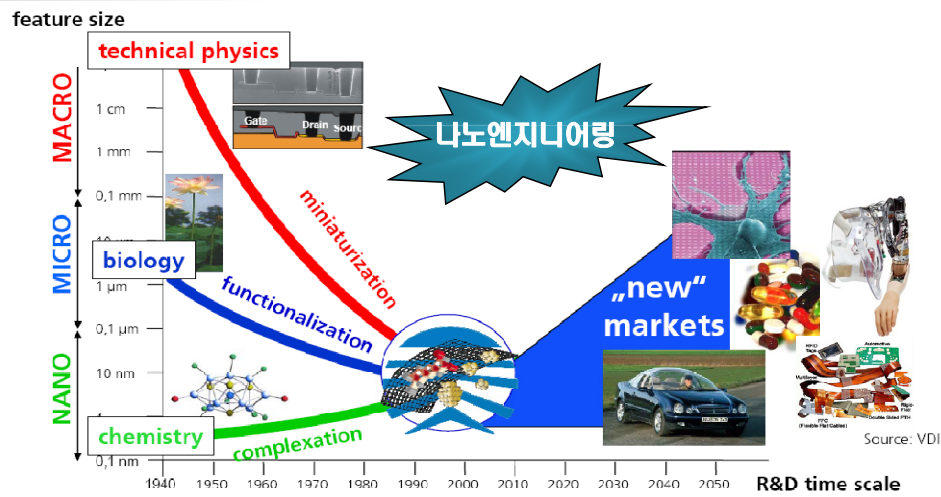




## Trends of Technical Textile Industry

- ▶ Technology Convergence: NT, BT, ET ....
- ▶ CO<sub>2</sub> reduction by Biomass Raw Materials
- ▶ Purification by Filtration & Separation Technology
- ▶ Introduction of New Standard & Regulation

## 기술융합시대의 도래



Ref. Hans-Jörg Bullinger, Nanotechnology as a Driving Force in Innovation, Fraunhofer-Gesellschaft, Munich, Germany

## Protective Textiles

- ▶ Flame Retardant
- ▶ Fire-proof
- ▶ Bullet-proof
- ▶ Cut Resistant
- ▶ Antistatic
- ▶ Shielding
  - EMI, EMF, M/W 등
- ▶ UV Reflection



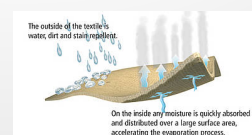
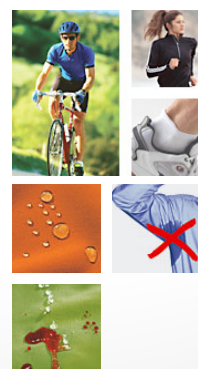
## Cosmetic, Hygienic & Medical Textiles

- ▶ Moisture Management
- ▶ Breathability
- ▶ Anti-microbial
- ▶ Anti-bacterial
- ▶ Repellency
  - Water
  - Blood
  - Alcohol
  - Stain (-release)



## Leisure/Sports & Beddings

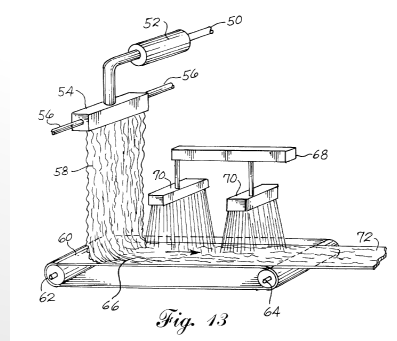
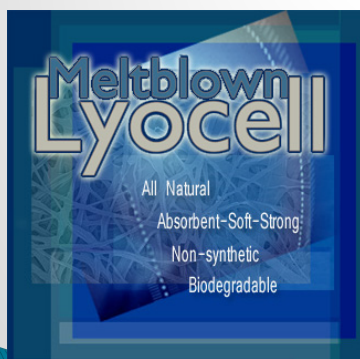
- ▶ Climate Control
  - Moisture Management
  - Temperature Control
- ▶ Breathability
- ▶ Anti-microbial
- ▶ Anti-bacterial
- ▶ Repellency
  - Water
  - Stain (-release)



## Biomass Resources for CO<sub>2</sub> Reduction

- ▶ Spunlaid Cellulose
  - Spunbonded
  - Meltblown
  - Meltspun
- ▶ Functionalized Viscose

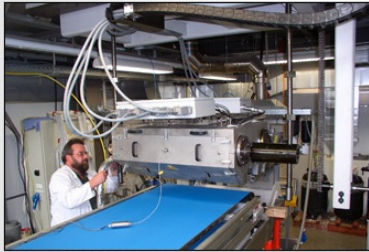
## Meltblown Process



Ref. USP 6,219,801, USP 6,221,487, USP 6,235,392 외 다수



## Meltblown Process

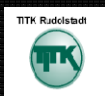


Reicofil meltblown nozzle being used on the 60 cm-wide meltblown lyocell pilot line at Fraunhofer IAP in Potsdam-Golm



Item	Unit	Value
Diameter of the single fiber	µm	<10
Mass per unit area	g/m <sup>2</sup>	10-200
Thickness	µm	30-500
Bulk density	g/cm <sup>3</sup>	0, 1-1
Tensile strength — longitudinal	N/m	200-2500
Tensile strength — transversal	N/m	150-1500
Rewetted tensile strength — longitudinal	N/m	60-500
Rewetted tensile strength — transversal	N/m	30-400
Extension	%	10-20
Absorption WRV (DIN 5384)	%	120-160
Liquid absorptive capacity (edana 10.4-02)	%	600-800
Liquid wicking rate 300 s (edana 10.4-02)	mm	80-120

## Nanoval Process



Thüringisches Institut für  
Textil- und Kunststoff-  
Forschung e.V. (TITK)



Lenzing Aktiengesellschaft



## Spunbond Process

- ▶ Asahi Kasei社에서 기술개발을 완료하여 상업적으로 생산(제품명: Bemliese)
- ▶ 큐프라 셀룰로오스 Spunbond 기술
- ▶ 각종 산업 및 위생용 와이퍼류, 화장 소모품, 식생 메트, 티백 등의 필터 소재로 적용

## Cellulose Meltspinning

- ▶ Toray社에서는 셀룰로오스 용융방사기수의 세계 최초로 개발하여 상업생산 연구를(제품 Foresse) 수행



Toray's environmentally friendly fiber, *Foresse*® is the first cellulosic fiber in the world produced by the "melt spinning method," which does not use organic solvents.

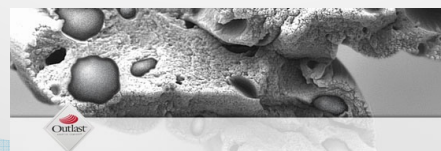


Clothing made using *Foresse*®

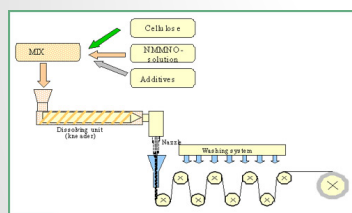
## Functionalized Viscose(1)



Fibre for	Danufil	Galaxy	Viloft	Outlast
Hygiene & Nonwovens				
Fibres for Tampons				
Textile				
Flock				
Short cut				



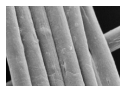
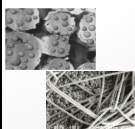


## Functionalized Viscose(2)





## Spunlaced Flax

## Climate Control – Heat Storage Capabilities

Products	Systems	Heat storing capability in joules per gram fiber			Loss of performance	Pictures
		new	after 10 washes	after 40 washes		
Smartcel clima	parafin <u>direct into cellulose</u> without micro capsules	60 J/g	–	57 J/g	5%	
Outlast	parafin in micro capsules integrated in acrylic fibers	40 J/g	5–10 J/g	–	87–75%	
Kelheim	parafin in micro capsules integrated in viscose fibers using Outlast technology	13 J/g	–	–	–	
Schoeller	parafin in micro capsules integrated in fibers	–	–	–	–	

## Oeko Textiles

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- ▶ Introduction of New Standard & Regulation
  - Öko Text Standard 100
  - REACH Certificate
  - Bluesign® standard

- 
- ▶ Super Fiber Products for
    - High Temperature Resistant & Chemical Resistant Fibers
    - Purification by Filtration & Separation Technology



## Medical Textiles 전문업체





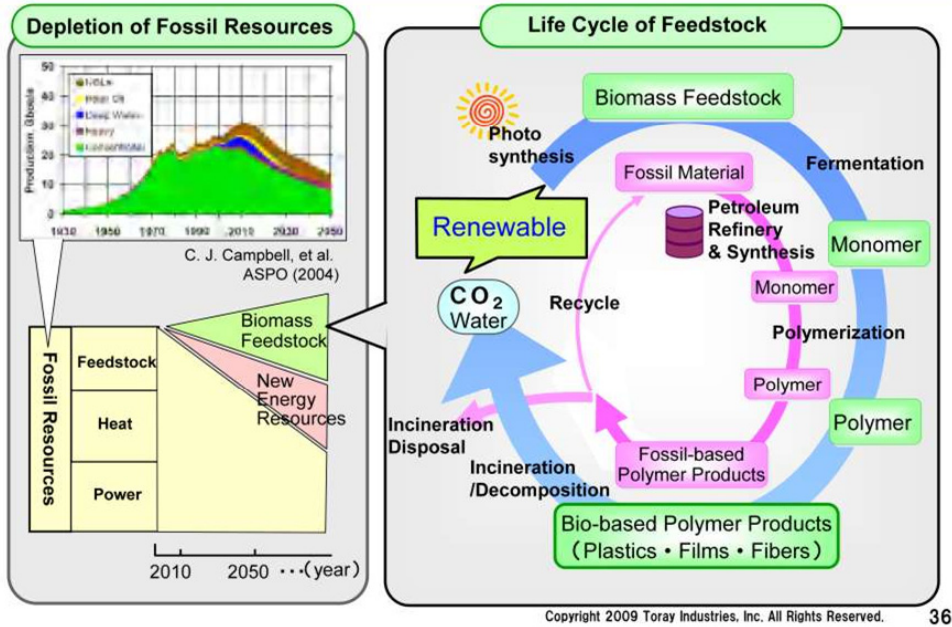
## Cushion Materials

- ▶ 3D Multilayer Structural Fabric by Eiheiji Sizing Co., Ltd.(일)



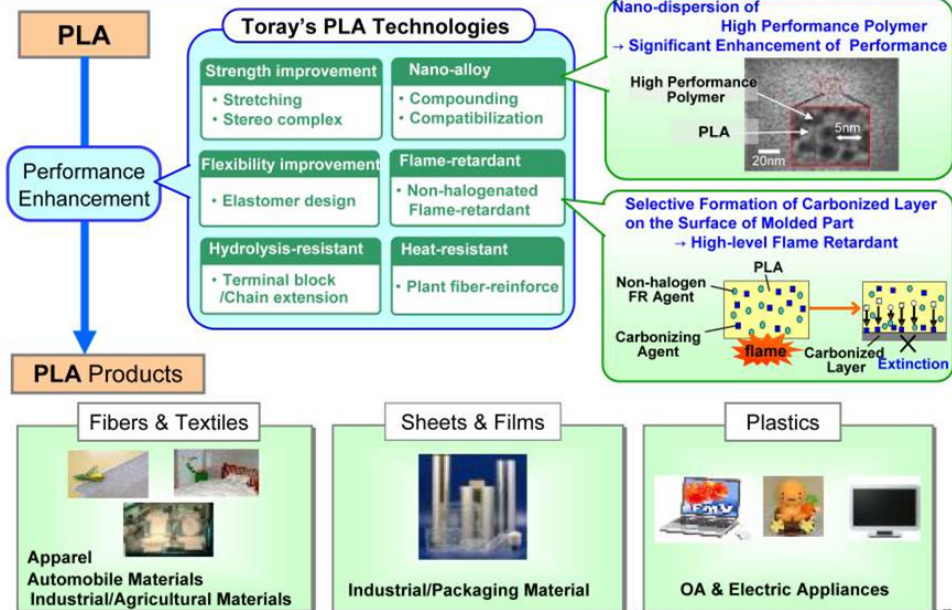
## Ecodream Project Advent of Biomass Feedstock Era

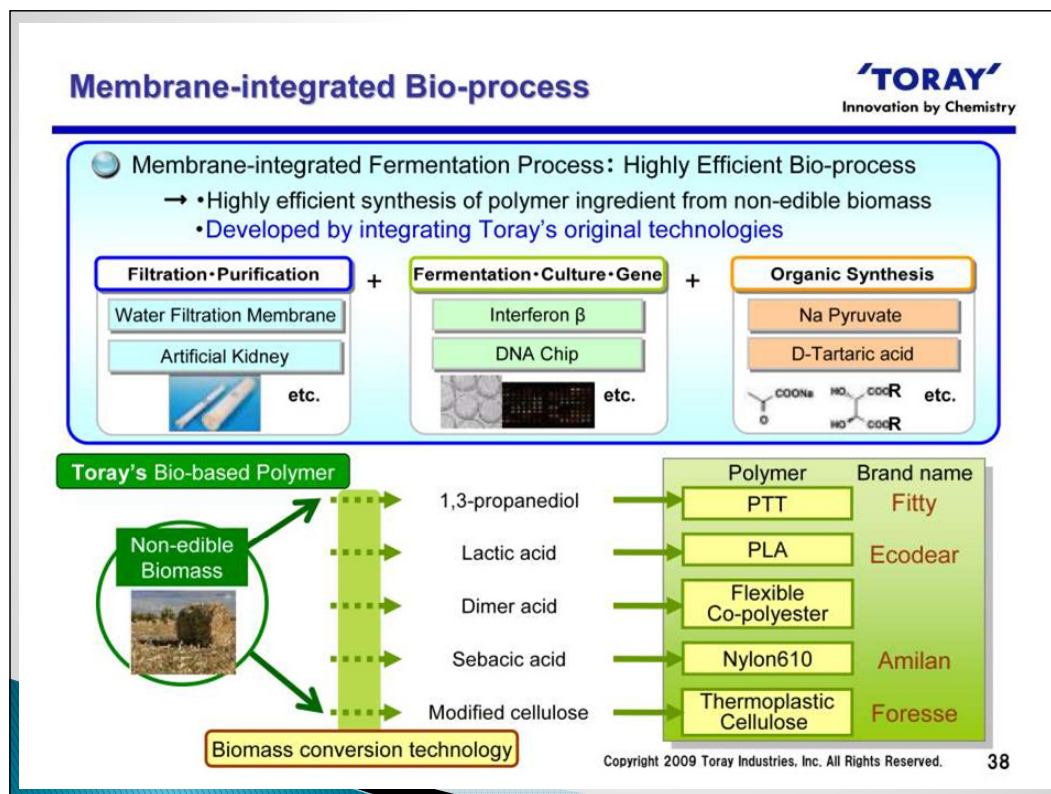
**TORAY**  
Innovation by Chemistry



## Polylactic Acid (PLA)

**TORAY** Innovation by Chemistry





Expected Effects on Environmentally Friendly Products and Technologies	
Expected Effects	Products
CO <sub>2</sub> Gas Reduction	PLA (Polylactic Acid) fibers, plastic resins, films; 3GT fibers & textiles; Bamboo composite fibers; Cellulose fibers; Soybean protein fibers; Flexible and heat resistant films
Energy Reduction	Torayca* for transport machineries; Engineering plastic resins; Components for turbine generators; Components for fuel cells; Films for solar cells; films for capacitors for hybrid cars
Water Purification (Water treatment)	RO (reverse osmosis) membranes; UF-MF membranes; Immersed membranes for MBR; Water treatment system businesses; Torayvino*
Air Purification	Heat resistant bag filters (PPS, PTFE fibers); Air filters
Hazardous Materials Reduction	Non-halogen flame retardant (fibers & textiles, plastic resins, films); Waterless CTP plate; Non-halogen circuit materials; Heavy metal-free color filters
Recycling	PET; Nylon 6; PBT; ABS; PPS; CFRP; DMSO

■ Fibers & Textiles
■ Plastics & Chemicals
■ IT-related Products
■ Carbon Fiber Composite Materials

■ Environment & Engineering
■ Life Science & Other Businesses

Product/technology	Description	Carbon dioxide reduction**	Energy reduction**	Water reduction**	Air purification**	Hazardous substance reduction**	Recycling**	Others
Torcon*, Toroflon*, Teflon*, Tefaire*	PPS fibers and fluorofibers used to collect dust in the exhaust gas of garbage incinerators and coal-fired boilers.	●	●					
Ecodear*	Environmentally friendly polylactic acid fiber made from corn or other plants.	●	●					
Sotake*	Bamboo-based fiber combining the superior features of natural bamboo with Toray's technologies.	●	●					
Foresse*	Fiber made from non-petrochemicals, plant-based cellulose. Also, the spinning process does not involve organic solvents, but uses the melt spinning method.	●	●					
Aminos*	Plant protein fiber made from proteins derived from soybeans.	●	●					
UNFLA*-ex	Non-halogen flame resistant polyester material using phosphorous flame retardants.					●		
Warmsensor*	Moisture-absorbent, heat-generating, insulating material achieved through special fiber structure processing.		●					
Eco Dye® process	Low-energy carpet fiber dyeing method that reduces the amount of water needed for dyeing and cuts the number of processes through consistent dyeing and heat treatment technology.		●					
Fieldmate* biodegradable fishing line	Fishing line that largely breaks down into water and carbon dioxide to return to the natural environment if accidentally left in the water or on the ground after use.					●		
Fieldmate* biodegradable material	Used to provide underground support for trees but returns to the natural environment over time.					●		
Recyclon*	Recycled fiber made from used PET (Poly (ethylene terephthalate)) bottles, nylon fibers and other products.						●	
Nylon-6 recycling	Spent nylon-6 fiber products are depolymerized back into their constituent monomers, and then repolymerized to make new nylon-6.						●	
Acrylic recycling	Acrylic fiber scrap from spinners, knitters, and other manufacturers is collected and dissolved to make new fibers.						●	
Cellulose sponge	Environmentally friendly product that is made from wood pulp, does not generate harmful gases when incinerated, and is biodegradable when buried in the ground.	●						
Toraymicron*	Ultra-fine nonwoven fabric used in air filter and mask as it can clean foul air at the micro level.				●			
Wossp* microfiber nonwoven material	A non-woven fabric made from polypropylene ultrafinefibers that can separate the oil content of oil wastewater and does not generate harmful gases after disposal.			●				
Tekasiran* oil-removing cloth	Oil-removing cloth made using microfiber technology that can be washed and reused.						●	