EUREKA

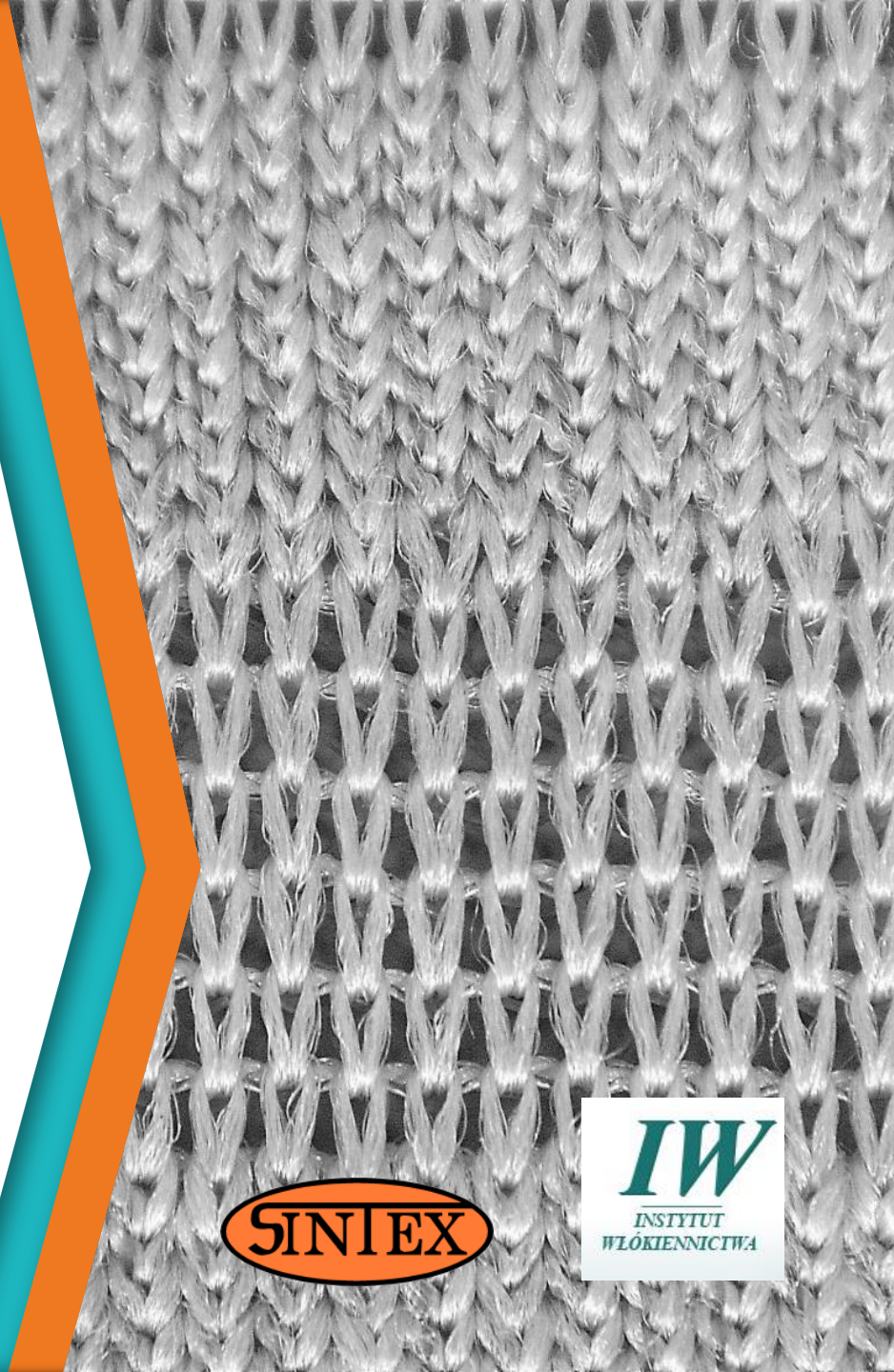
MINISTERSTVO ŠKOLSTVÍ, MLÁDEŽE A TĚLOVÝCHOVY

E!8735 DITEX

Spacer fabrics for ensuring thermo-physiological comfort

SINTEX a.s., Czech Republic
Jiří Procházka, Zdeňka Ledrová,
Dita Kráčalová,

Textile Research Institute, Poland
Anna Pinar, Romualda Koźmińska,
Katarzyna Śledzińska

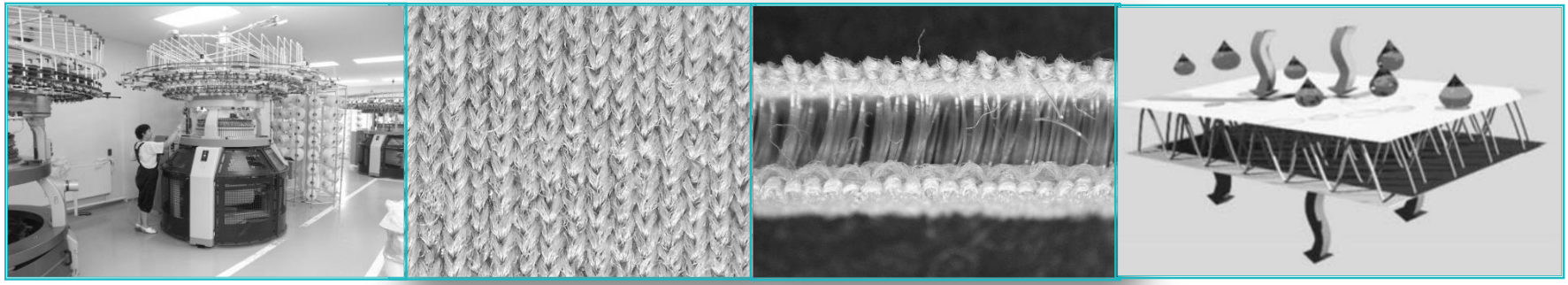


SINTEX

IW INSTYTUT WŁÓKIENNICTWA

Agenda

- Brief SINTEX company introduction
- Main goal of the DITEX project
- Introduction of DITEX results (fabrics, products)
- Testing the properties of thermophysiological comfort
- Conclusion



SINTEX, a.s. Česká Třebová

- 1992 – Foundation of SINTEX Ltd.
- 1993 – SINTEX Ltd. launched the production of weft knitted fabrics and created its own sewing room
- 2003 – SINTEX Plc. was certified according to ČSN EN ISO 9001:2001
- 2009 – Merger of SINTEX Plc. and SPOLSIN Ltd. SINTEX Plc. became the succession company and took over all activities of SPOLSIN, including R&D

Main company activities:

SINTEX technological possibilities

Spinning

- ring spinning technology + compact spinning
- the production range include aramid yarn (antistatic), polypropylene yarn (antistatic, antibacterial) etc.

Weaving

- weaving looms with needle or hydraulic jet picking device
- the production range include fabrics with improved resistance to abrasion, antistatic fabrics, flame and chemical resistant fabrics etc.

Warp knitting

- single-needle bed warp knitting machines
- the production range include nets, linings, ice-hockey dress fabrics, technical and flags fabric

Weft knitting

- single and double bed circular knitting machines
- the production range include knitted fabrics for sport and leisure wear, fabrics for working and protective cloths (antistatic fabrics, flame resistant etc.) and bedding

SINTEX technological and testing possibilities

Sewing room

- sewing room for processing of knitted fabrics in weight range from 150 to 350 g/m2
- digital cut preparation, hand and band-saws, cutting machine, transfer press, overlock and flatlock machines etc.

Testing

- laboratory accredited according to ČSN EN ISO / IEC 17025
- evaluation of physical, mechanical, chemical, colouristic and electrostatic properties of all kinds of textile materials




SINTEX Research and Development

SINTEX Plc. (thanks to the merger with SPOLSIN) has an extensive experience and long tradition in research and development in the field of linear and surface textiles.

R&D activities

- Research and development of textile materials, structures and verification of textile processing technologies
- National as well as international cooperation in research and development
- Participation in research and development projects leading to the production of new and highly functional textiles
- Sampling capacity e.g. sampling device CCI (warping, sizing machine and weaving loom)

CCI sampling device

- verification of processability of new materials
- simulation of production conditions

Main goal of the project

E! 8735 DITEX

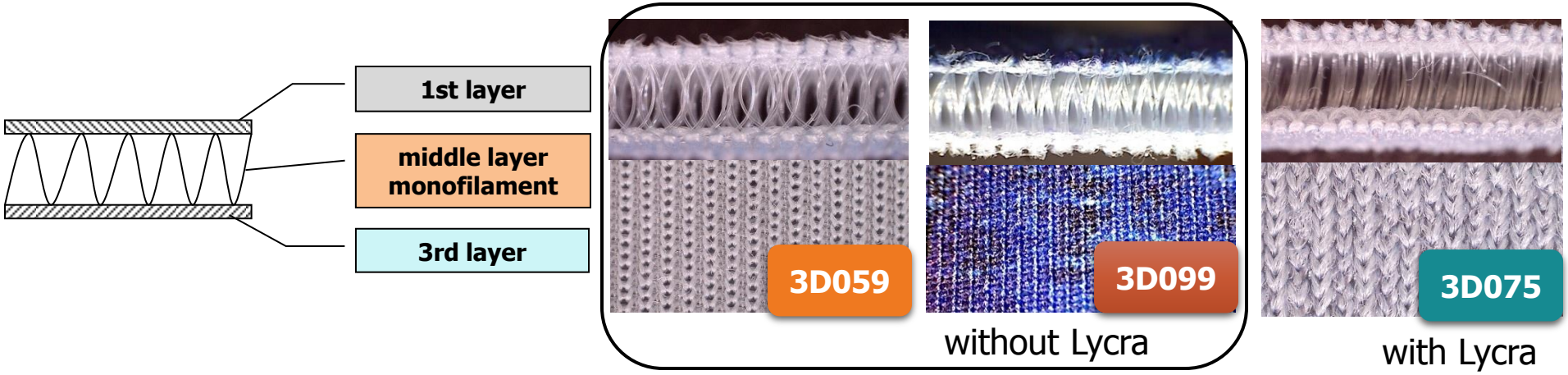
DITEX Spacer fabrics for ensuring thermo-physiological comfort

- production of 3D weft knitted fabrics and their verification for physiological comfort
- finishing (washing, dyeing, printing ...) of 3D fabrics
- evaluation of the influence of material composition and construction of 3D knitted fabrics on thermo-physiological properties
- application of 3D knitted fabrics to upholstery and clothing products focusing on the target group of the elderly and disabled people

The project was solved within a consortium of Sintex, a.s. and the Textile Research Institute, Lodz.

Project results – spacer fabrics

- weft knitted spacer fabrics with a without Lycra

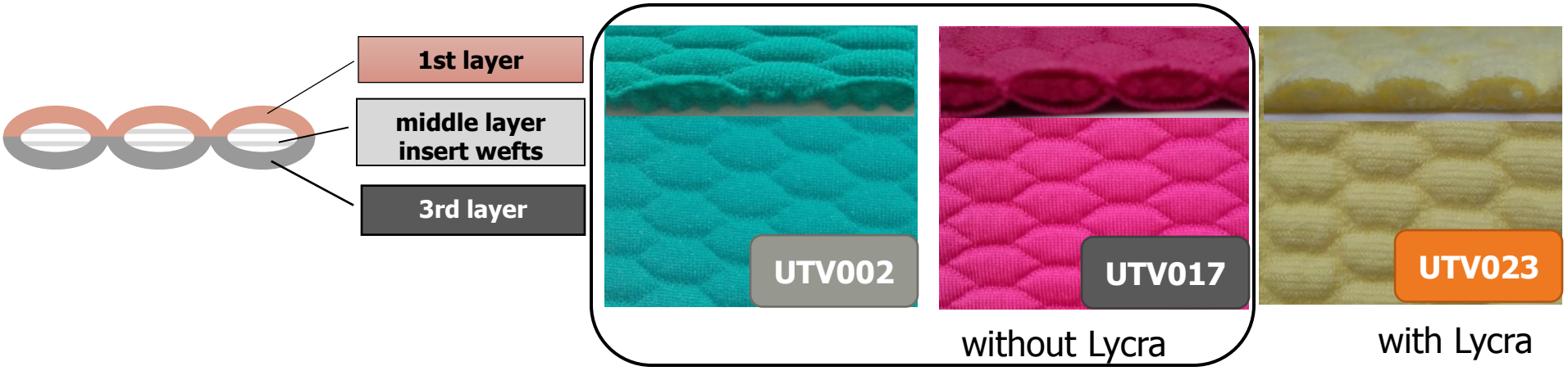


It was sampled more than 50 types of spacer fabrics:

- different material composition (POP, functional PES fibers – Coolmax, Thermocool, Thermolite, Tencel, cotton, with and without Lycra)
- different thickness 1 - 3,8 mm
- different surface construction

Project results – fabrics with insert wefts

- 3D weft knitted fabric with insert weft

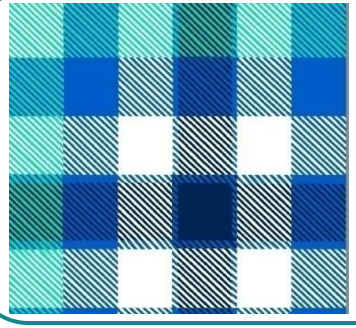
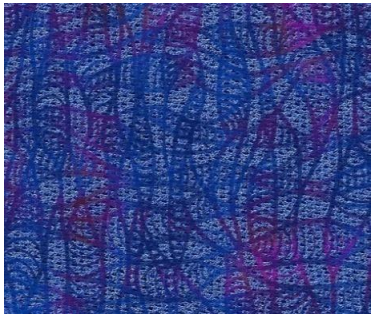


It was sampled more than 30 types of fabrics with insert weft :

- different material composition (PES standard, micro, air texturised, functional PES fibers – Coolmax, Thermocool, Thermolite, Tencel, cotton, wool, with and without Lycra)
- different structures

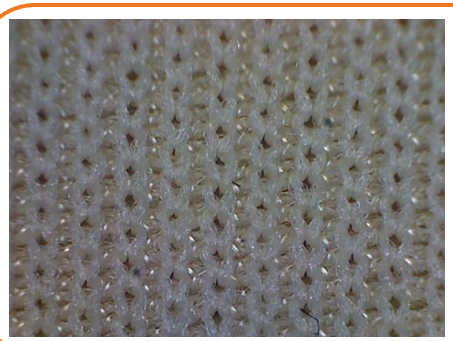
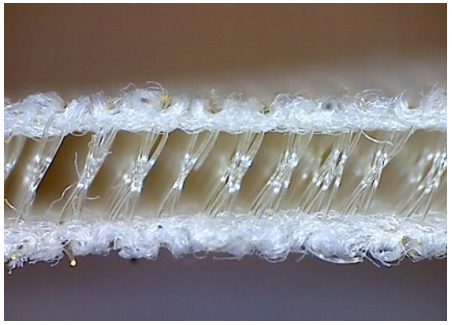
3D fabric finishing

- during project was solved problems with finishing of 3D fabrics
  - washing
  - dyeing, bleaching
  - printing


selected print patterns

  - special finishing (softening, fire-resistant finishing...)


3D106 FR

meet standards:
EN 1021 – 1
EN 1021 – 2

Project results – multilayered woven fabrics

- multilayered woven fabrics

3D woven fabric with monofilament

3D woven fabric with insert weft

3D woven fabric with monofilament and insert weft

It was sampled several types of multilayered fabrics:

- using shrinkage of polypropylene monofilament in weft during fabrics finishing (fixation)
- tubular fabrics with insert wefts etc.

Application of 3D weft knitted fabrics in the field of health care

Selected spacer fabrics were used for prototypes of products for the elderly and disable people.

Application of weft knitted spacer fabrics with their ventilation middle layer was evaluated as a possible substitute and alternative to soft polyurethane foams that have a great tradition but have physiologically and hygienically unsuitable properties.

It was verified application of 3D knitted fabrics in the following areas:

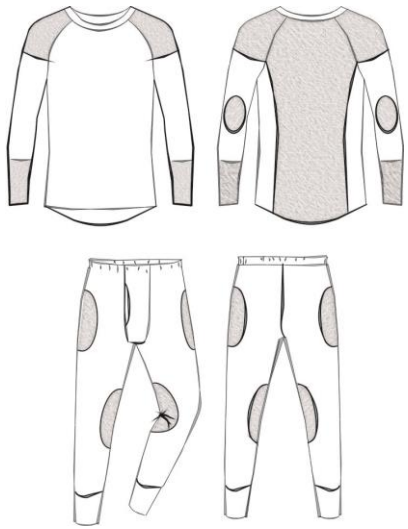
clothing components and bandages

covers and covers of mattresses

wheelchair cushion covers for immobile people or patients with limited mobility

Application of 3D weft knitted fabrics in the field of health care

Men's two-piece set of underwear with integrated zones



zones from 3D fabric

Orthoses, Braces

Half pillow cover

Wheelchairs seat cover

Thermophysiological comfort properties testing

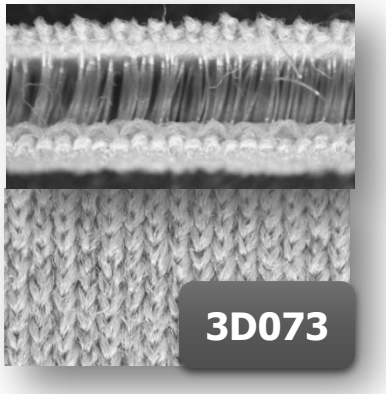
- testing of thermophysiological comfort of 3D fabric

parameter			testing methodology
Thermal insulation	R_{ct}	m^2K/W	EN ISO 11092
Water vapour resistance	R_{et}	m^2Pa/W	
Water vapour permeability	W_d	$g/m^2Pa.h$	
Air permeability		mm/s	PN-EN ISO 9237:1998
Sorption	S_{max}	$\mu l/cm^2$	The test procedure of laboratory No.14/1:2001 1st edition 4.9.2001
Desorption	S_{DESmax}	$\mu l/cm^2$	The test procedure of laboratory No.14/2:2003 1st edition 02/2003
Cold and warm feeling values	q_{max}	W/m^2	KES-F7 Thermo Labo II
Thermal conductivity	k	W/mK	

- thermophyological comfort of developed products
  - Underwear microclimate measurement – Cyclogergometer
  - Thermal conductivity of wheelchair seat cushions - KES
  - Testing of the surface temperature of the wheelchair seats using the VarioCAM® Thermocouple

Basic characteristic of selected 3D weft knitted fabrics

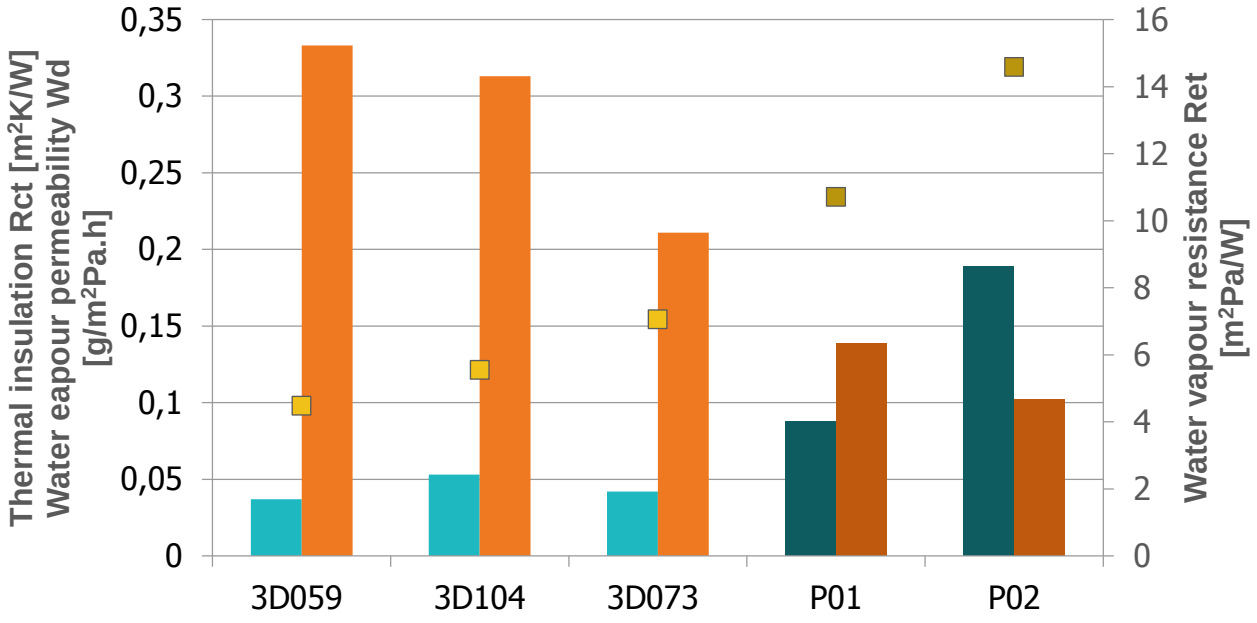
	3D059	3D104	3D073
1st layer	PES 110dtex f36	PES Thermocool 83 dtex f 100	PES 110 dtex f 36 Lycra 44 dtex
2nd layer	PES monofilament 72dtex		
3rd layer	PES 110dtex f36		PES 110 dtex f 36 Lycra 44dtex



	P01	P02
1st layer	94% cotton / 6% Lycra (jersey blue)	75% cotton / 25% Lycra (terry black)
2nd layer	foam	foam
3rd layer	85% PA / 15% Lycra (jersey black)	97% PA / 3% Lycra (warp knitted black, combed)

Sample	3D059	3D104	3D073	P01	P02
Weight [g/m^2]	346	263	679	376	416
Width [cm]	170	180	109	-	-
Thickness [mm]	3,62	3,28	4,02	3,5	6,7
Fabric density ρ_V [kg/m^3]	95,6	80,2	168,9	107,4	62,1

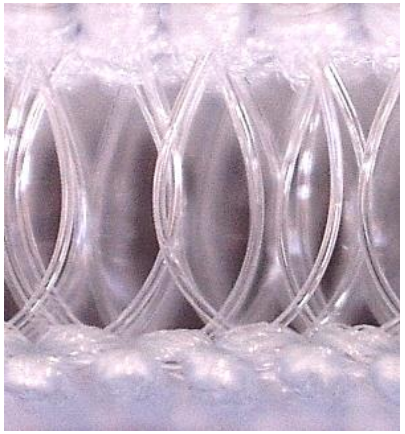
Spacer fabrics thermo - physiological comfort properties



To prevent accumulation of moisture, the fabrics used to make the bandages should have the lowest values of water vapour resistance R_{et}. From this point of view, the 3D059 sample was most appropriate.

Sample	3D059	3D104	3D073	P01	P02
Thermal insulation R_{ct} [m^2K/W]	0,037	0,053	0,042	0,088	0,189
Water vapour permeability W_d [$g/m^2Pa.h$]	0,333	0,313	0,211	0,139	0,102
Water vapour resistance R_{et} [m^2Pa/W]	4,47	5,54	7,05	10,71	14,59

All 3D knitted fabrics showed higher water vapor permeability values and lower water vapour resistance values R_{et} than foam materials.



Conclusion

Thanks to the EUREKA project and national and international cooperation:

- solving technological problems of production and finishing of 3D weft knitted fabrics (e.g. finishing - dyeing, printing, etc.)
- market research
- investment plan for the purchasing of the new machinery for the weft knitted spacer fabric production

New application areas:

- health care mainly in the area of care for the elderly and the disabled people
- protective work wear, especially in the field of gloves and clothing resistant to mechanical risks
- upholstery of cars and airplane seats with integrated sensor networks or waveguides

Thank you very much for your attention