

*a product of* smartpolymer

# smartpolymer

## Functional and Structural Polymeric Materials

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# Outline

- ❖ TITK Group
- ❖ Cell Solution® fiber family
- ❖ Basic Idea
- ❖ **Cell Solution® CLIMA (PCM)**
- ❖ **Cell Solution® SKIN CARE (Vitamin E)**
- ❖ **Cell Solution® SKIN CARE Lanolin**
- ❖ Functionalities
- ❖ fibre data

# TITK Group



TITK e.V. (NPO, 1991)  
[www.titk.de](http://www.titk.de)

Applied Research Institut  
130 Research Fellows  
~100 Institutional and Individual  
Members

Dr. Ing. Ralf-Uwe Bauer  
(Managing Director)

100%



OMPG (LLC, 1992)

[www.ompg.de](http://www.ompg.de)

Accredited Testing Laboratory  
~30 Employees  
Dr. Ing Ralf-Uwe Bauer  
(General Manager)

100%



smartpolymer GmbH (LLC,  
2013)

[www.smartpolymer.de](http://www.smartpolymer.de)

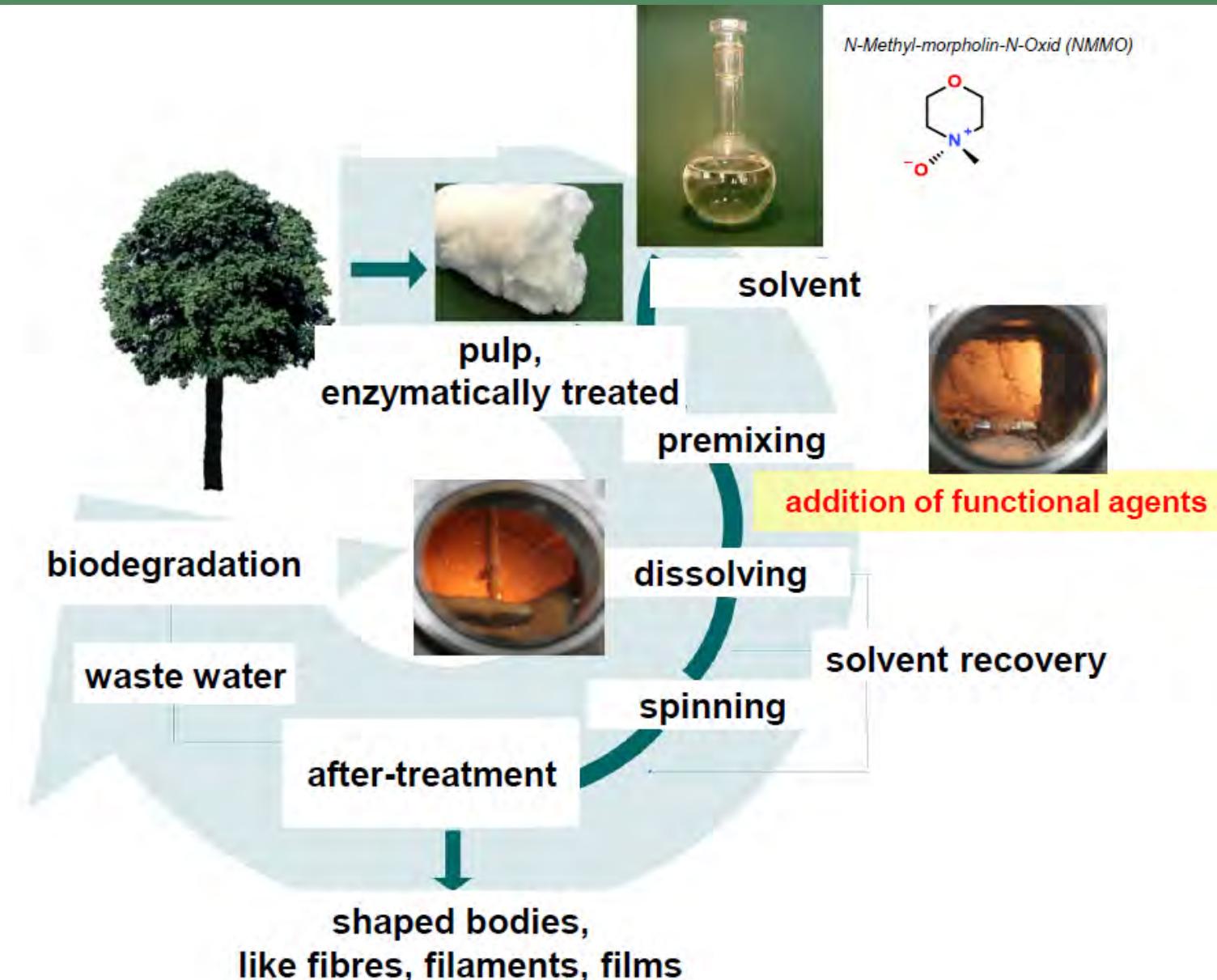
Marketing, Sales Production  
~30 Employees  
Ute Schubert  
Christoph Löning  
Benjamin Redlingshöfer  
(General Managers)

# smartpolymer's product portfolio

## Cell Solution® fiber family:

- |   |  |
|---|--|
| (1) Cell Solution® CONDUCTIVE           | - carbon black                             |
| (2) Cell Solution® BIOACTIVE            | - silver, copper, zinc ions                |
| (3) Cell Solution® ALGEA CONTROL        | - Benthopos                                |
| (4) Cell Solution® ACTIVE CARBON (IL)   | - active charcoal                          |
| (5) Cell Solution® PRUSSIAN BLUE (IL)   | - adsorption $Tl^+$ and $Cs^+$ - ions      |
| (6) Cell Solution® CERAMIC              | - piezoceramic, $Al_2O_3$ ceramic          |
| (7) Cell Solution® XR PROTECTION        | - $BaSO_4$ , $Bi_2O_3$                     |
| (8) Cell Solution® HEAT DISPERSION (IR) | - ceramic powder                           |
| (9) Cell Solution® ADSORPTIVE           | - adsorption of liquid impurities          |
| (10) Cell Solution® ADSORPTIVE          | - adsorption and desorption of ions        |
| (11) Cell Solution® CLIMA               | - paraffin                                 |
| (12) Cell Solution® PROTECTION          | - insecticide                              |
| (13) Cell Solution® SKIN CARE           | - vitamins, essential fatty acids, Lanolin |
| (14) Cell Solution® ODORANT             | - scents                                   |
| (15) Cell Solution® FLAMERESISTANT (FR) | - melamine derivatives                     |
| (16) smartcell® sensitive               | - $ZnO^+$ , $MgO^+$ and other minerals     |
| (17) Cell Solution® COMFORT (C)         | - ITO, ATO, STIR® ceramic                  |

# Lyocell process





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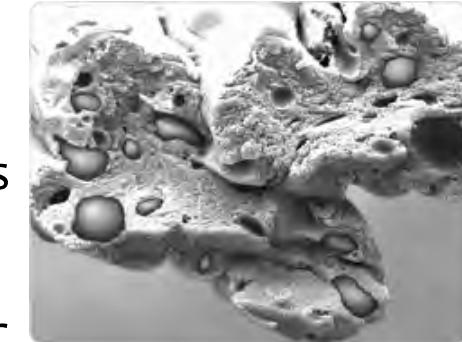
# Cell Solution® CLIMA

## Unique temperature regulation

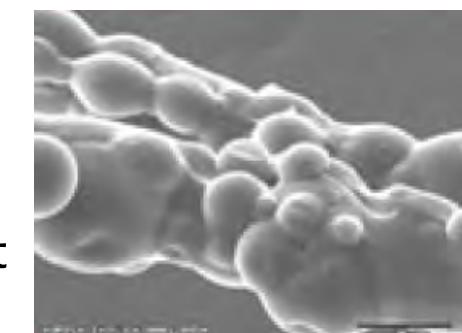
# Cell Solution® CLIMA

## State of the art:

- Direct incorporation of meltable or volatile lipophilic additives (PCM, carboxylic acids, ...)
- ... by means of encapsulated additives and fibers or fabric after-treatment, only!
- Main disadvantages:
  - high demands on uniformity of capsules sizes,
  - limitation of incorporated amount of capsules and
  - high damage of capsules during mechanical stress at textile fibers processing



REM images showing fiber with PCM capsules and bumpy surface.

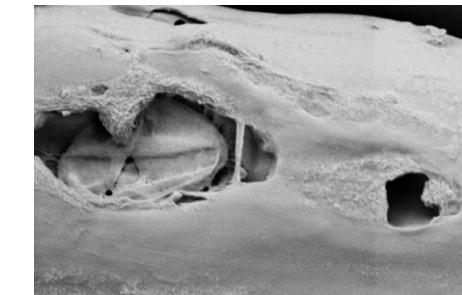


## New patent (WO 2009/062657 A3)

- Direct incorporation of lipophilic additives into fibers



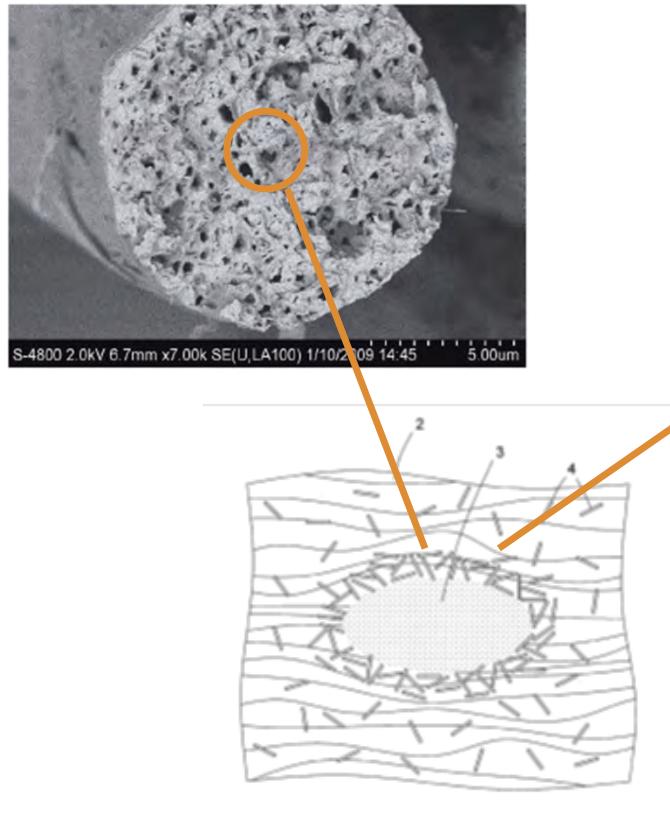
Thermodynamic incompatibility of hydrophilic cellulose and lipophilic PCM wax has to be overcome by PCM composites, which allows permanent incorporation.



# Fiber analysis

Cell Solution® -

## A new Lyocell type fiber with active agents



### What is new?

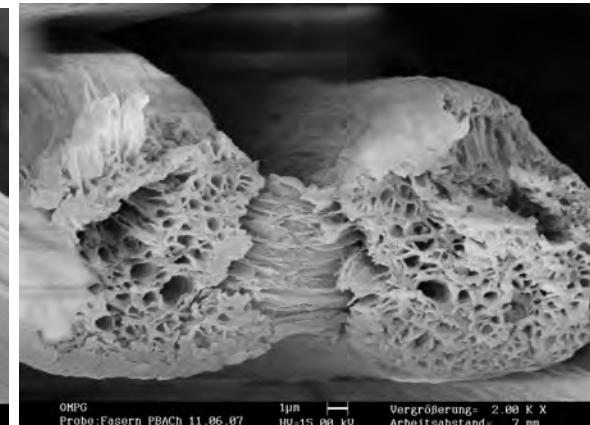
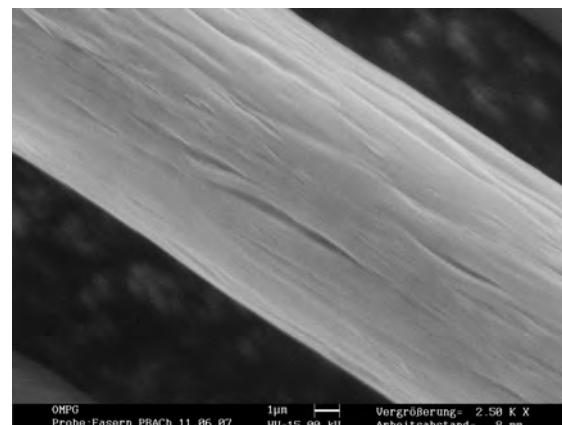
- Incorporation of lipophilic Substances inside nano-composite structure.
- Layered silicates assure phase interaction.
- Nano-particles fix the incorporated lipophilic composite.
- **Depot** of lipophilic substance
- **No microcapsules; no coating**
- An easy and long lasting storage system of active agents (**Paraffin as carrier**)

# Cell Solution® CLIMA

## Paraffin as phase change material (PCM)

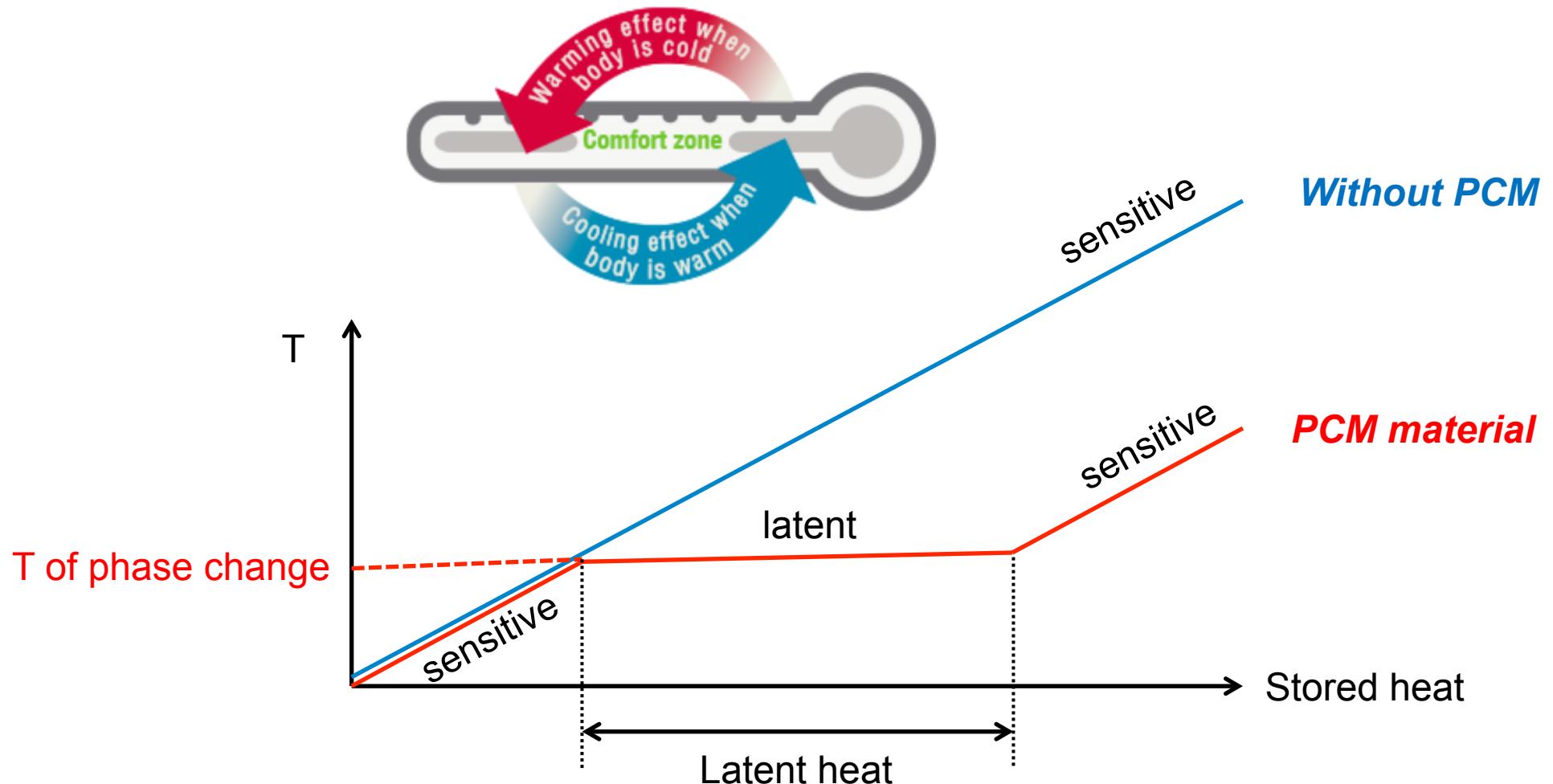
- Cell Solution® CLIMA fiber is a PCM micro composite of latest generation with thermo-regulating features.
- Functional improvement compared to classic PCM.
- Paraffin is embedded in highly crystalline lyocell fibers forming many micro composite accumulators per unit of cellulose.
- Hence, greater heat storage capacity can be achieved.
  - up to 70 J/g for fiber 6.7 dtex
  - up to 50 J/g for fiber 2.3 dtex

REM images of smooth fiber surface and cross-section. During fiber spinning length orientation results in layers side-by-side.



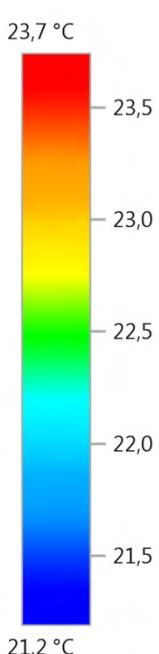
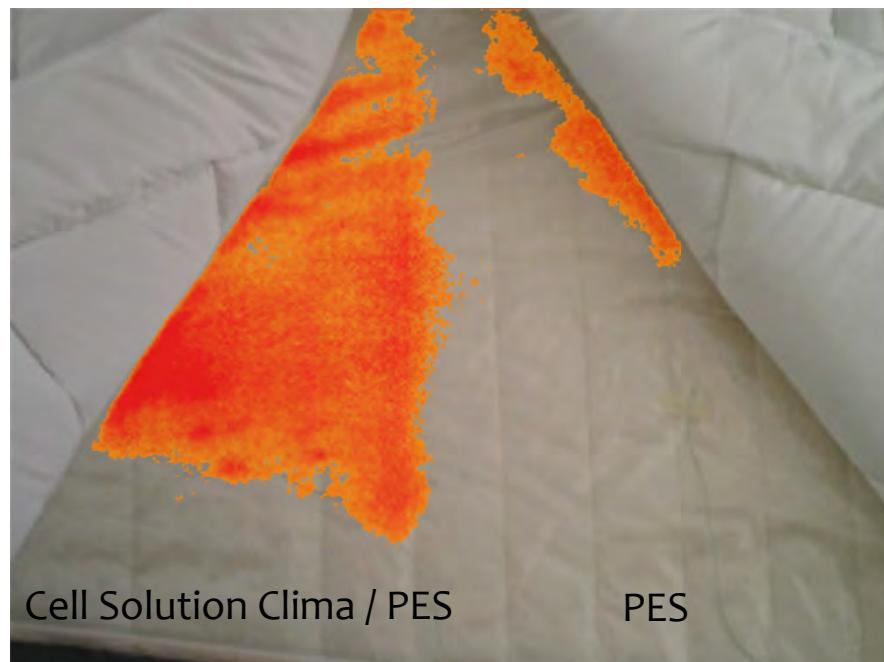
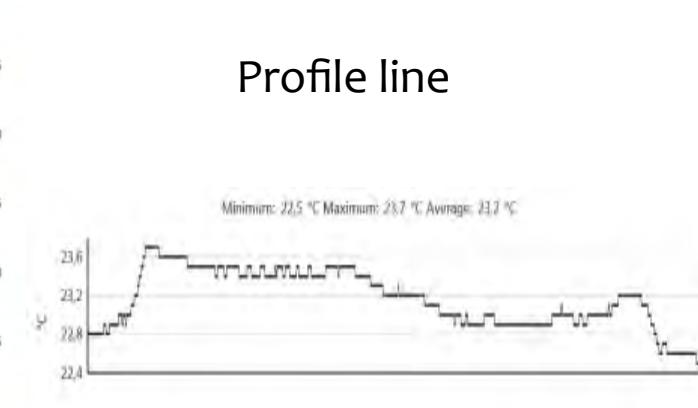
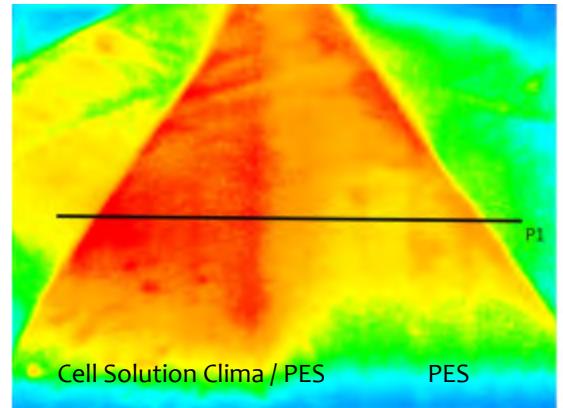
# Cell Solution® CLIMA

## Paraffin as phase change material (PCM)



# Cell Solution® CLIMA

## Effect of PCM in Blankets



➤ After 95 min cooling  
Cell Solution® CLIMA remains  
warmer.

# Cell Solution® CLIMA



## Results of bio-compatibility assessment

➤ Cell Solution® CLIMA Lyocell staple fibers meet the human-ecological requirements of the Oeko-Tex® Standard 100 presently established for baby articles.



Tested for harmful substances.  
[www.oeko-tex.com/standard100](http://www.oeko-tex.com/standard100)

HOHENSTEIN Textile Testing Institute GmbH & Co. KG  
Schloss Hohenstein, 74357 Bönnigheim, Germany

OEKO-TEX®  
CONFIDENCE IN TEXTILES

## CERTIFICATE

### The company

smartpolymer GmbH  
Breitscheidstraße 97  
07407 Rudolstadt, GERMANY

is granted authorisation according to STANDARD 100 by OEKO-TEX® to use the STANDARD 100 by OEKO-TEX® mark, based on our test report 17.0.07354



### for the following articles:

Lyocell-staple fibre Cell Solution™ clima, in raw white.

The results of the inspection made according to STANDARD 100 by OEKO-TEX®, Appendix 4, **product class I** have shown that the above mentioned goods meet the human-ecological requirements of the STANDARD 100 by OEKO-TEX® presently established in Appendix 4 for baby articles.

The certified articles fulfil requirements of Annex XVII of REACH (incl. the use of azo colourants, nickel release, etc.) as well as the American requirement regarding total content of lead in children's articles (CPSIA; with the exception of accessories made from glass).

The holder of the certificate, who has issued a conformity declaration according to ISO 17050-1, is under an obligation to use the STANDARD 100 by OEKO-TEX® mark only in conjunction with products that conform with the sample initially tested. The conformity is verified by audits.

The certificate 14.0.40537 is valid until 30.04.2018

Bönnigheim, 02.05.2017

A handwritten signature in blue ink, appearing to read "Elisabeth".  
Dipl.-Ing. (FH) Elisabeth Weisheit  
Head of Certification Body Oeko-Tex®



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# Cell Solution® SKIN CARE

## Life-long skin care

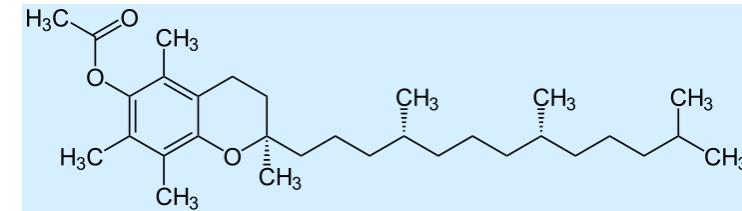
# Cell Solution® SKIN CARE

## Launch of a new anti-aging

➤ Cell Solution® SKIN CARE implies a continuous skin care by large-scale transfer of **vitamin E acetate ( $\alpha$ -tocopheryl acetate)** on human skin.

➤ Vitamin E has special properties:

- To capture free radicals
- To repair and to regenerate damaged skin surface
- To support the moisture regulation of the human skin.



➤ Release of vitamin E turns into a life-long effect.

➤ Textiles, which have a close contact to the body, getting an unknown importance for care and well-being.

➤ Other active substances such as natural oils or medicines can be incorporated into the cellulosic structure besides vitamin E.

# Cell Solution® SKIN CARE

## UV irradiation protection

- Repair and regeneration of damaged skin surface
- UV protection substances absorb irradiation at around 310 nm (Maximum of sun light. This region is necessary for desired preservative **suntan**.)
- Absorption maximum of Vitamin E is 290 nm.  Light protection of vitamin A is caused by special other molecular effects, additionally.
- Sunburn-causing UV light dosage is clearly enhanced by vitamin E before and **after** irradiation.

H. Möller, A. Ansmann and S. Wallat: Fat Science Technology, 91. Jahrgang, Nr. 8, 1989:

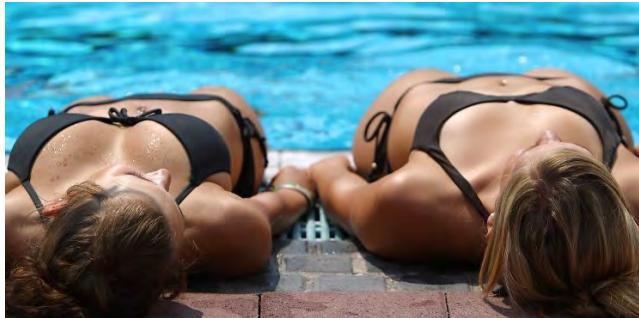
... In einem anderen Fall konnte gezeigt werden, dass akute Hautschädigungen, die durch UV-Licht ausgelöst wurden, von einer verstärkten Aktivität der Ornithindecarboxylase (ODC) begleitet sind und sich diese erhöhte ODC-Aktivität durch topisch angewendetes  $\alpha$ -Tocopherylacetat wieder erheblich senken ließ. Bei Anwendung von 100%-igem  $\alpha$ -Tocopherylacetat konnte der ODC-Anstieg nahezu vollständig verhindert werden.

# Cell Solution® SKIN CARE

## UV irradiation protection

- Healthy preservative suntan

### Sun blocker



+

### Skin Care after sun bath



# Cell Solution® SKIN CARE

## Results of bio-compatibility assessment

➤ Cell Solution® Skin Care Lyocell staple fibers meet the human-ecological requirements of the Oeko-Tex® Standard 100 presently established for baby articles.

HÖHENSTEIN Textile Testing Institute GmbH & Co. KG  
Schloss Höhenstein, 74357 Bönnigheim, Germany

OEKO-TEX®  
CONFIDENCE IN TEXTILES

### The company

smartpolymer GmbH  
Breitscheidstraße 97  
07407 Rudolstadt, GERMANY

is granted authorisation according to STANDARD 100 by OEKO-TEX® to use the OEKO-TEX® mark, based on our test report 16.0.00329



### for the following articles

Lyocell staple fibres, Cell Solution® SKIN CARE, raw white.

The results of the inspection made according to STANDARD 100 by OEKO-TEX®, product class I have shown that the above mentioned goods meet the human-ecological requirements of the standard presently established for baby articles.

The certified articles fulfill the requirements of Annex XVII of REACH (incl. the use of azo-dyes, nickel, etc.) as well as the American requirement regarding total content of lead in children's articles (CPSIA; with the exception of accessories made from glass).

The holder of the certificate, who has issued a conformity declaration according to ISO 17050-1, is under an obligation to use the OEKO-TEX® mark only in conjunction with products that conform with the sample initially tested. The conformity is verified by audits.

The certificate 14.0.54126 is valid until 31.01.2018

Bönnigheim, 27.01.2017



Dipl.-Ing. (FH) Elisabeth Weisheit  
Head of Certification Body Oeko-Tex®

# Cell Solution® SKIN CARE

## Bio-compatibility assessment

- Materials with contact to human skin have to be declared regard to cell damage or growth.
- In-vitro cytotoxicity of DL-tocopherol fibres according to DIN 10993-5.
- Human HaCa-T-Keratinocyte cell line with complete epidermal differentiation capacity.

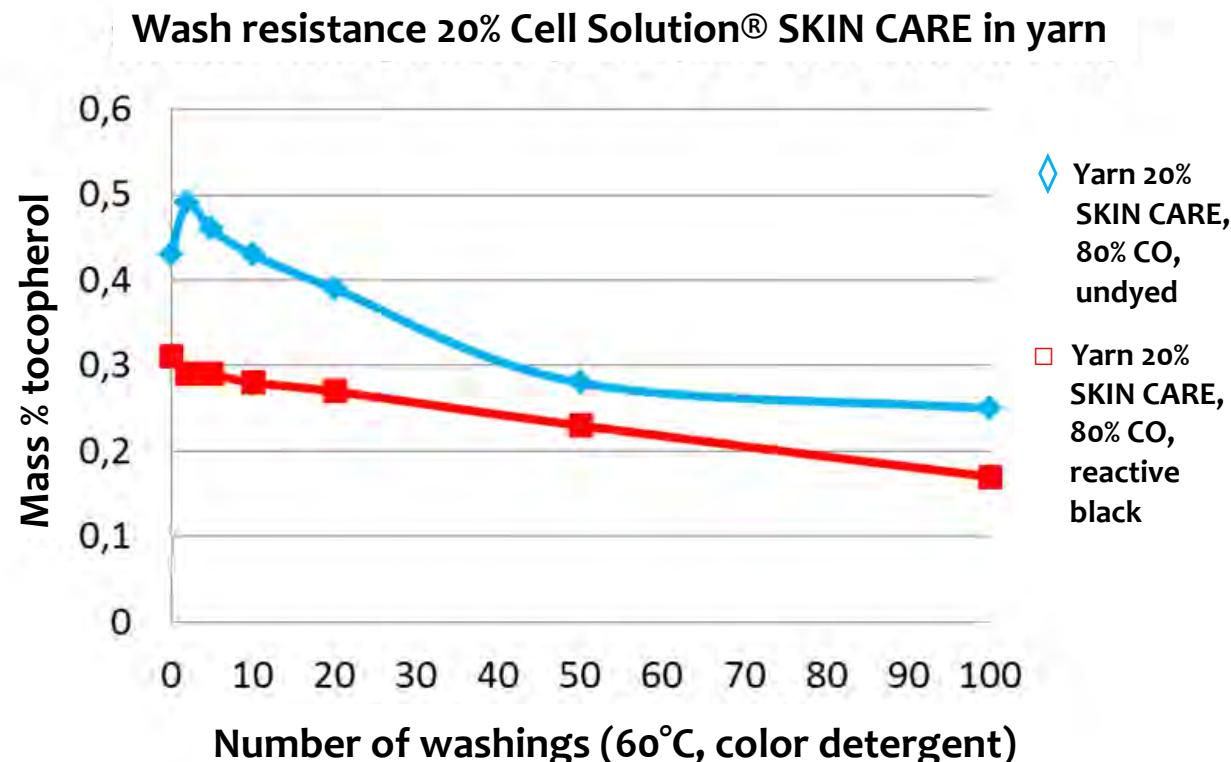
Cell Solution Skin Care® Lyocell staple fibers show no cytotoxicity meaning improved proliferation of human cells can be expected.



# Cell Solution® SKIN CARE

## Washing and bleaching durability of yarn

- After 100 washing cycles at 60°C even 60 % of the initial tocopherol content can be detected.
- Reactive dyeing lowers the content to ca. 70 %, after 100 washing cycles of dyed yarn contains ca. 40 % of initial tocopherol.



# Cell Solution® SKIN CARE

## Measurement of active substance transfer to the skin

- **1,29 mg/m²** of tocopherol (vitamin E) pass-over from the textile to artificial skin model (Human®skin)
- (Hohenstein Institute / Germany: Test report no. 14.8.5.0091, August 12, 2014)



**HOHENSTEIN**

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74307 Bamberg - Germany  
Hohenstein & Wöhle  
Telefon +49 7132 271 94 444  
Fax +49 7132 271 94 444  
Hohestein.de

Zertifiziert für Nachhaltigkeit / Certified for sustainability  
Sicher Zertifiziert / Safe  
Julia Schreyer  
Datum / Date:  
12. August 2014

**Prüfbericht Nr. / Test report no. 14.8.5.0091**

Auftraggeber:	siehe Anschaff.
Prüfgegenstand:	siehe Seite 2
Auffangmedium:	07.07.2014
Eingang Prüfgegenstand:	09.07.2014
Prüfzeitraum:	21.07.2014 bis / to 31.08.2014
Praesentation:	Der Prüfgegenstand wurde uns vom Auftraggeber überstellt. The test sample has been delivered to us by the client.

Der Prüfbericht umfasst 4 Seiten. / The test report consists of 4 pages.



# Cell Solution® SKIN CARE

## Product Data Sheet

### Cell Solution® SKIN CARE - 2,3 dtex, 38 mm

- Cellulose fiber with vitamin E embedded in paraffin, produced according to the Lyocell – process
- Fiber composition in mass % at conditioned state:
  - Cellulose > 57 %
  - Stabilized paraffin of defined melting point ca. 14 %
  - Organically modified layered silicate 8.7 – 9.1 %
  - Vitamin E- acetate > 11 %
  - Finisher content < 0.5 %
  - Moisture < 10.0 %

# Cell Solution® SKIN CARE Lanolin

## NEW: Lanolin



- Wool wax or wool grease
- mixture: long chain esters, alcohols, acids, hydrocarbons
- Emollient effect
- Skin smoothing

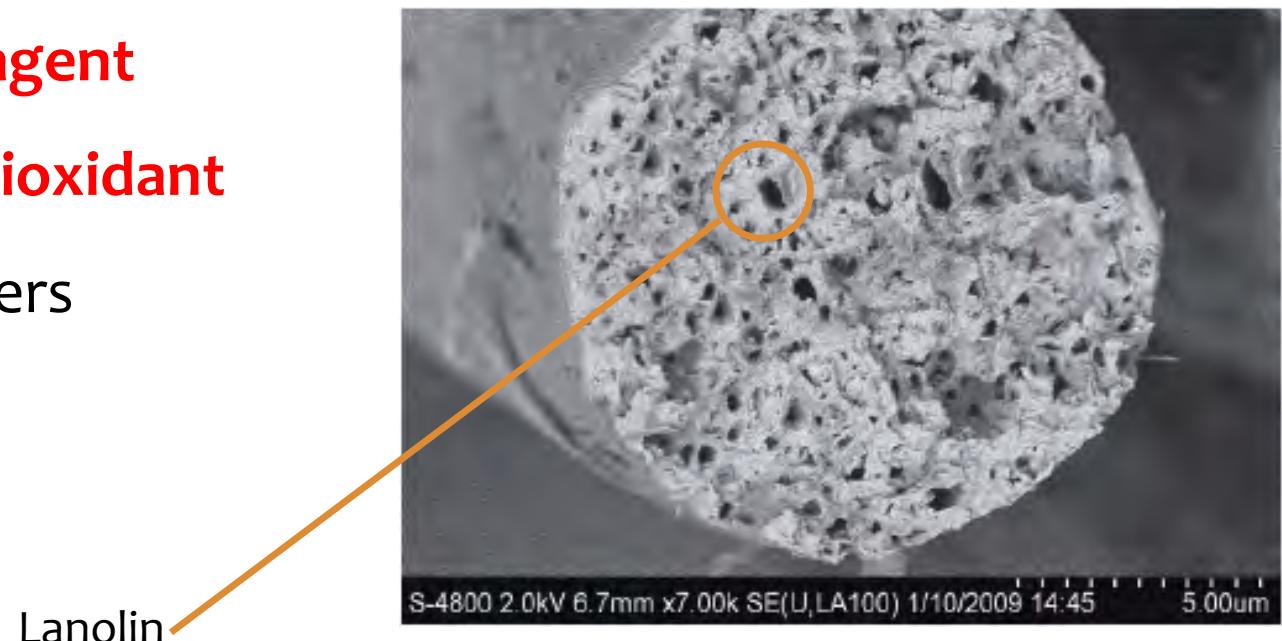
# Cell Solution® SKIN CARE Lanolin



**Cell Solution® Lanolin fibers are natural**



- Main raw material is wood pulp
- **Lanolin as active agent**
- **Tocopherol as antioxidant**
- Anorganic stabilizers

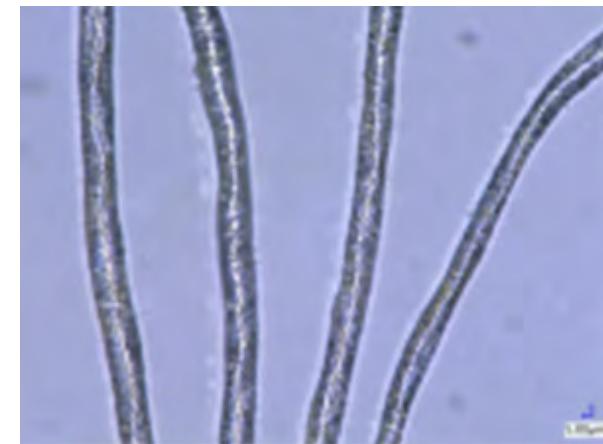


# Cell Solution® SKIN CARE Lanolin

- Fibre with > 15 % Lanolin
- Smooth fibres for good textile processing
- Sufficient fibre strength



Fibre parameters		V 3190
finessess	dtex	1,75
breaking force cond.	cN	4,92
breaking force variation	%	11,1
elongation cond.	%	13,2
breaking force cond.	cN/tex	28,0
loop strength cond.	cN/tex	8,90
modulus 0,5-0,7%	cN/tex	457



# Cell Solution® SKIN CARE Lanolin

## Hautpflegende Faser aus natürlichen Rohstoffen:

- Cellulose (Holz aus nachhaltiger Forstwirtschaft)
- Lanolin aus Schafwolle mit bekannter kosmetischer Wirkung, Pharma-Qualität verfügbar
- paraffinfrei
- Silikate und Vitamin E als Stabilisatoren
- bioabbaubar, kompostierbar
- textile Verarbeitbarkeit möglich
- keine Bildung von Mikroplastik-Partikeln



# Contact

## smartpolymer GmbH

MEMBER of TITK-Group

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[www.smartpolymer.de](http://www.smartpolymer.de)

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Thüringen  
Deutschland / Germany

### Geschäftsführer:

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Dipl.-Wirt.-Ing. (FH) Benjamin Redlingshöfer,  
Dipl.-Wirt.-Ing. Ute Schubert

UST-IDNR.: DE 284238097  
Amtsgericht Jena: HRB 507939



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