technological field
- Establishing innovative technologies
- Industrial up-scaling of energy-efficient technologies
- Gaining innovative products with improved functionalities
- Saving energy and processing time
- Improvement and adaption of machinery and equipment for worldwide applications
- Transferability of Good Practice to other regions



# UV-LED curable coatings

## GP Contact

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# RESET

Interreg Europe



European Union  
European Regional  
Development Fund

# Thank you!



*Project smedia*

