



European Union
European Regional
Development Fund

MUFTEX

MUFTEX - textiles for protective clothing and health care sector

Miloš Beran

CLUTEX – Cluster Technical Textiles, Czech Republic

beran@clutex.cz

4 April, 2017 | 3rd RESET seminar in Bucharest

About CLUTEX

Foundation



- Founded in 2006
- 17 founding members (companies, FT TUL, ATOK, research institutions)
- civil association => open structure
- join together Czech companies interested in technical textile innovations



About CLUTEX

Objectives

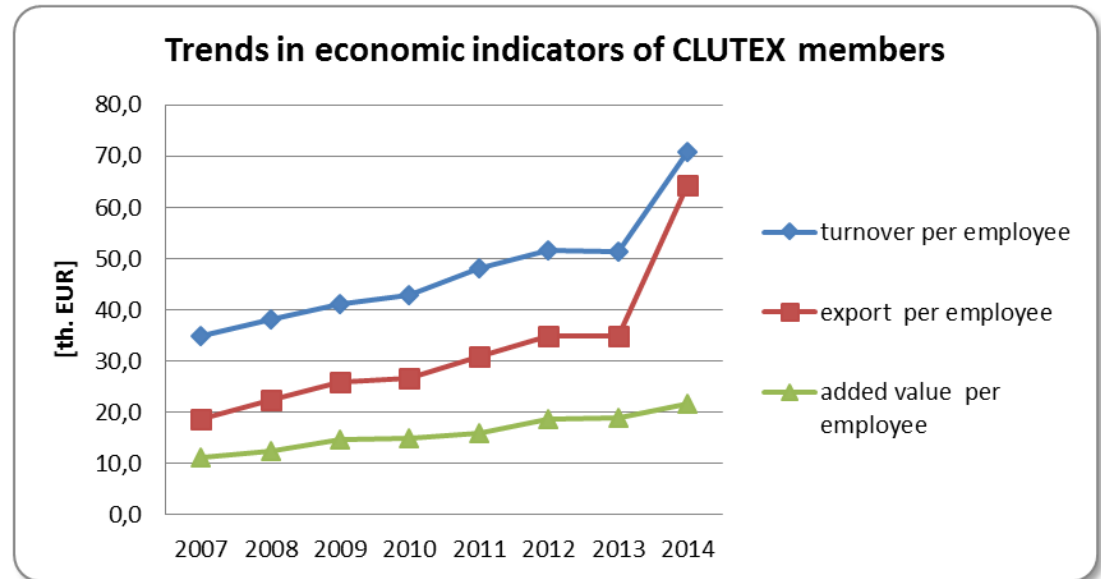


- The cluster is seeking to increase prestige of Czech firms and at the same time Czech textile industry.
- This has been achieved by focusing to production with
 - higher utility and added value
 - making higher use of R&D results and
 - improving qualification of workers.
- Main aim is to involve members of the cluster to production of special types of technical textiles

About CLUTEX

CLUTEX in 2016

- 2015: 31 members
 - 24 SME
 - 5 Large comp.
 - 1 University
 - 1 Association
- Number of employees: near 4,5 thousand
- Turnover 2014: 8 296 mio.CZK (305 mio. EUR)
- Export 2014: 7 517 mio.CZK(276 mio. EUR)



Project MufTex

The main objective of the project is research and development of textiles with new functional properties (functional samples) based on the combined solution by selecting the material's structure, technology processes and finishing.

5 sub-tasks

- **Prediction of comfort fabrics for extreme climatic conditions**
- **Multifunctional barrier textiles**
- **3D textile structures for special application**
- **Textile materials resistant against repeated radiation sterilisation**
- **Development of new 3D textile structures intended for functional sports and leisure clothing**

Project MufTex

The main objective of the project is the development of textiles with multifunctional properties (functional samples) based on the selection of the material's structure, processing processes and finishing.

5 sub-tasks

- Prediction of comfort fabrics for external use
- **Multifunctional barrier textiles**
- 3D textile structures for special applications
- Textile materials resistant against radiation
- Development of new 3D textile structures for sports and leisure clothing



Flame-retarded textiles present nowadays a very significant article on the market with functional textiles determined for protective clothing (as preferred EU market segment supported by PPE Lead Market Initiative: PPE-personal protective equipment)



Existing conventional FR systems drawbacks and limitations

- limited content of synthetic fibre (PES) in blend with cotton (maximum 25%). Blends with a higher PES content cannot be washpermanently FR finished by available FR finishing systems. On the other hand, PES/cotton blends with a high PES content (incl. 50/50 blends) aspire nowadays to be used because of their prolonged service life and increased mechanical resistance in many repeated washing cycles compared with pure cotton.
- **negative impacts on environment and human health:** formaldehyde emissions and rest formaldehyde on the finished fabric (pyrovatex system), Br and antimony content (coating systems)
- **negative impacts** of conventional FR finishing systems on **mechanical-physical properties** (tensile and tear strength loss) and comfort parameters

Result of MufTex

Subtask: Multifunctional barrier textiles

A development and optimization of a technologically viable processing system for **eco-friendly washpermanent FR finishing** of cotton and CO/PES blends has been conducted by INOTEX company (CZ) in frame of MUFTEX project (CLUTEX).



TEXAFLAM DFR

Private small textile company - innovation, R&D, textiles and auxiliaries production, technologies development, optimization and transfer.

SME: 47 employees

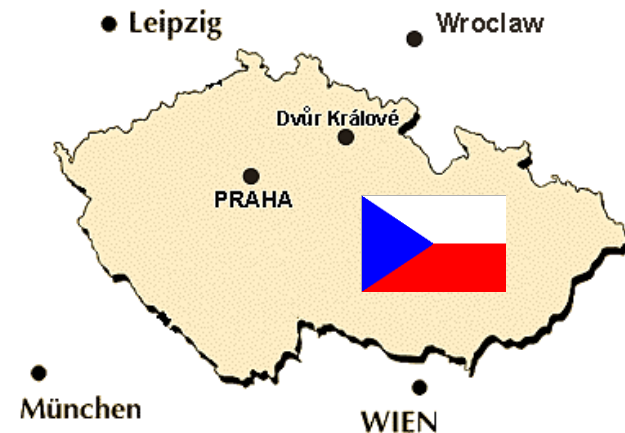
KEY STRATEGY:

***TO SUPPORT IMPLEMENTATION OF TAILORED R&D RESULTS
INTO THE PRACTICE OF TEXTILE COMPANIES
BY USE OF OWN PILOT PRODUCTION CAPACITIES***

CZ 544 01 Dvůr Králové n.L.

Czech Republic

inotex@inotex.cz, www.inotex.cz



ACTIVITY AREA

TEXTILE WET PROCESSING AND PRODUCT SALE

- Production and service - small scale production unit
- New products development and transfer to the SME's
- Development and introduction of new eco-friendly technologies
- Textile biotechnology



SPECIAL MACHINERY equipment and devices production

SMALL-SCALE finishing / coating capacity

functional textiles, technical textiles,.....



ACTIVITY AREA

DYES, COLOURISTIC DEPARTMENT

- Complex colouristic service
- Colourmatching
- Customization of dyeing processes
- Supply of dyes and auxiliary agents of reputable producers



ACCREDITED TESTING LABORATORY (ISO EN 17025)

- testing of textiles (colour fastness, formaldehyde content, material resistance, flame resistance, MMT, dimensional changes,...)

CENTRE OF ECOLOGY

- consultancy and testing for ecolabelling (CZ Ecolabel), IPPC, eco-friendly techniques
- decolourisation and separation of heavy metal ions from textile waste water
- ADR (road transport of dangerous goods)

R&D / INNOVATIONS

Experience in the national and international team cooperation

International R&D programmes



Multidisciplinary clusters



*Cluster for
technical textiles*



*Biopharmaceutical
cluster*

Coordination

*EU R&D Roadmap for
Textile Biotechnology*



TEXAFLAM DFR

is determined for 100% cotton and CO/PES blends up to 50/50 incl. lighter constructions:

- **Protective clothing** (working clothing, firefighters' underwear, military uniforms – no influence on infrared camouflage colourations) EN ISO 15025; EN ISO14116: 3/25x60
- **Bed-linen, incl. white goods** (compatible with optical brighteners, no yellowing effect EN ISO 12952
- **Draperies, interior and upholstery textiles** (EN ISO 6940, EN ISO 6941, BS 5852, EN ISO 1021-1, 1021-2
- **woven and knitted materials**



Protech



Homotech



Medtech



TEXAFLAM DFR is envi-friendly

- based on organic P/N chemistry (phosphorus/nitrogen)
- formaldehyde-free, VOCs-free (volatile organic compounds)
- halogen (Cl, Br) and antimony-free
- heavy metals-free



Results

FLAMMABILITY

LOI (EN ISO 4589-3)

■ Cotton

LOI_{DFR} similar to Pyrovatex and Proban

■ 50/50 Co/PES

Pyrovatex : FR not sufficient

Proban: LOI_{DFR} > LOI_{PROBAN}

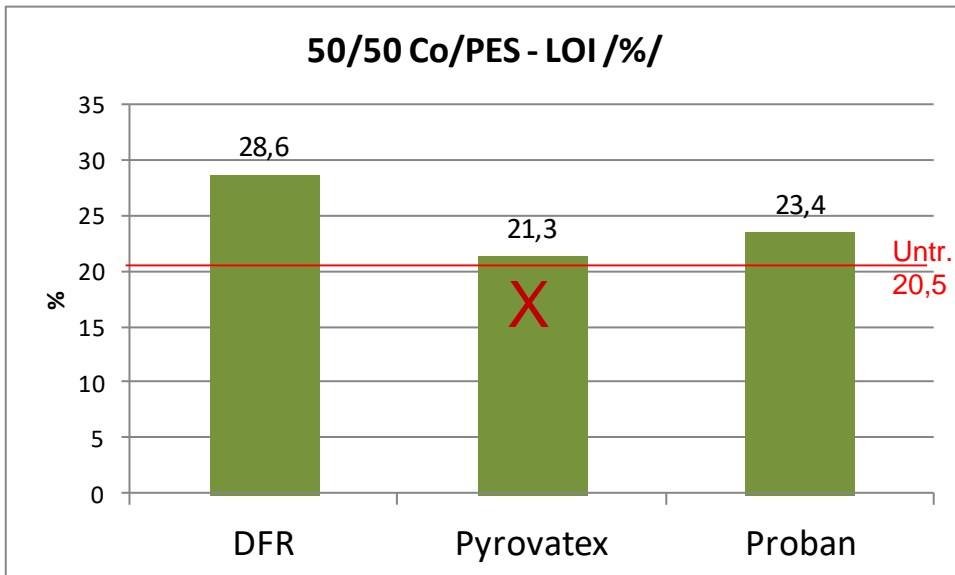
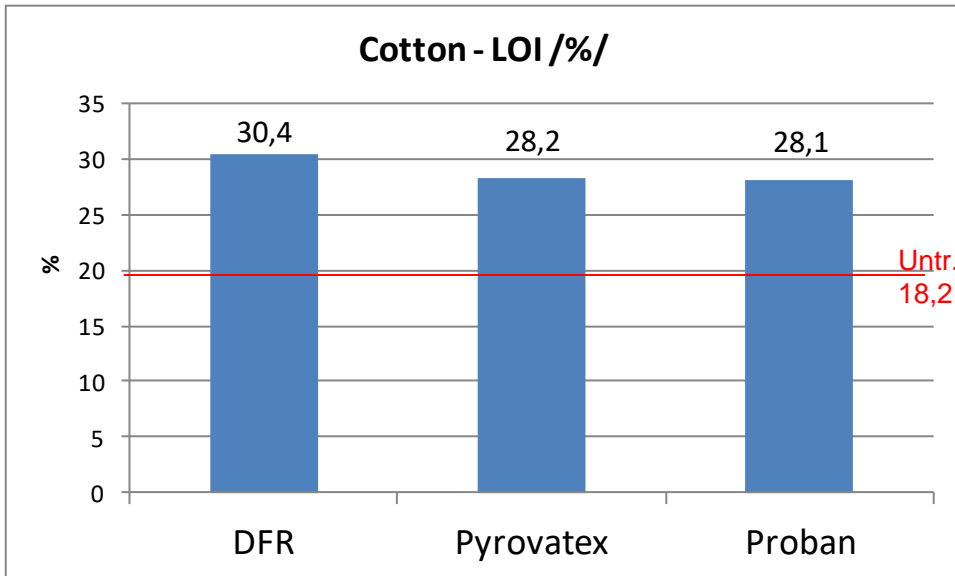
(compared in coop with Veramtex Brussels)

FR testing

EN ISO 14116: 3/20X60

EN ISO: 6940 no flame spread

EN ISO: 12952 0 s



100%
cotton



50/50 Co/PES

Properties of textiles finished by TEXAFLAM DFR

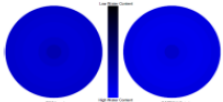
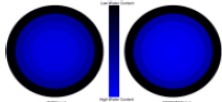
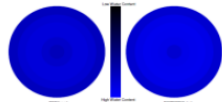
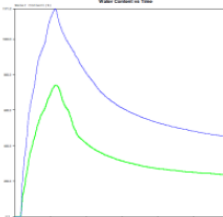
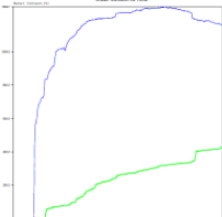
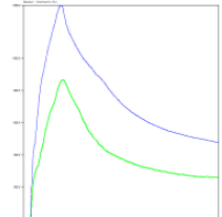
- **Washpermanent FR effect**
(minimum 25 washing cycles at 60°C)
- **Reduced tensile strength loss**
(high content of strong PES fibre)
- **High wearing comfort** (moisture management, rapid sweat transport)
- **Good physiological parameters:**
air permeability not influenced by the finishing, breathability, handle (a quat-based softener incorporated into the FR finishing system permanently cross-linked on the fibre)



WEARING COMFORT:

Liquid (sweat) transport

AATCC TM 195 (MMT SDL Atlas)

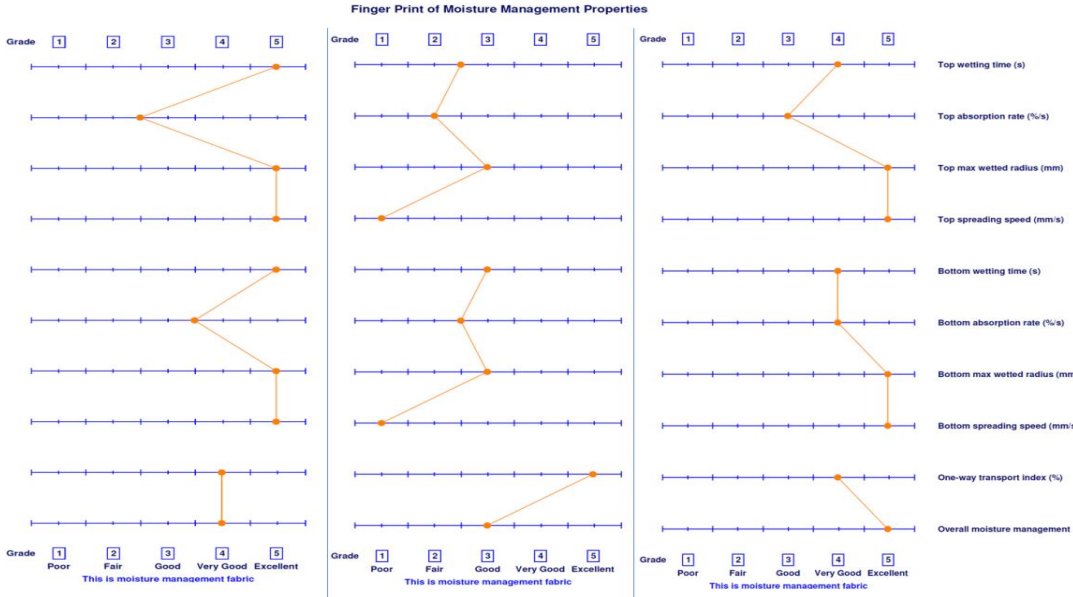
MMT – SDL ATLAS	Untreated	FR finished	FR finished & washed (1x60°C)
OWTC One-way transport capability Grading	284,7492 Very Good	785,649 Excellent	316,4968 Very Good
OMMC Overall moisture management capability Grading	0,7512 Very Good	0,5855 Good	0,8164 Excellent
Water location vs. time left – back side (inner); right – front side (outer)			
Water content vs. time green – back side (inner) blue – front side (outer)			

Finger Print :
Complex liquid spread characteristics:

- FR finishing speeds up the sweat transport from inner to outer side
- Overall moisture management remains on Good level and is improved by washing



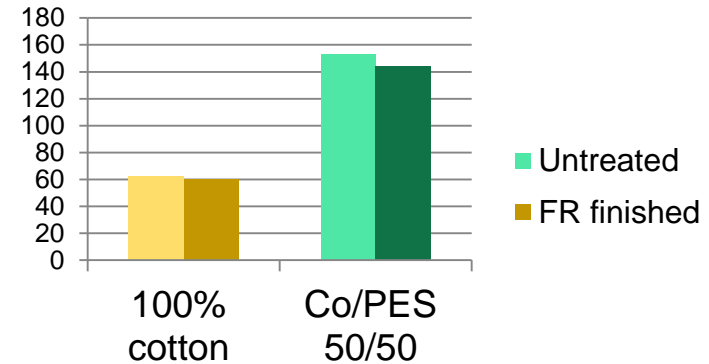
High wearing comfort



Results: Whiteness/colour shade influence

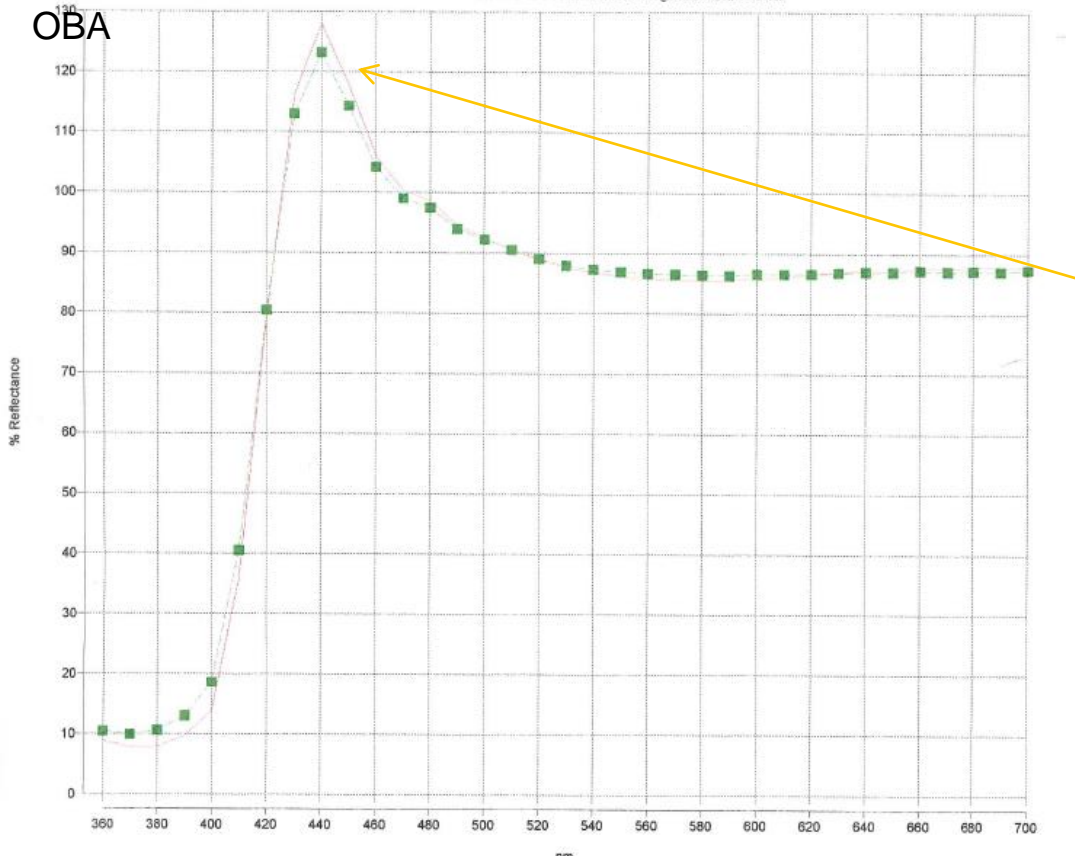
	100% cotton	Co/PES 50/50 (OBA)
Untreated	62,06	153,18
FR finished	59,76 (-3,7%)	144,27 (-5,8%)

Whiteness degree (Berger)



Co/PES 50/50 with
OBA

%Reflectance Plot
STD NAME : St.Sandra-bil-ing.Martinková-09.10.15
BAT NAME : Vz.Sandra FR-bil-ing.Martinková-09.10.15



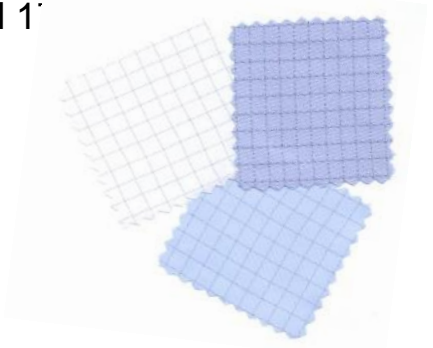
Whiteness

- No yellowing after FR
- FR finishing doesn't extinguish OBA

DFR is suitable for white goods finishing

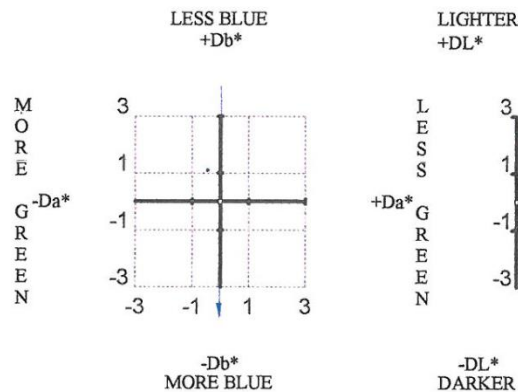
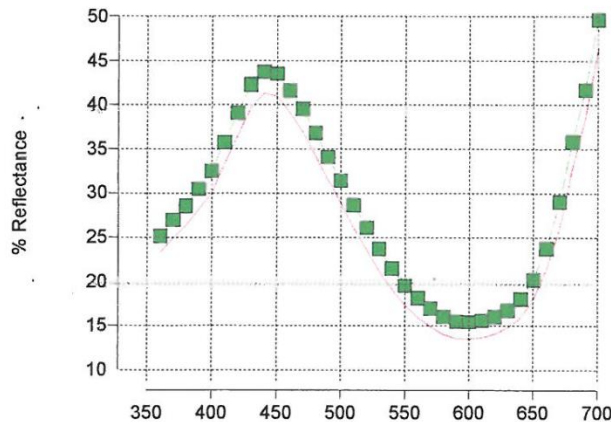
Colour shade influence

Material: Cotton/PES/C-fibre (resistat) – 47%/51%/2%, ROMANA (SINTEX), twill 1'



1% reactive dyeing Sumifix Blue BG

Ill/Obs	DL*	Da*	Db*	DC*	DH*	DE*
D65 10 Deg	2.45	-0.43	1.09	-1.08	-0.44	2.72
A 10 Deg	2.55	0.02	1.22	-1.20	-0.23	2.82
F11 10 Deg	2.55	-0.38	1.32	-1.31	-0.42	2.90



Shade change influence
(depending on used dyes)
is to be considered –
dyeing recipe adjustment

Surface resistivity:

Untr.: $5,3 \cdot 10^5 \Omega$

FR finished: $4,7 \cdot 10^5 \Omega$

No impact on C-fiber
- antistatic properties

St.ref.BA/PES-rel.sila-ing.M — á Vz.BA/PES-FR-rel.sila-ing.Martina

Sila: Integral %

84.19

Application technology:

- **No special equipment needed**, applicable on a common finishing device
 - Impregnation (padder) – drying & curing (stenter frame)– technological washing (jigger, jet)



Multifunctional properties of finished goods

- **FR + antistatic:** DFR finishing is compatible with antistatic fiber (if incorporated in textile constructions e.g. in for of an antistatic grid)
- **FR + high-vis:** DFR finishing is compatible with yellow high-vis colouration of cotton (EN ISO 20741, β coefficient)
- **FR + oleophobic/hydrophobic:** can be combined with fluorocarbons (replacement with F-free repellent system under development)



- **Optical brighteners compatible,** the influence on dyeing shade is to be verified in advance (depends on type of dyestuffs used)

Other eco-friendly FR finishing systems optimized withing the MUFTEX project:

- **Washpermanent FR for 100% PES (clothing EN ISO 15025; EN ISO14116: 1/25x40, automotive (ISO 3795, FMVSS 302), upholstery (BS 5852), technical textiles:**
 - TEXAFLAM HT - one-bath with disperse dyeing of PES (HT jigger, 130°C)
 - TEXAFLAM PE Conc - (thermosol (padder, stenter frame, 180-210°C)
- **Br/Sb-free FR coating of upholstery fabrics (BS 5852) for natural and synthetic fibres and blends, incl. 100% PES:**
 - TEXAFLAM ECO FR (water-based, back-coating from paste)



RESET

Interreg Europe



European Union
European Regional
Development Fund

Thank you for your attention!



Project smedia