



# **Chemiefasern für Vliesstoffe: gestern – heute – morgen**

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**25. Hofer Vliesstofftage**

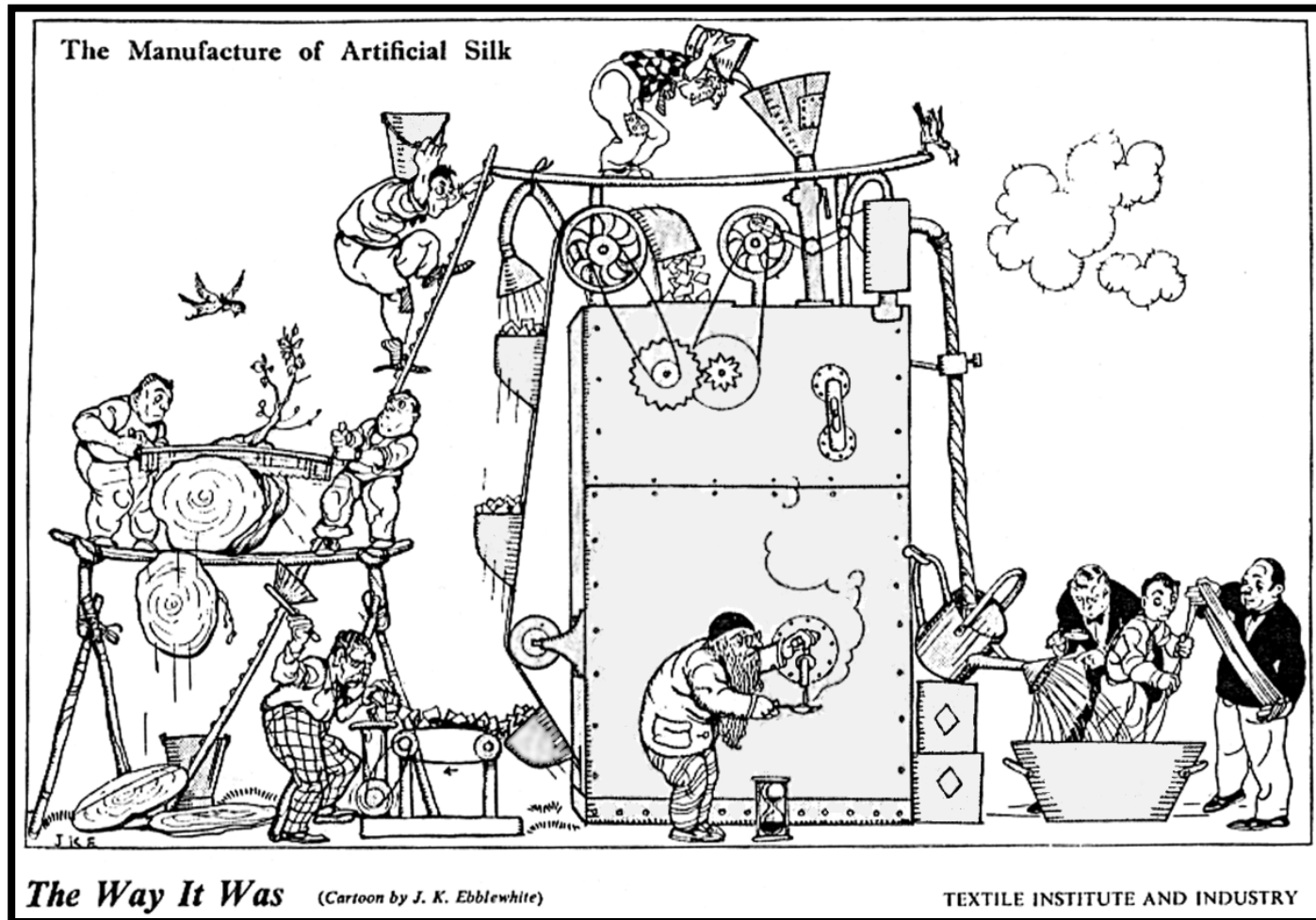
**10. November 2010**



**„Es ist nicht schwer zu komponieren,  
aber es ist fabelhaft schwer,  
die überflüssigen Noten  
unter den Tisch fallen zu lassen“**

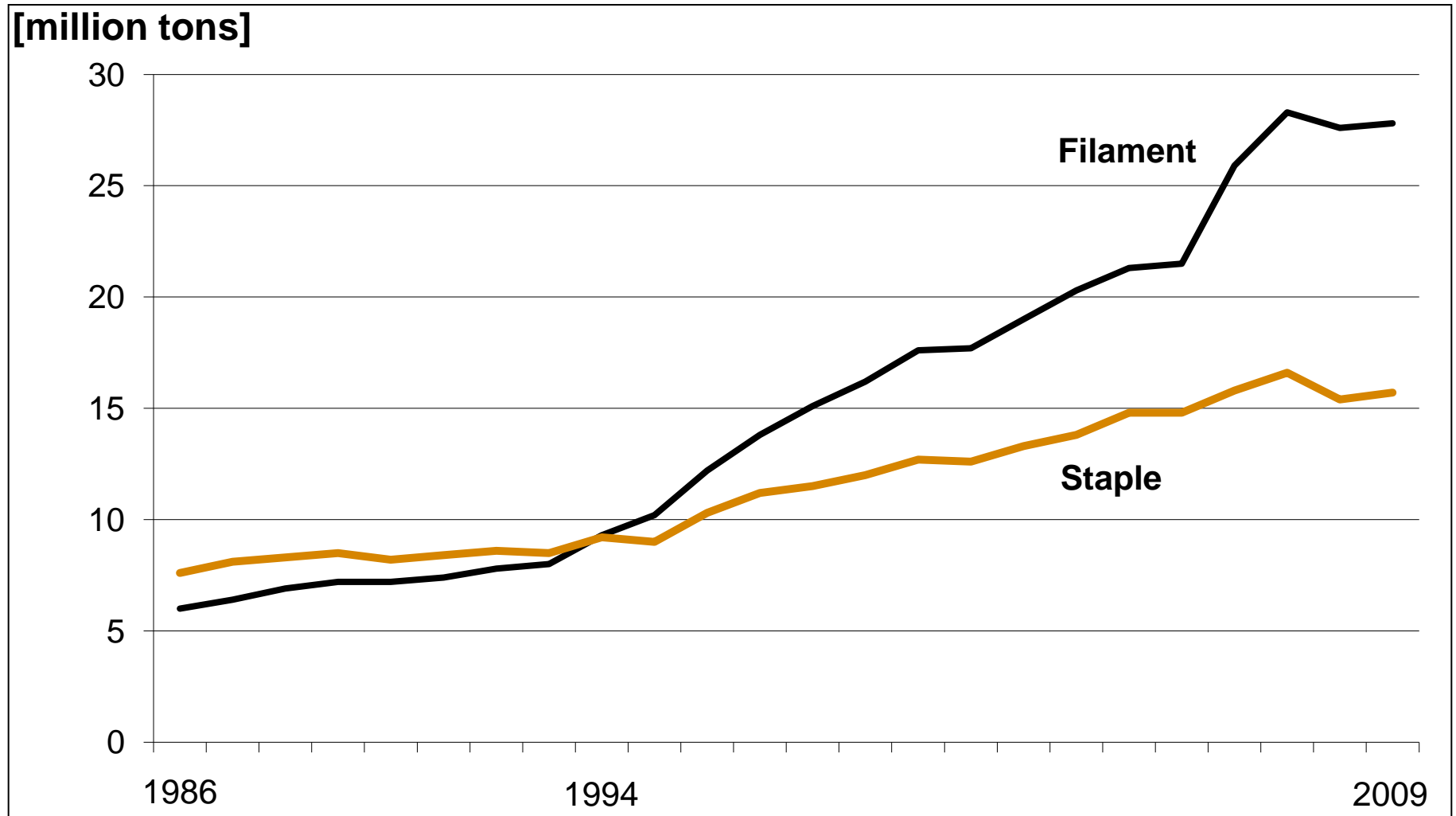
**Johannes Brahms**

# The Way It Was



**Fig. 1**

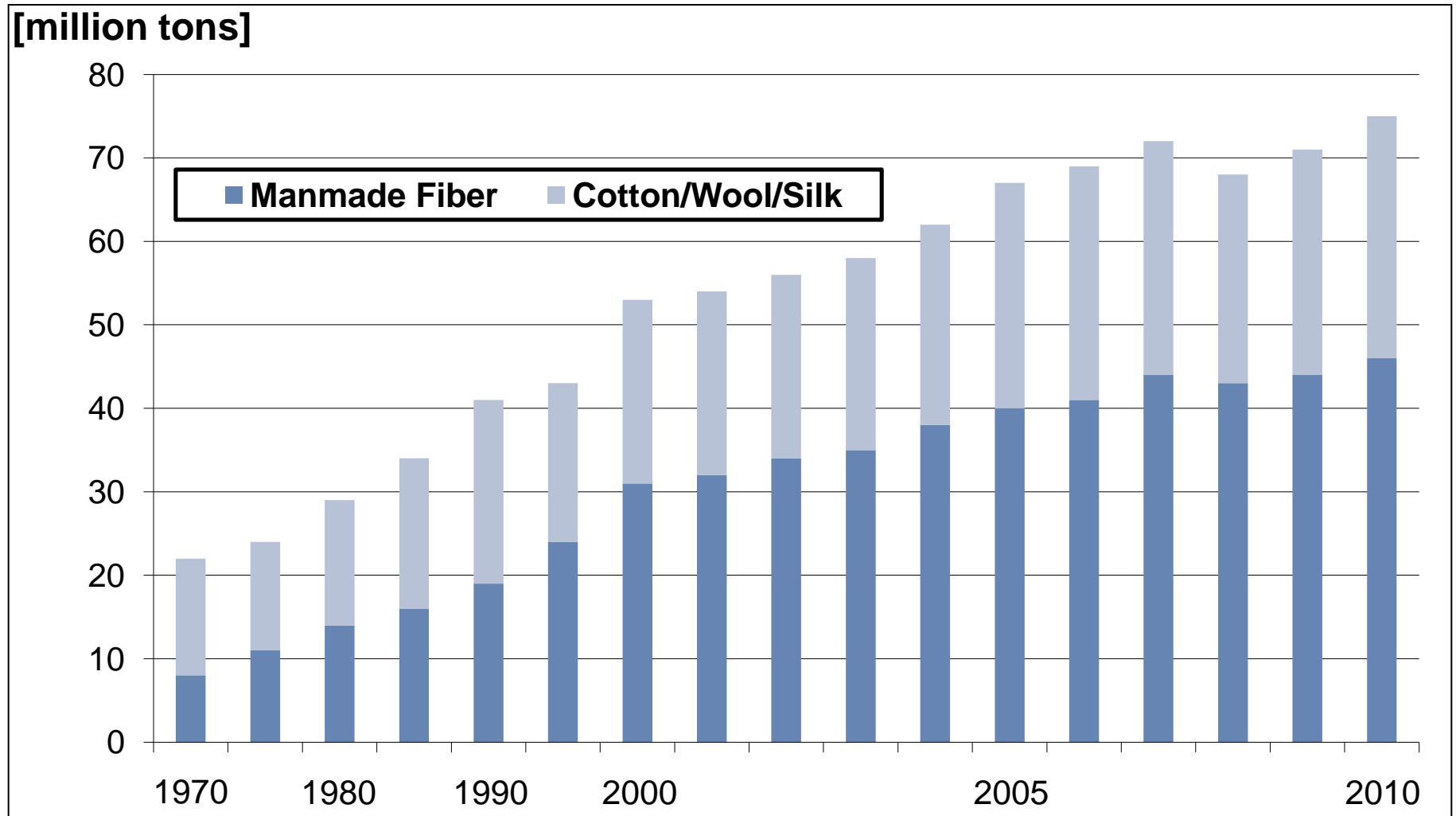
**Global synthetic fiber production**



Source: CIRFS

**Fig. 2**

**World fibers supply**



Source: Oerlikon Textiles

**Fig. 3****Global production of textile fibers**

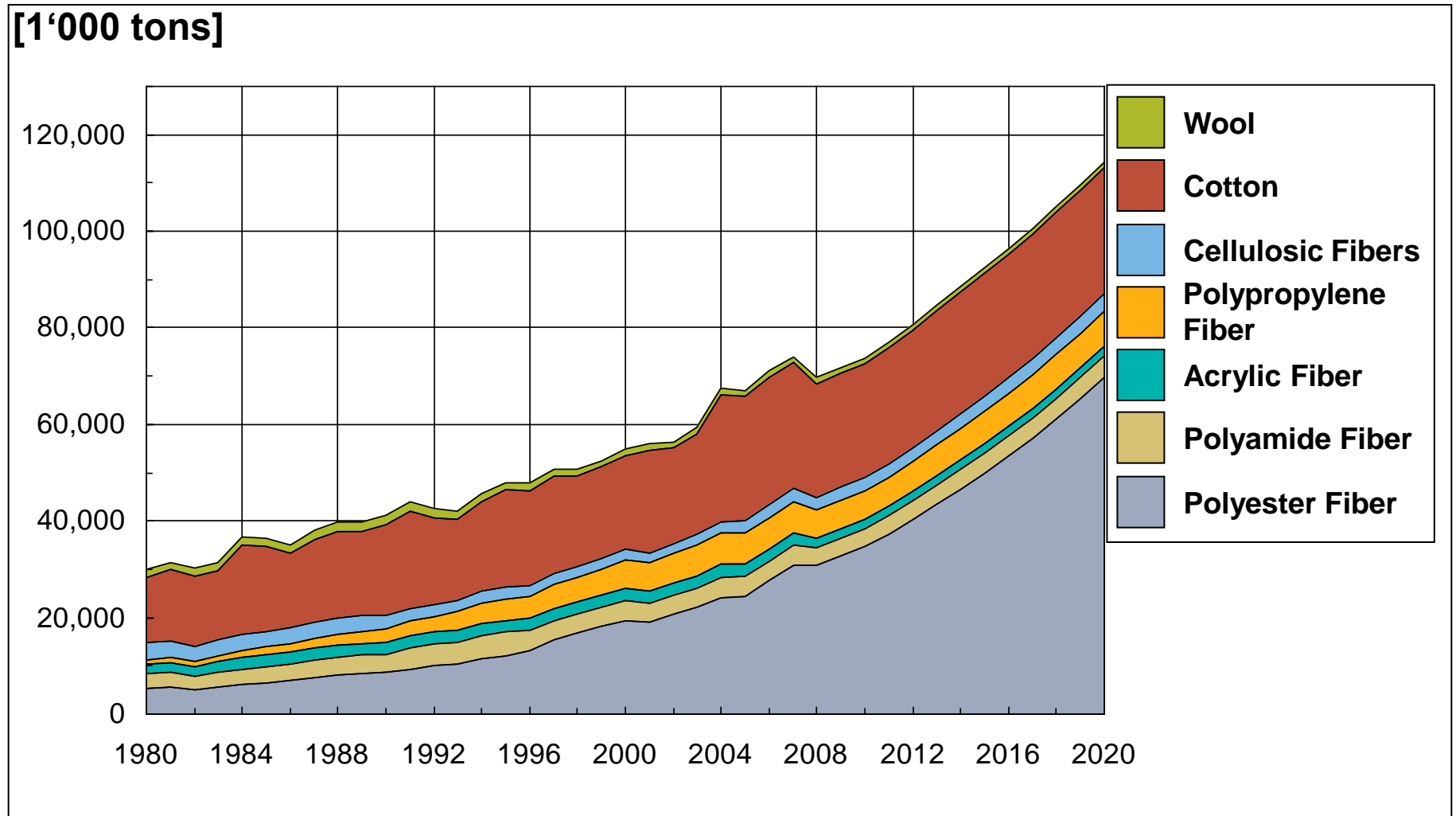
<b>[million tons]</b>	<b>2000</b>	<b>2006</b>	<b>2009</b>
Synthetic Fibers	33.0	41.5	43.7
Polyester	18.9	28.1	32.0
PP fibers <sup>1)</sup>	6.0	6.4	5.8
Polyamide	4.1	3.9	3.3
Acrylics	2.7	2.5	2.0
Others	0.3	0.6	0.6
Cellulosics <sup>2)</sup>	2.8	3.3	3.5
Cotton	19.7	25.8	22.0
Wool	1.3	1.2	1.2
Silk	0.1	0.1	0.1
<b>Total</b>	<b>56.9</b>	<b>71.3</b>	<b>70.5</b>

1) Incl. film fibers    2) excluding lyocell fibers (capacity 130'000 t/y in 2009) , including acetate filter tow

Source: Fiber Organon / USA

**Fig. 4**

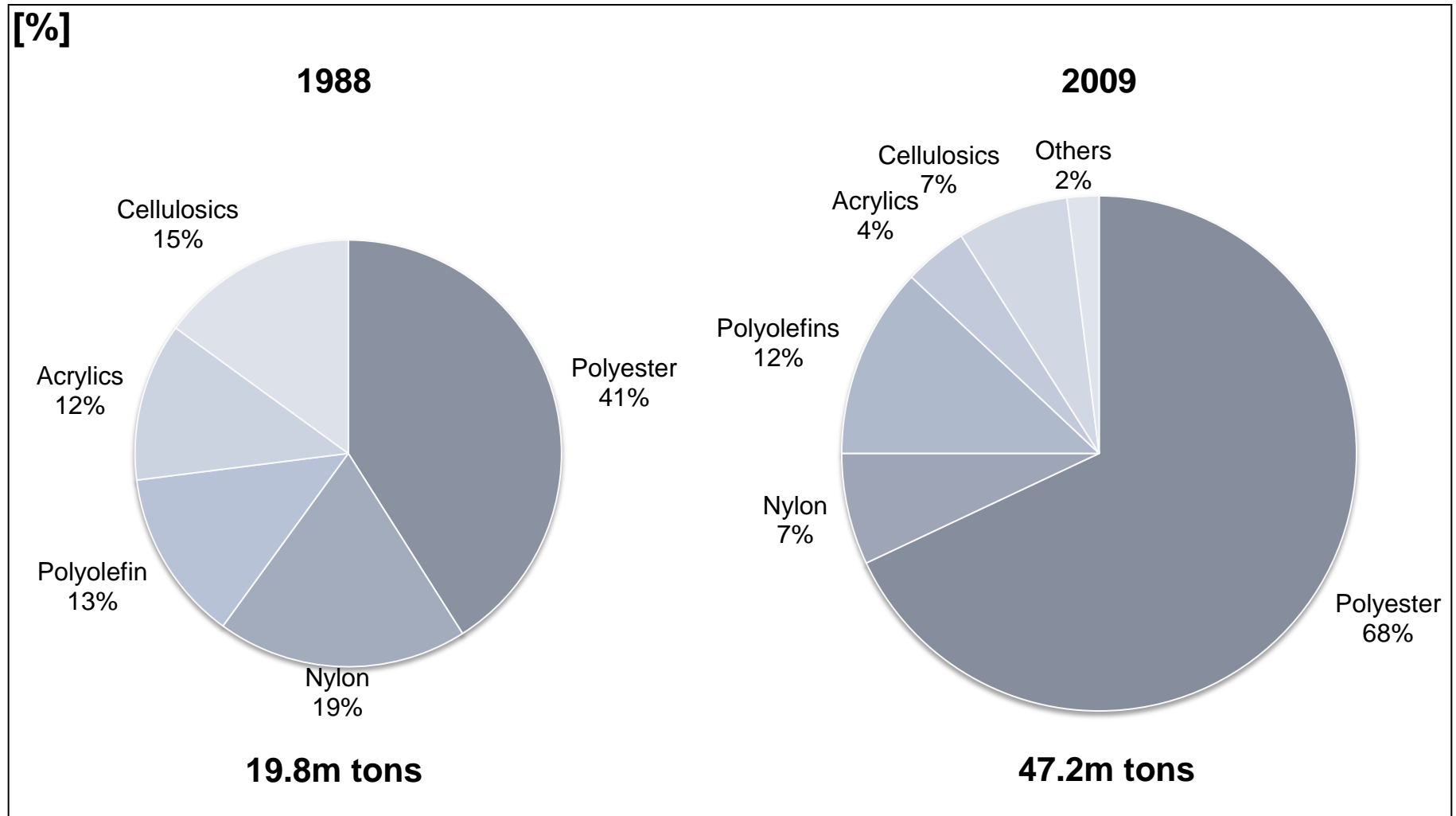
**World fiber production 1980-2020**



Source: Tecnon OrbiChem

**Fig. 5**

**Worldwide man-made fiber production by fiber type**

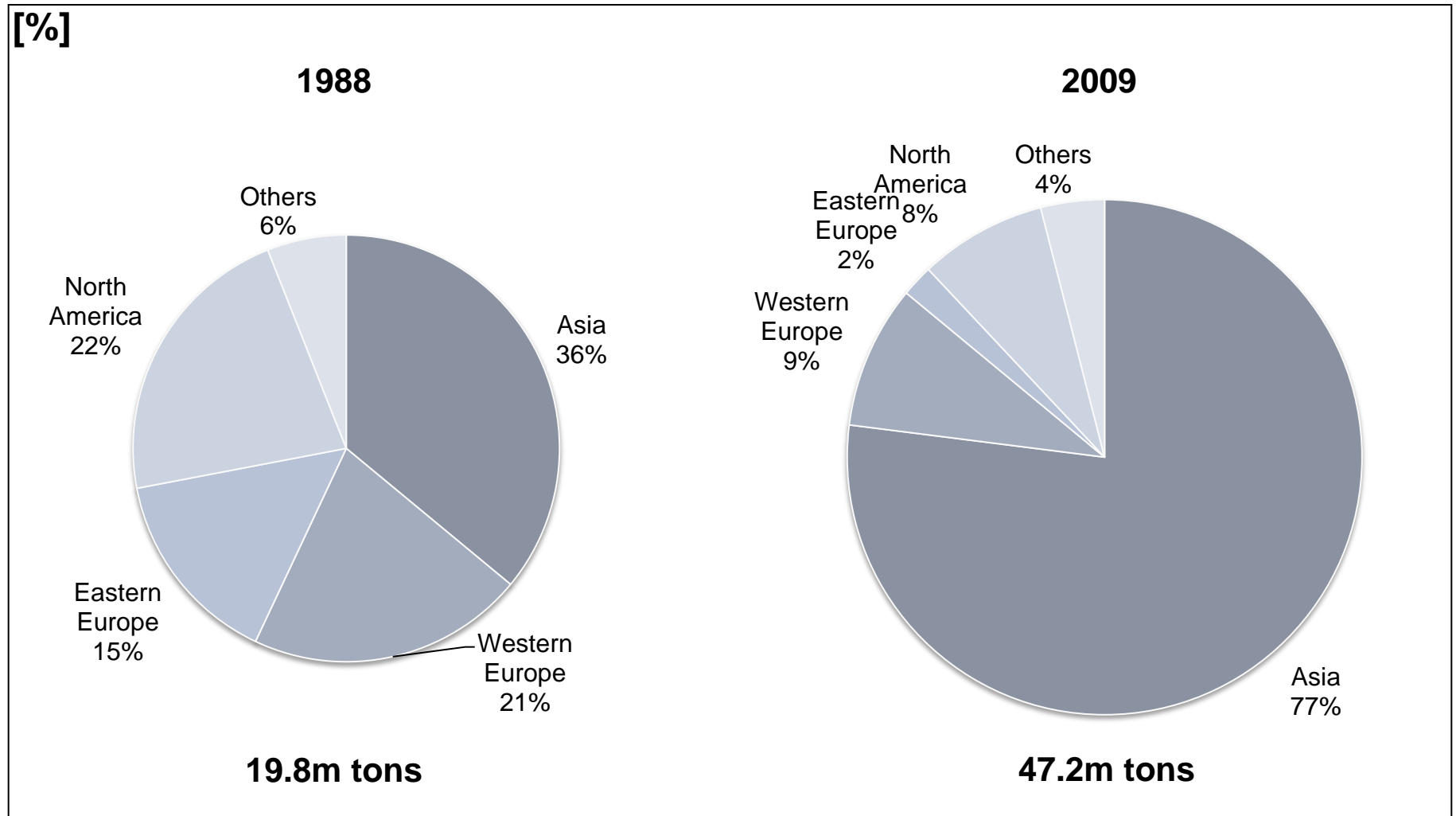


Source: Fiber Organon



**Fig. 6**

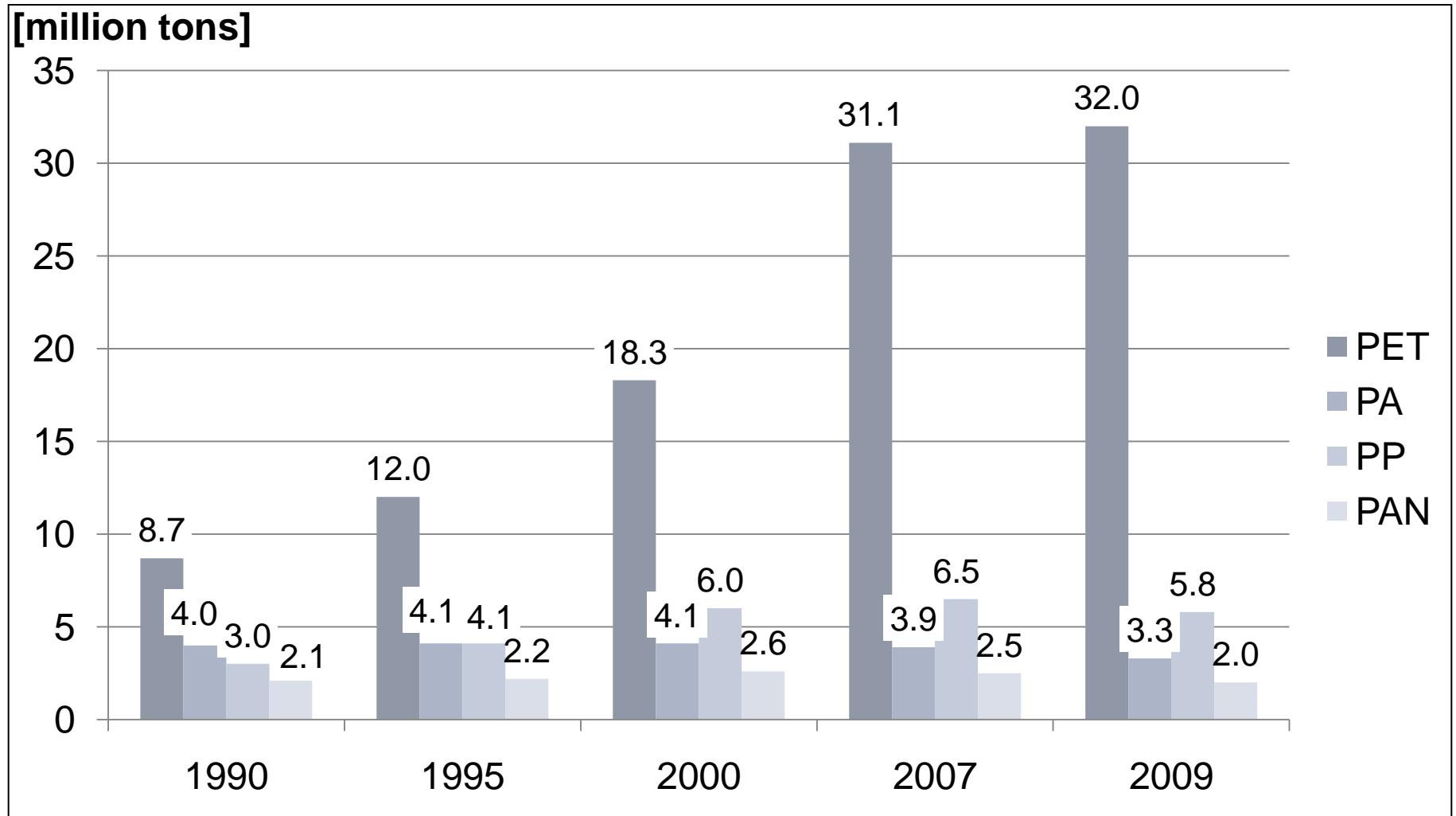
**Worldwide man-made fiber production by region**



Source: Fiber Organon

**Fig. 7**

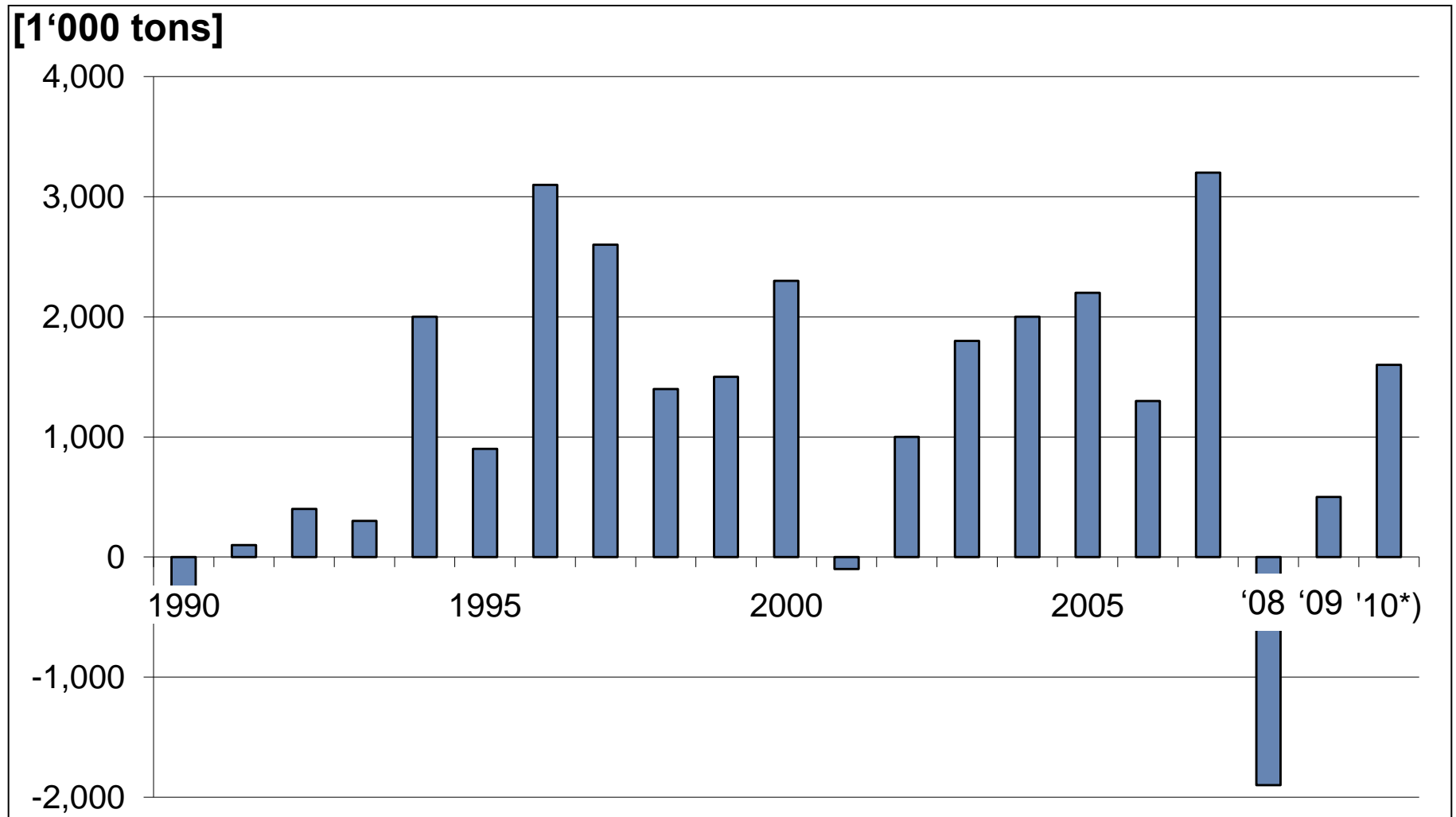
**Global production of synthetic fibers (1990 - 2009)**



Source: Fiber Organon / USA

**Fig. 8**

**Y/Y increase of global synthetic fiber prod. 1990 – 2009 (incl. PP fibers)**

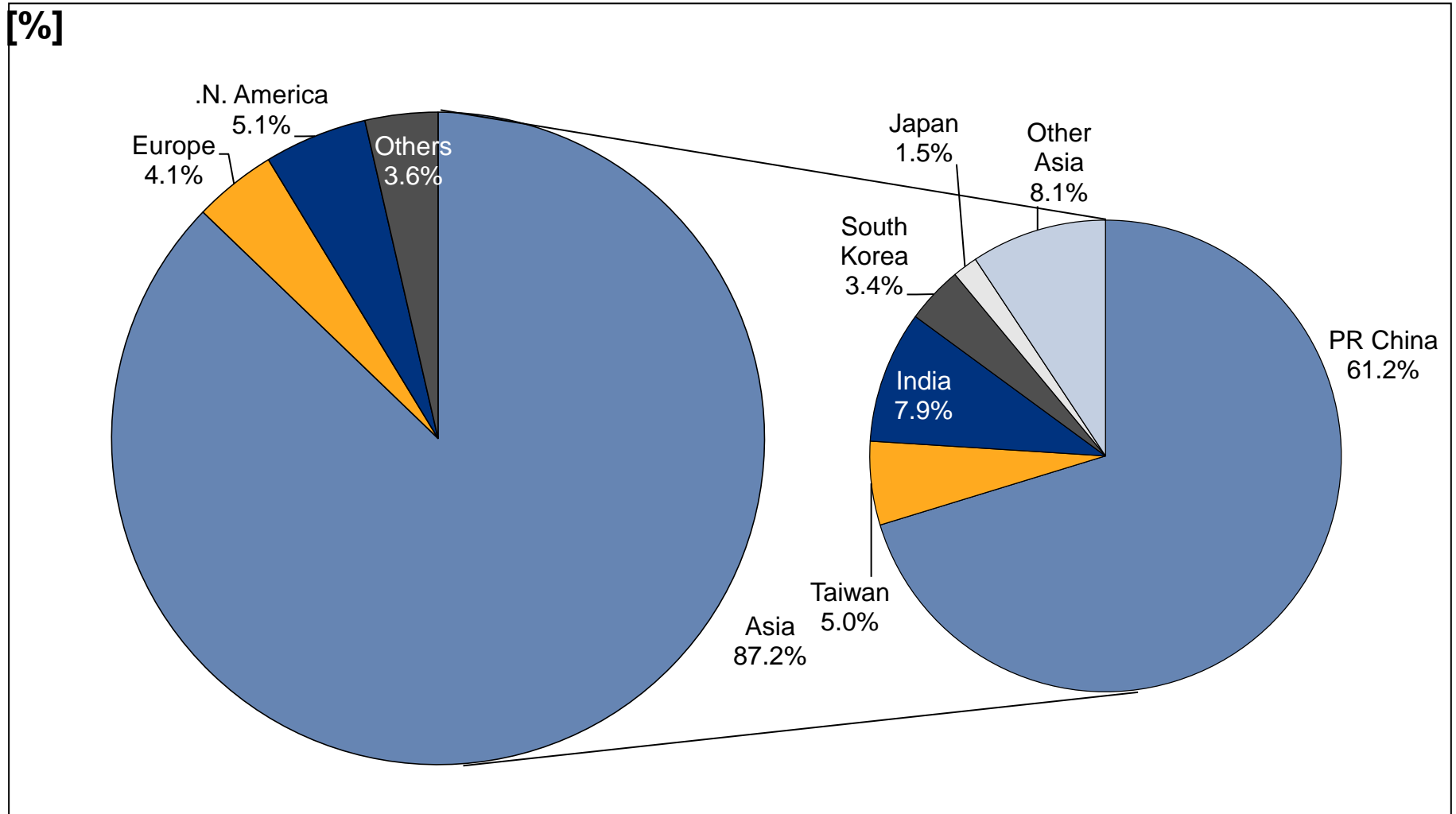


Source: Fiber Organon / USA

\*) estimated

**Fig. 9**

**Synthetic fiber production share by region 2009**



Source: Fiber Organon / USA

# Fig. 10

## % share of global production and capacity of synthetic fibers

[%]	Production			Capacity		
	2005	2008	2009	2005	2008	2008
PR China	45.0%	60.0%	61.2%	51.3%	60.3%	61.2%
USA	8.5%	5.2%	4.3%	6.7%	4.8%	4.3%
Taiwan	8.2%	5.3%	5.0%	7.2%	4.7%	4.3%
India	5.8%	6.2%	7.9%	6.7%	7.7%	8.3%
W. Europe	5.5%	3.8%	3.0%	4.4%	3.3%	2.9%
South Korea	5.4%	3.7%	3.4%	4.1%	3.3%	3.3%
Indonesia	3.5%	3.0%	2.9%	3.2%	2.8%	2.8%
Japan	3.0%	2.1%	1.5%	2.7%	2.1%	1.9%
Thailand	3.0%	2.3%	2.2%	2.5%	2.1%	2.1%
Turkey	2.5%	1.6%	1.5%	2.2%	1.6%	1.6%
Pakistan	1.8%	1.4%	1.4%	1.8%	1.5%	1.5%
Malaysia	1.1%	1.0%	0.9%	1.0%	1.0%	1.0%
C.I.S.	1.0%	0.9%	0.9%	1.0%	0.9%	0.9%
Brazil	1.0%	0.8%	0.7%	0.9%	0.7%	0.7%
Mexico	0.9%	0.5%	0.5%	0.8%	0.5%	0.5%
	96.2%	97.8%	97.2%	96.5%	97.1%	97.1%

Source: Fiber Organon / USA

Note: not included polyolefins, glass fibers or acetate filter tow

**Fig. 11**

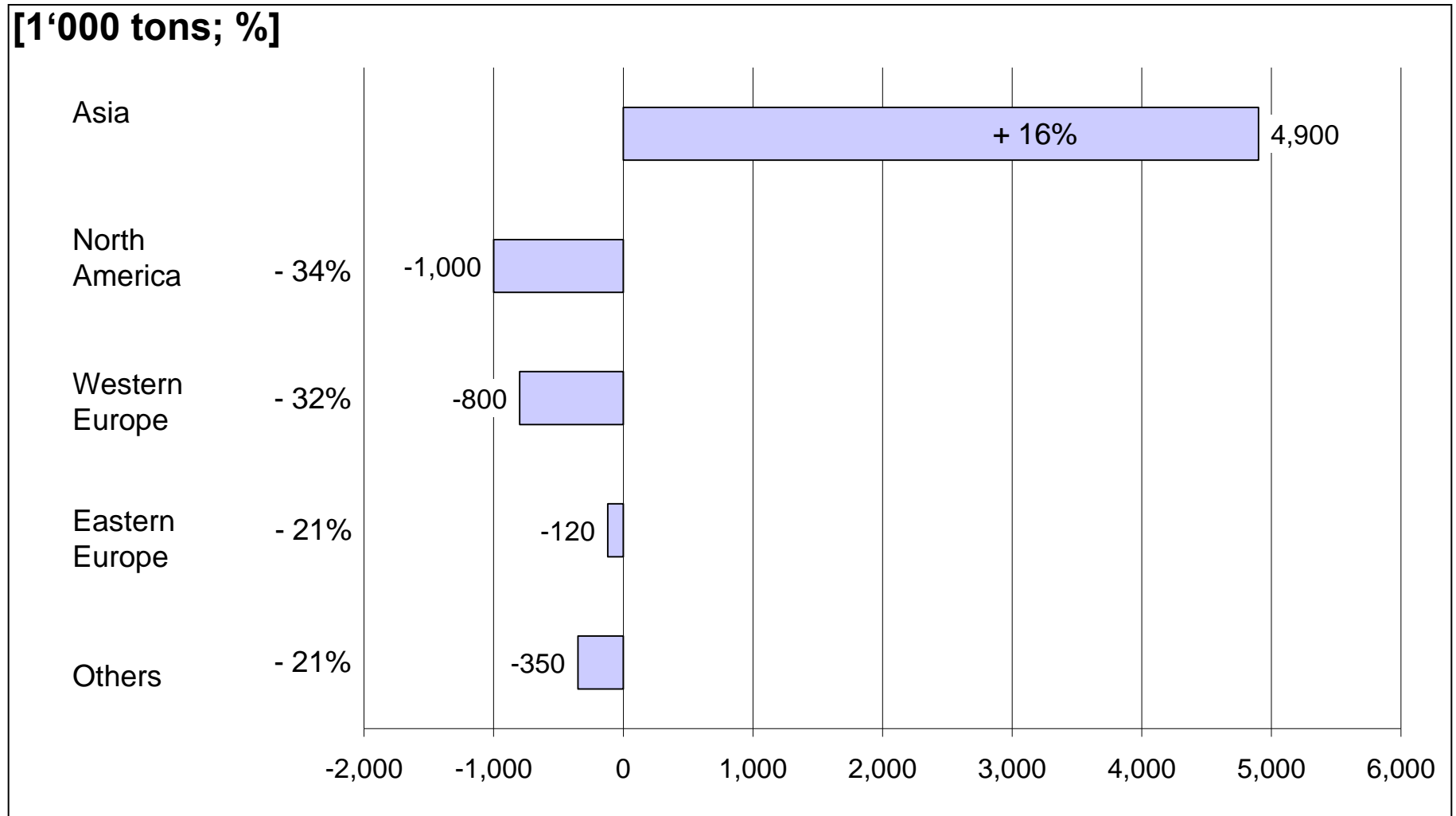
**Global synthetic fiber production increase / decrease**

[%]	2004/05	2005/06	2006/07	2007/08	2008/09
PET filament yarn	10.0%	7.6%	12.4%	-0.5%	3.8%
PET staple fibers	9.1%	1.7%	7.9%	-2.6%	1.9%
PA filament yarn	-2.4%	2.0%	-0.3%	-7.6%	-7.3%
PA staple fibers	-9.3%	-9.5%	-6.5%	-24.6%	-18.3%
Acrylic staple	-4.5%	-6.1%	-3.0%	-23.7%	5.5%

Source: Fiber Organon / USA

**Fig. 12**

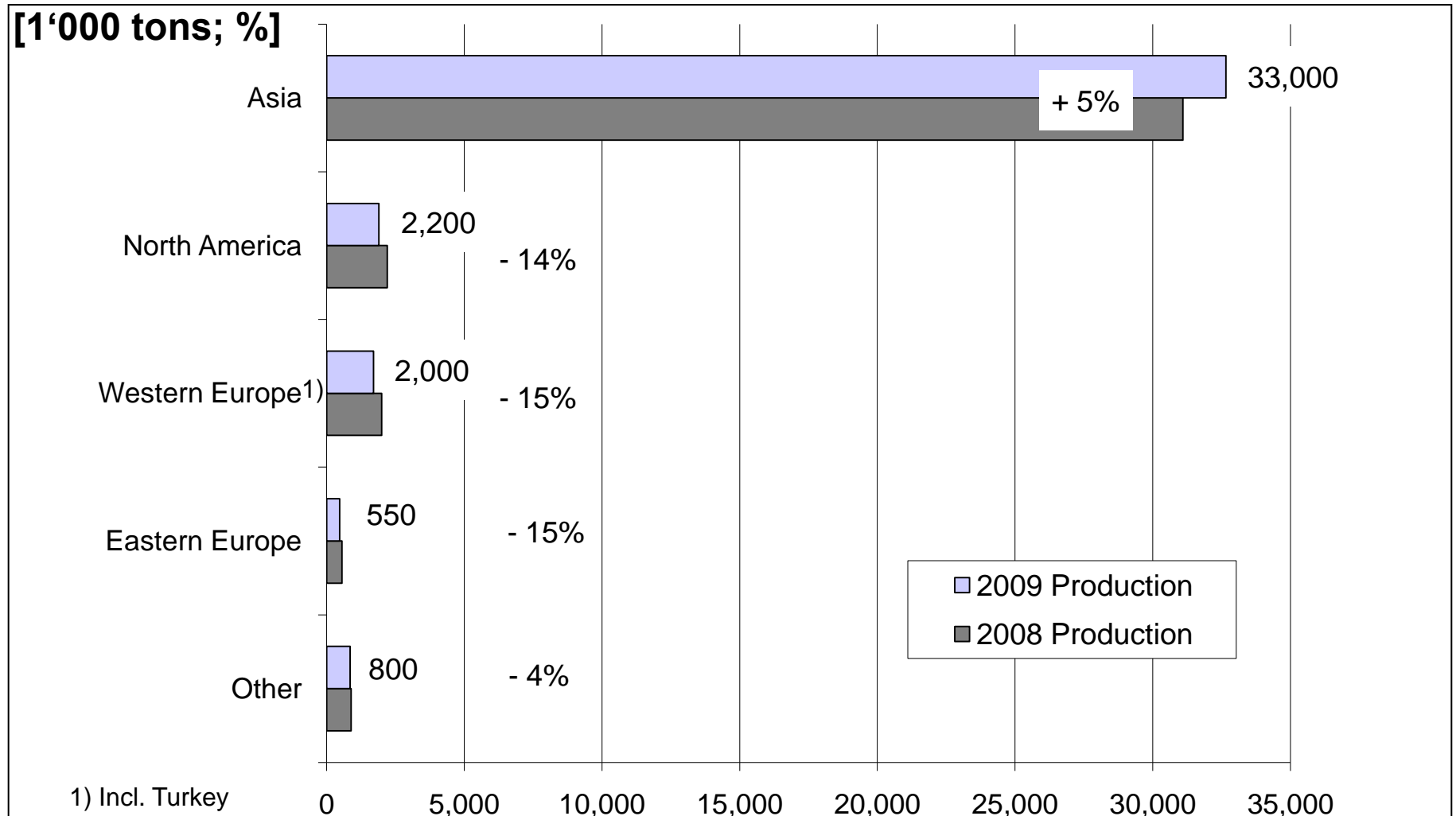
**Synthetic fiber production changes by region 2006 to 2009**



Source: Fiber Organon / USA

**Fig. 13**

**Synthetic fiber production by region 2008 to 2009**

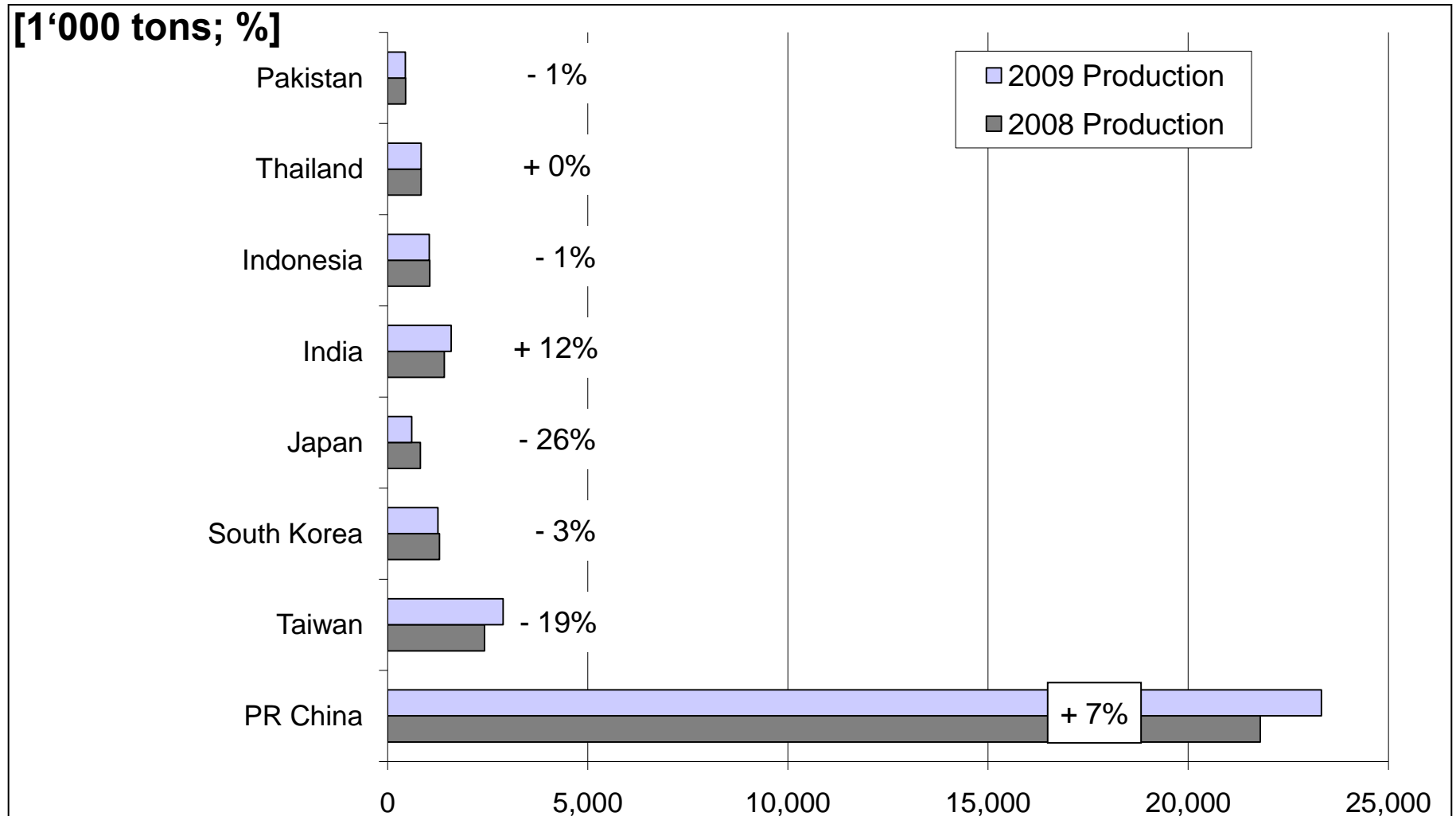


Source: Fiber Organon / USA



**Fig. 14**

**Synthetic fiber production<sup>1)</sup> in selected Asian countries 2008 and 2009**

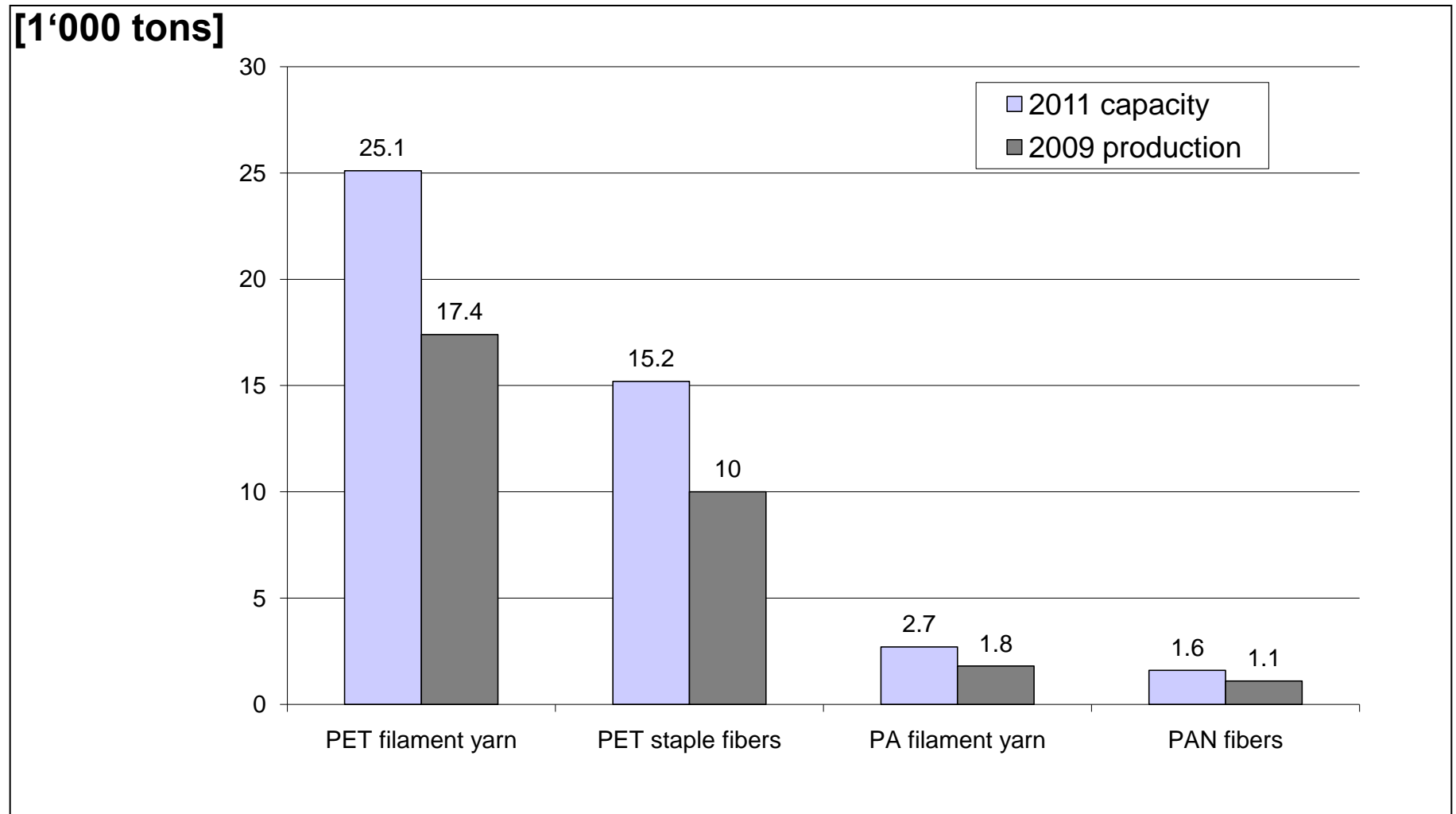


Source: Fiber Organon / USA

1) Excluding polyolefin fibers

**Fig. 15**

**Asia: Synthetic fiber production 2009 and capacities 2011**

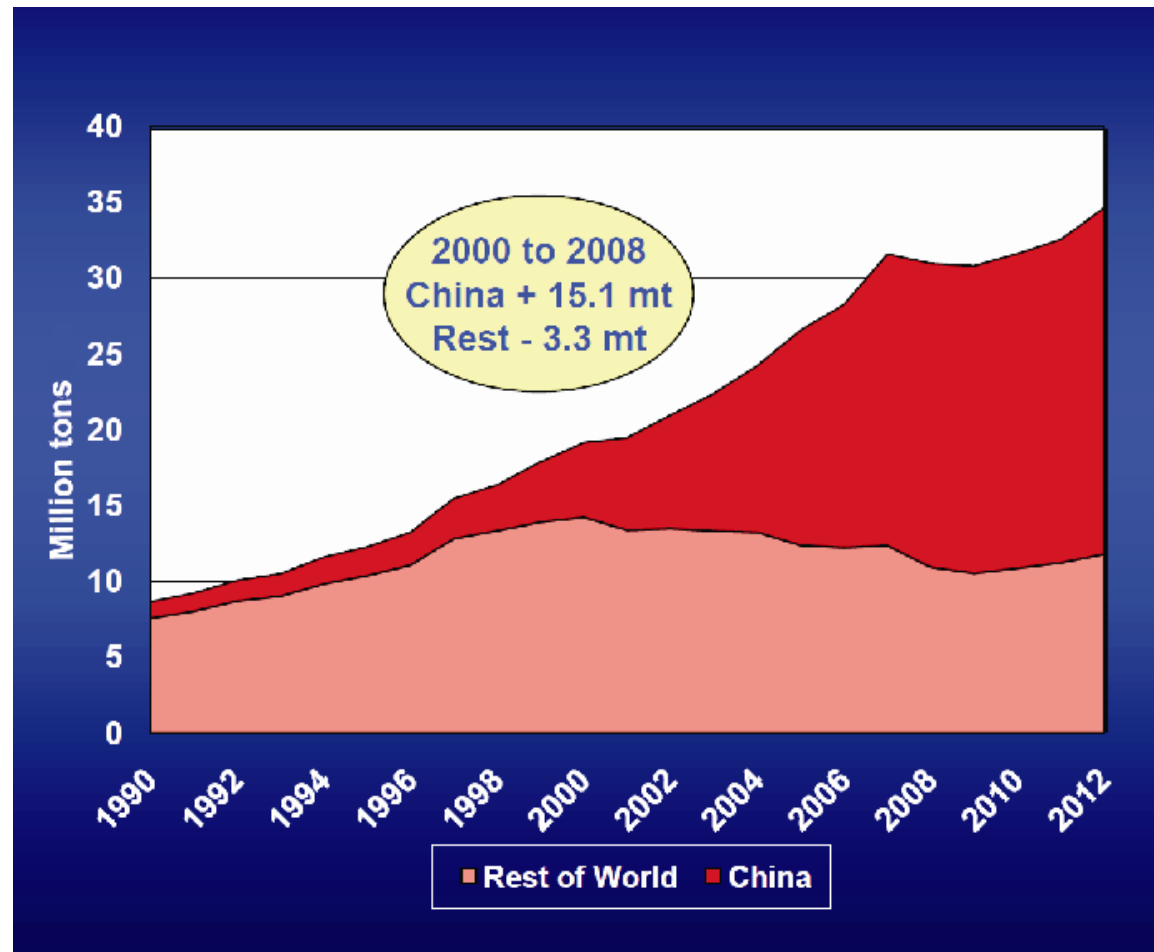


Source: Fiber Organon / USA

Fig. 16

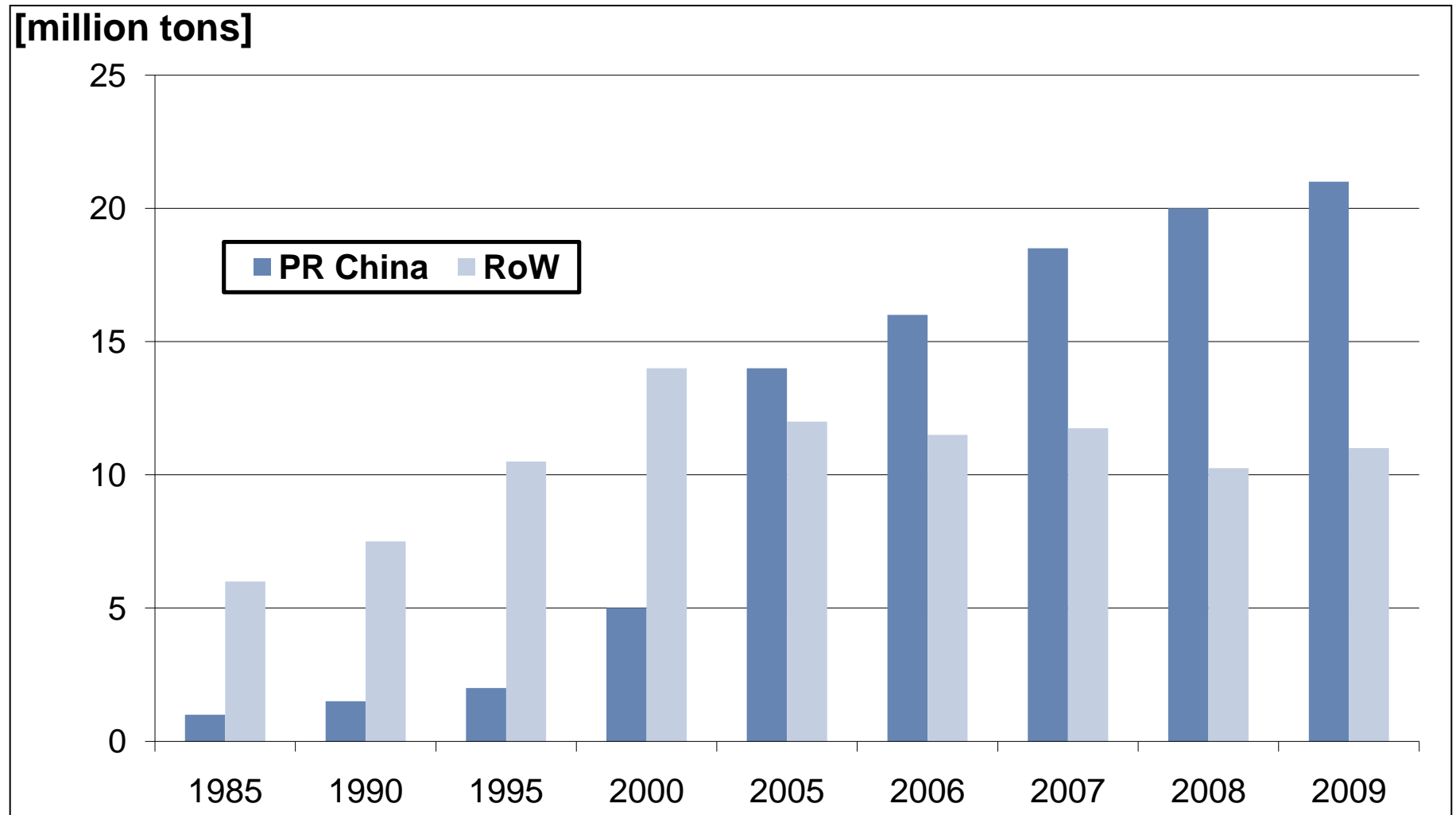
Global polyester fiber production

[million tons]



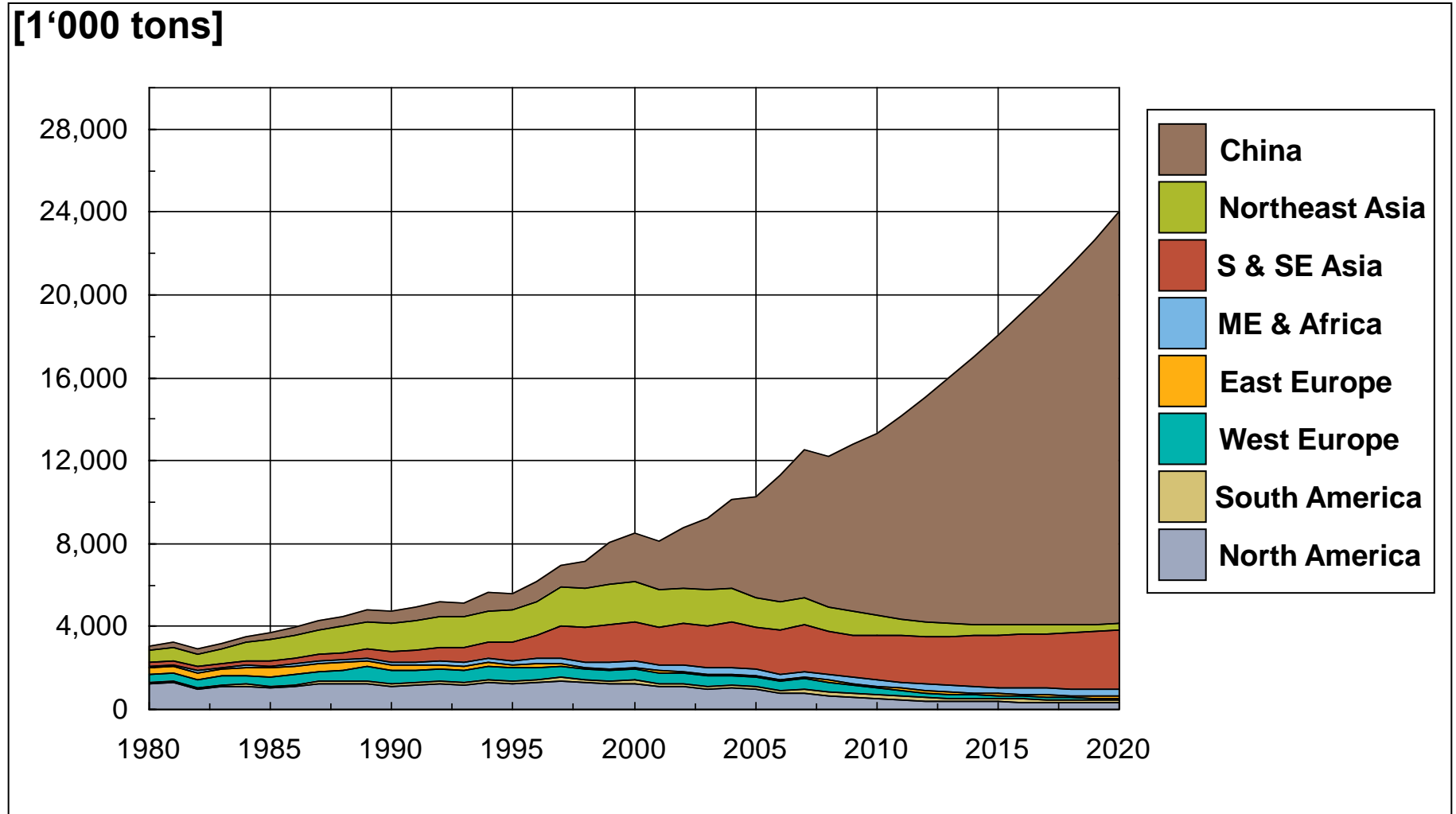
**Fig. 17**

**Polyester fibers production**



**Fig. 18**

**World polyester staple production**



Source: Tecnon OrbiChem

# Fig. 19

## Leading producers: polyester staple fibers

[1'000 tons/year]

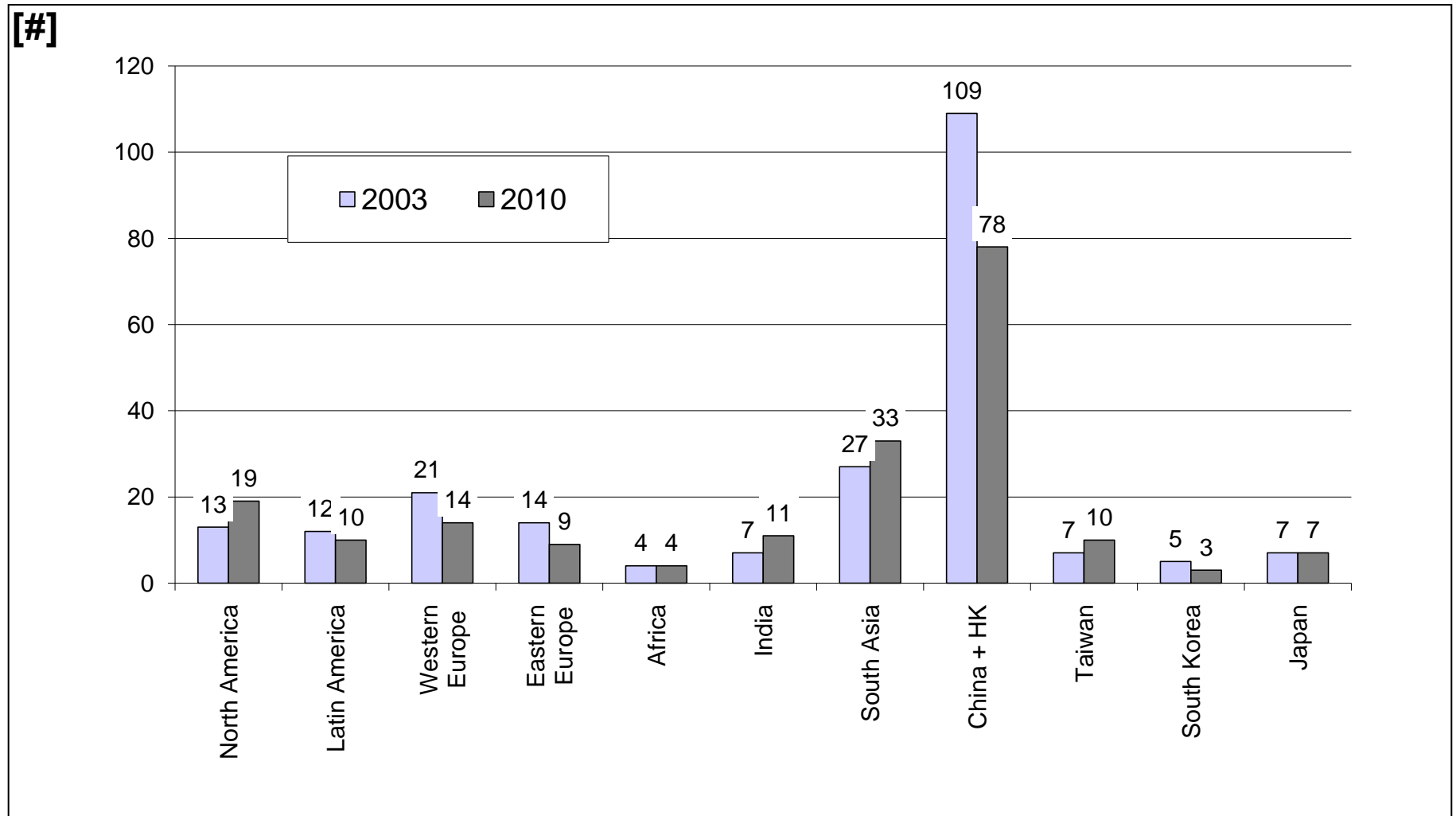
The 10 leading PET staple fiber producers 2010 (1,000 tons)

	Company	Location	Total
1	Sinopec, China	Tianjin	100
		Shanghai (SPC)	150
		Jiangsu (Yizheng)	580
		Henan	150
		Xinjiang	15
		Company Sub Total	995
2	Sanfangxiang, China	Jiangsu	840
3	Reliance Industries, India	Hazira	480
		Patalganga	110
		IPCL, various	130
		Recron, Malaysia	54
		Company Sub Total	774
4	Huvis, Korea	Chunju	235
		Ulsan	160
		Sichuan	154
		Company Sub Total	549

	Company	Location	Total
5	Indorama, S. Asia	Indonesia	60
		Thailand (IndoPoly)	20
		Thailand (Tuntex)	115
		India	310
		Company Sub Total	505
6	Nan Ya, Taiwan	Linkao	120
		USA	200
		Vietnam	50
		Jiangsu	50
Company Sub Total	420		
6	Ibrahim Fibres, Pakistan	Shahkot	420
8	Shaoxing Yuandong, China	Zhejiang	300
9	Far Eastern, Taiwan	Hsin Chu	170
		Shanghai	120
		Company Sub Total	290
9	Jiangyin Huahong, China	Jiangsu	290

**Fig. 20**

**Producers of polyester staple fibers worldwide 2003 and 2010 (incl. r-PET)**



Source: Fiber Organon / USA

**Fig. 21****PR China: Top 20 producers of PET****[1'000 tons/year]**

No.	Producer	Capacity (1,000 tons/year)
1	Sinopec Yizheng Chemical Fiber	1,700
2	Jiangsu Sanfanggang Group	1,600
3	Zhejiang TongKun Group	800
4	Zhejiang Shaoxing Far East	600
5	Zhejiang Hengyi	600
6	Zhejiang Hangzhou Rongsheng Chemical Fiber	600
7	Jiangsu Hengli Fiber	600
8	Jiangsu Shenghong Group	600
9	Zhejiang Shaoxing Zongheng Group	560
10	Sinopec Shanghai Company	550
11	Zhejiang Cifu Chemical Fiber	500
12	Wujiang Yingxiang Chemical Fiber Co., Ltd.	500
13	Zhejiang Xingfengming Fiber	500
14	Jiangsu Shenjiu Fiber Co., Ltd.	500
15	Shanghai Far Eastern Textile Fibers Co.	460
16	Petrochina Liaoyang	450
17	Guangdong Kaiping Polyester Enterprise Group	420
18	Zhejiang Hangzhou DaoYuan Chemical Fiber Group	400
19	Xiamen Xianglu Chemical Fiber Plant	350
20	Xiamen Tenglong special resin plant	320
	Other companies	11,190
	<b>Total</b>	<b>24,800</b>

Source: CICCC, Beijing / China



**Fig. 22**

**PR China: Consumption structure of PET**

[1'000 tons; %]

	2007		2012		2007/2012
	Consumption (1,000 tons)	Share %	Demand (1,000 tons)	Share %	±%/year
Fiber	15,542	84.2	19,505	82.3	+4.6
Bottle	2,307	12.5	3,200	13.5	+6.8
Film	425	2.3	711	3.0	+10.8
Other	185	1.0	284	1.2	+9.0
Total	18,458	100	23,700	100	+5.1

Source: CICCC, Beijing / China

**Fig. 23**

**Global R-PET consumption 2008**

[million tons; %]

Region	million tons	end-use
PR China	1.4	80 % fibers/tapes
India	0.1	87 % fibers/tapes
Japan	0.2	55 % fibers/tapes
EU	0,6	60 % fibers/tapes
North America	0.5	44 % fibers/tapes
Others	0.5	n.a.
Total	3.3	+4%/year

Source: Maack Business Services, Zürich / CH

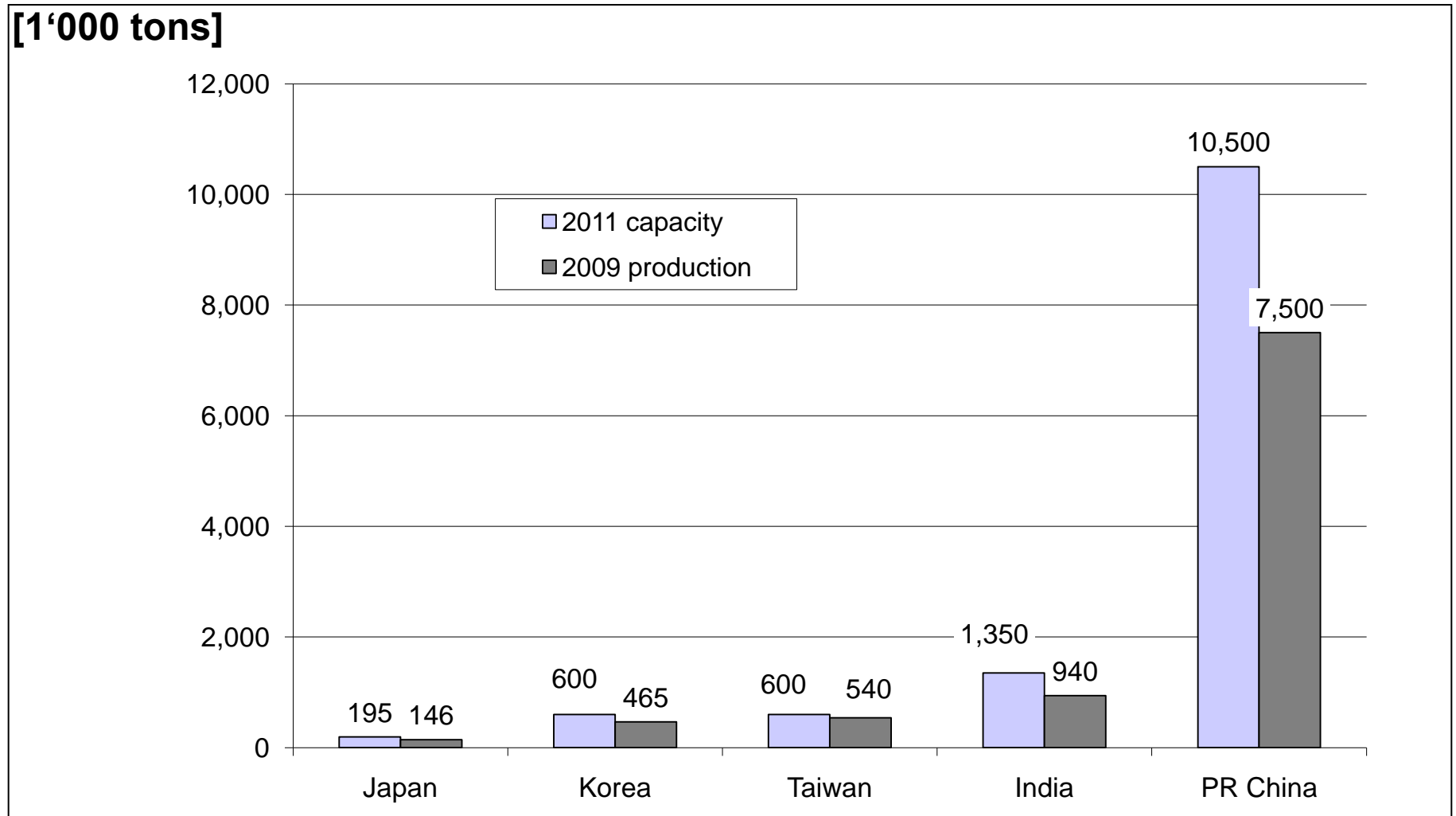
**Fig. 24****Application of recycled PET: North America & EU**

[1'000 tons]	EU: application of recycled PET (1000 tons)			
	2000	2005	2008	2010
Fibers	136	265	305	336
Food package bottles	10	42	46	49
Non-food package bottles	2	10	13	17
Brakes	20	55	64	70
Plastic metal straps	12	47	55	61
Engineering plastics	3	7	17	22
Polyols	-	4	19	20
Chemical recycling & other applications	-	22	102	118
<b>Total</b>	<b>183</b>	<b>453</b>	<b>620</b>	<b>692</b>
	North America: application of recycled PET (1000 tons)			
	2000	2005	2008	2010
Fibers	219	241	228	263
Food package bottles	25	94	129	139
Non-food package bottles	18	14	17	30
Brakes	37	36	43	47
Plastic metal straps	52	55	76	82
Engineering plastics	14	5	7	14
Others/polyols	3	8	12	15
<b>Total</b>	<b>368</b>	<b>452</b>	<b>512</b>	<b>590</b>

Source: PCI

**Fig. 25**

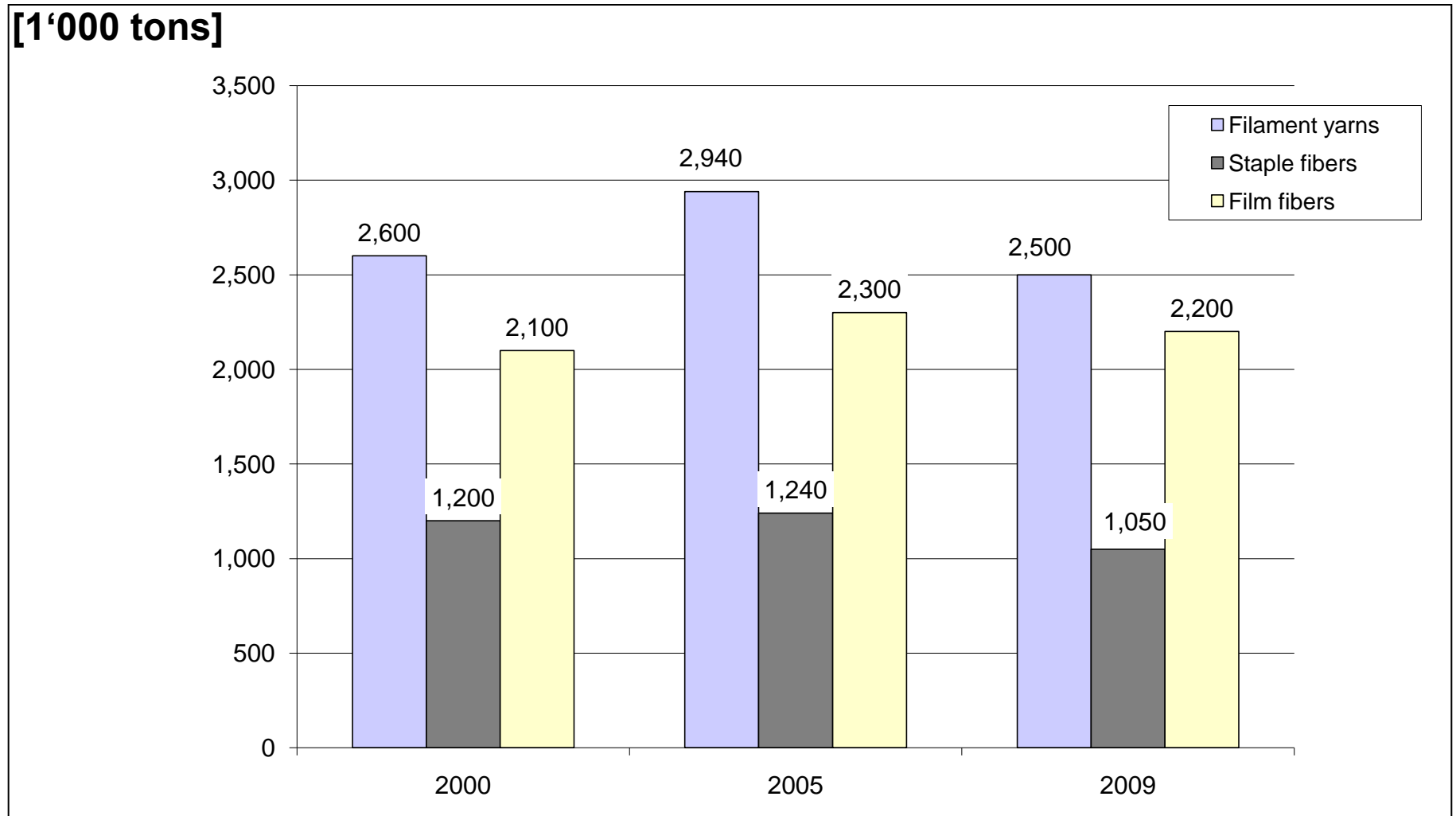
**PET staple fiber production 2009 and capacity 2011 in Asian countries**



Source: Fiber Organon / USA

**Fig. 26**

**Global production of PP fibers**



Source: Fiber Organon / USA

# Fig. 27

## Greater Europe: PP, polyolefins

[1'000 tons; %]

### Consumption of textile polyolefins

	2008	2009	±%
Staple fibers	502	430	-14
Multifilament yarns	438	395	-10
Monofilaments	53	62	+17
Spunbonds/MB	632	655	+4
Tapes	550	490	-11
Strapping	110	103	-6
Other	28	20	-29
<b>Total</b>	<b>2,313</b>	<b>2,155</b>	<b>-7</b>

### Production of PP multifilament yarns

	2007	2008	2009	08/09 ±%
Western Europe	284	242	231	-5
Eastern Europe (CEEC)	19	19	17	-10
Turkey	210	180	173	-4
<b>Total</b>	<b>513</b>	<b>441</b>	<b>421</b>	<b>-5</b>

### PP staple fiber production

	2007	2008	2009	08/09 ±%
Western Europe	469	432	398	-8
Eastern Europe (CEEC)	54	54	50	-7
Turkey	35	32	32	±0
<b>Total</b>				

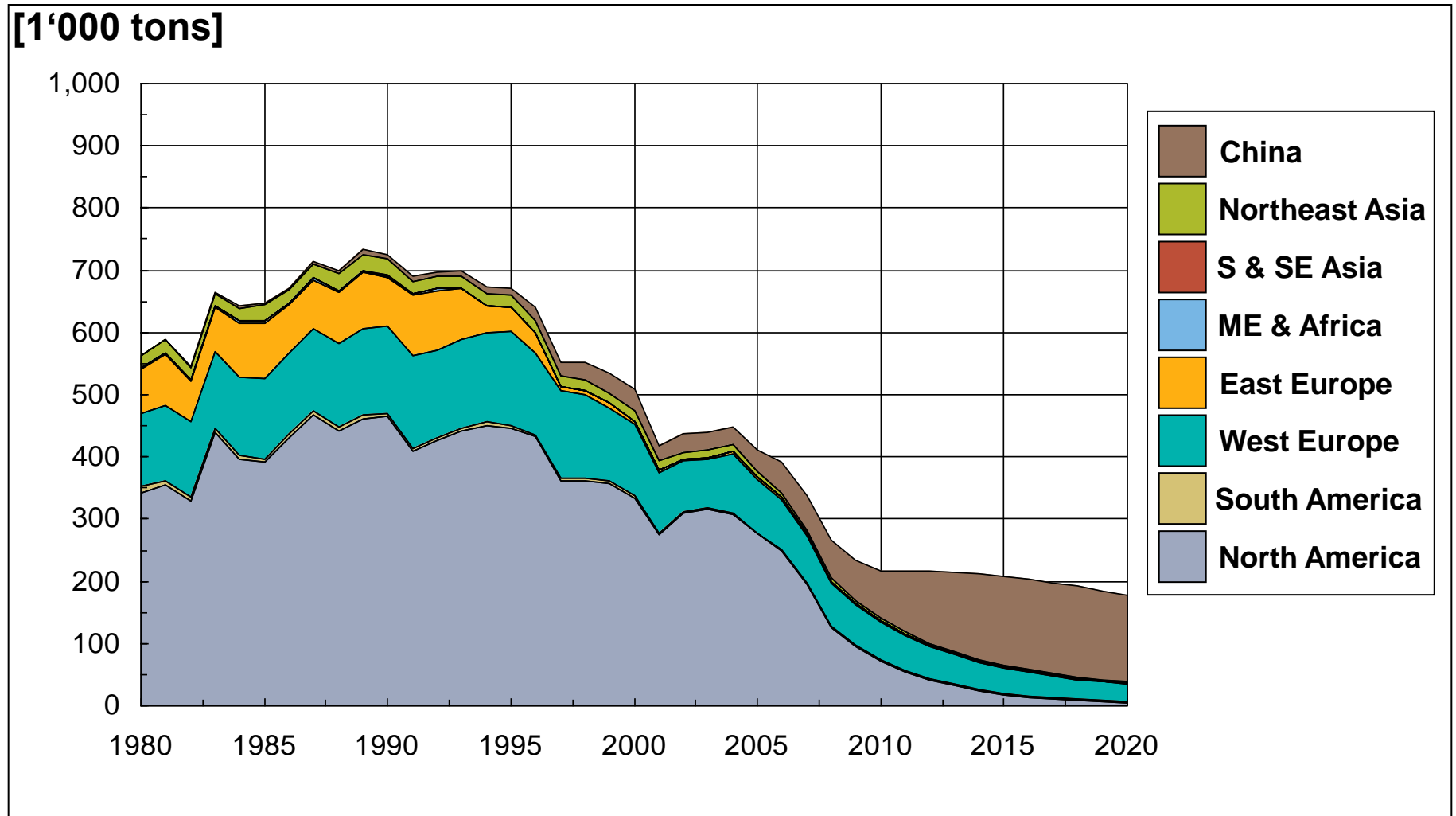
### Capacity for PP spunbonds

	2008	2009	2010	09/10 ±%
Western Europe	575	675	707	+5
Eastern Europe (CEEC)	87	87	102	+17
Turkey	71	71	82	+15
<b>Total</b>	<b>733</b>	<b>833</b>	<b>891</b>	<b>+7</b>

Source: EATP / Brussels, Belgium

**Fig. 28**

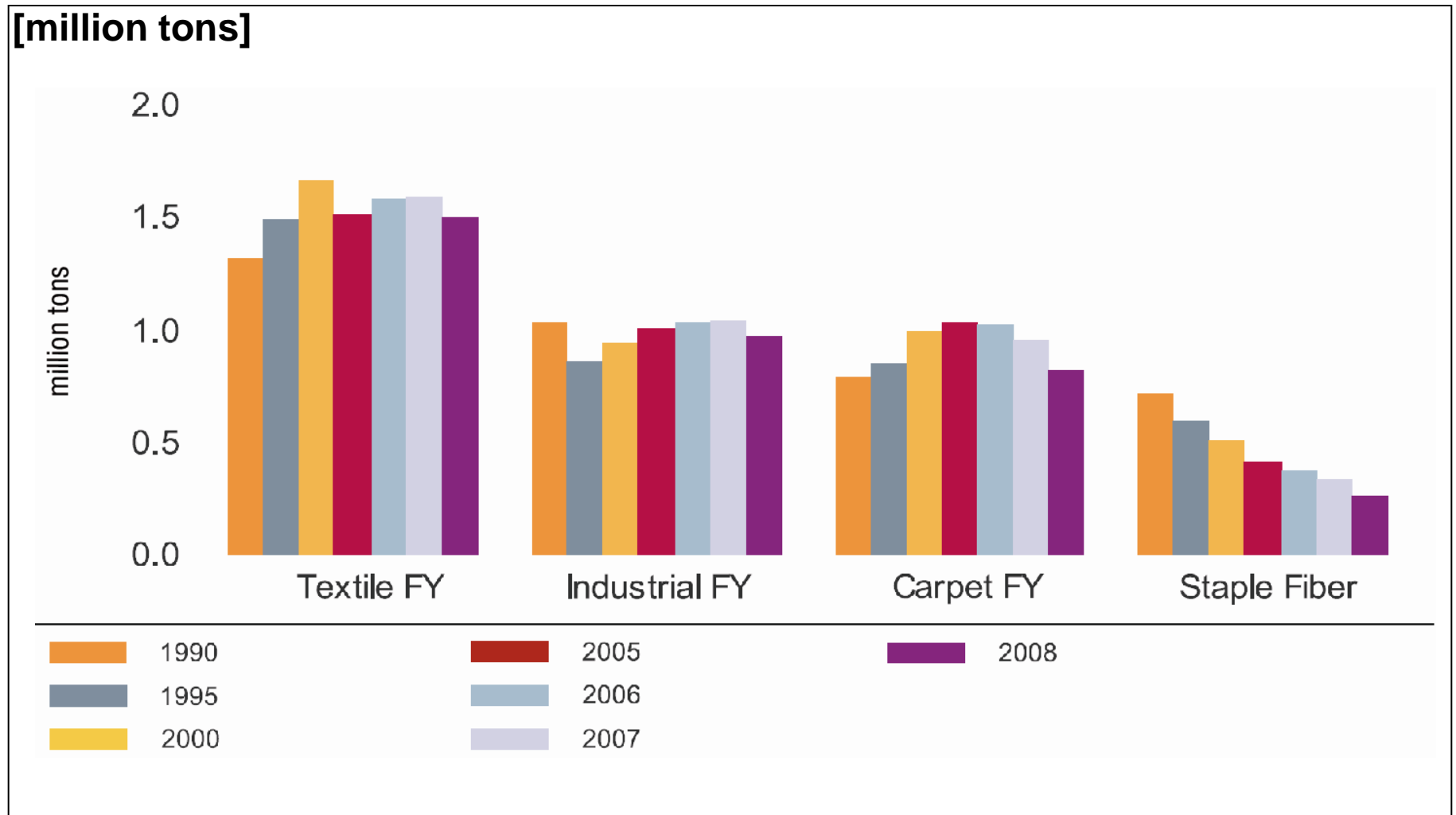
**World polyamide staple production**



Source: Tecnon OrbiChem

**Fig. 29**

**Global PA fiber production**

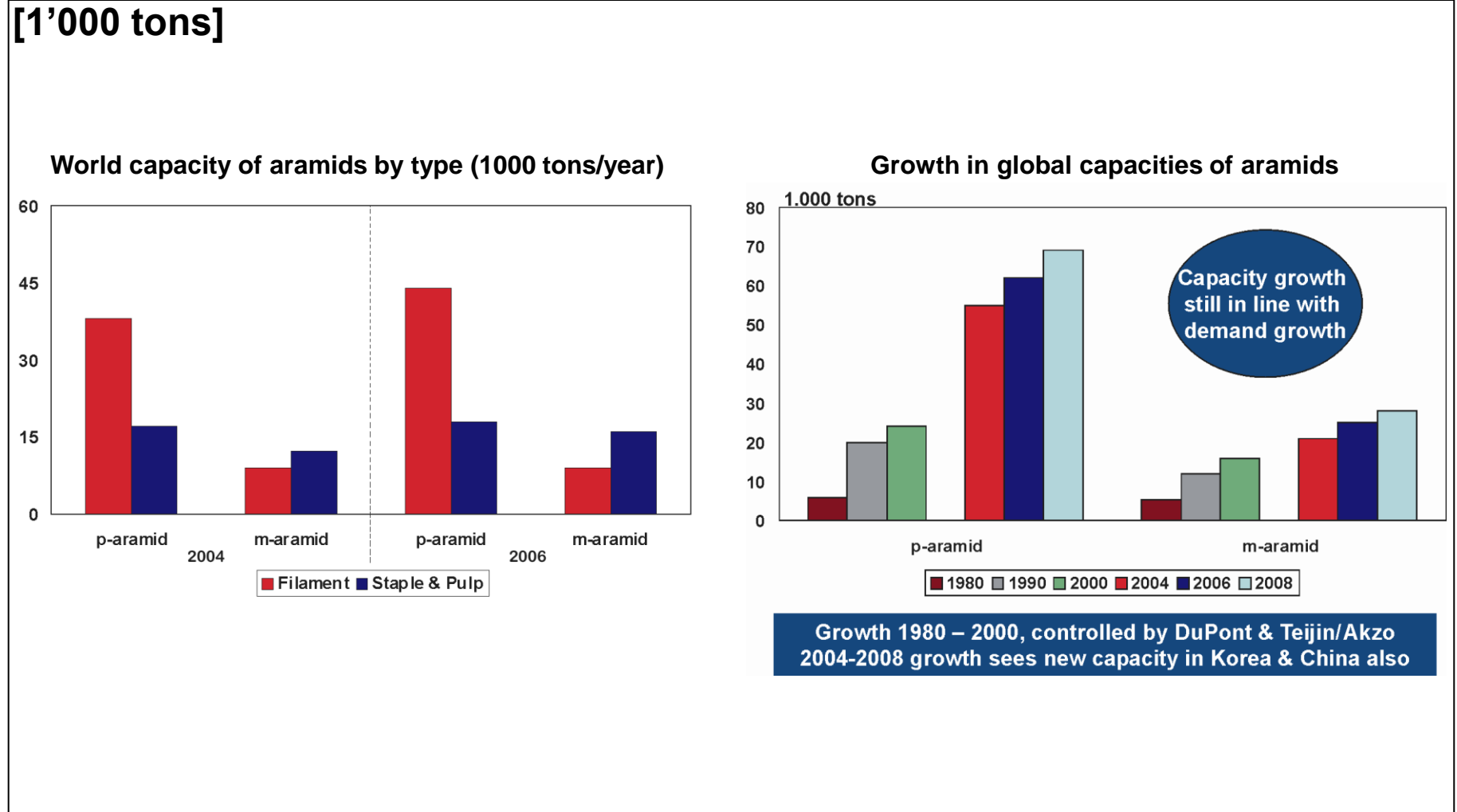


Source: Oerlikon Textile / Switzerland



# Fig. 30

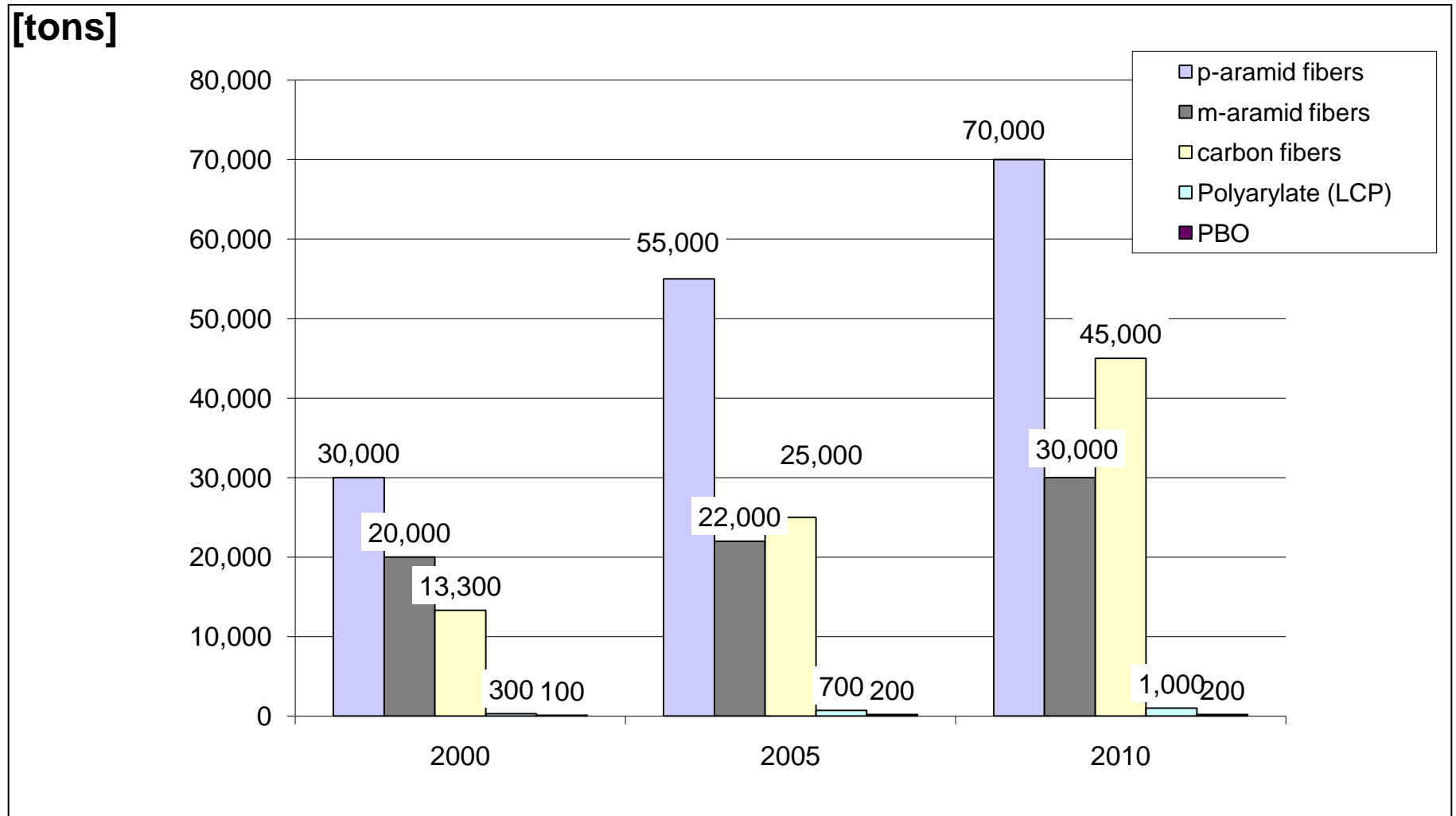
## World capacity of aramids



Source: PCI Fibres

**Fig. 31**

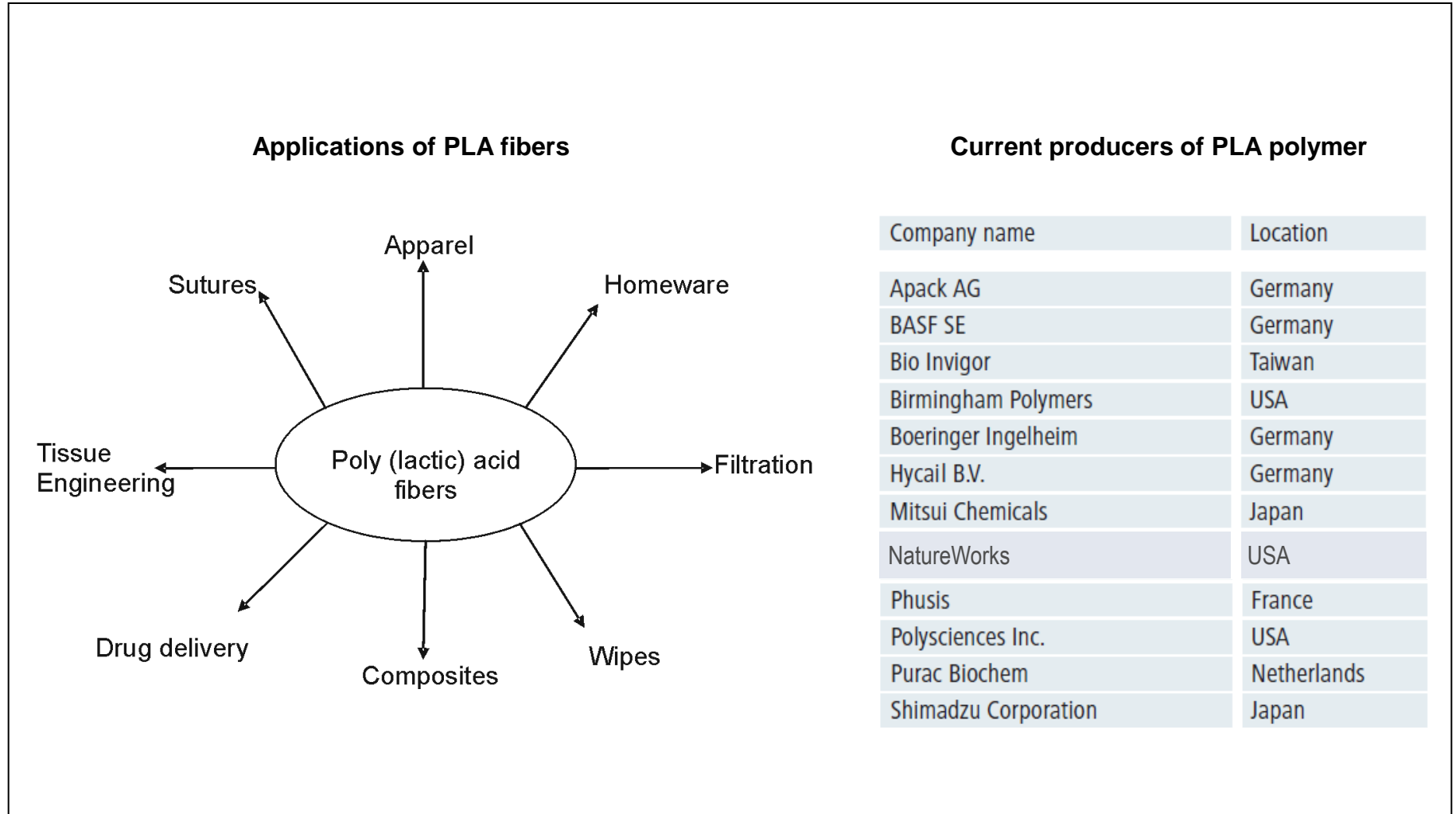
**Global production of high performance fibers**



Source: PCI Fibres

**Fig. 32**

**PLA fibers: Applications & producers**



# Fig. 33

## Global PAN-based carbon fiber capacities

[tons]


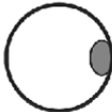
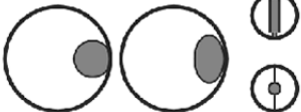
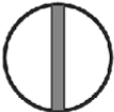








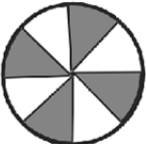

Company	Trademark	2008	2009	2010	2011
<b>Toray Group</b>	<b>Torayea</b>	<b>17,900</b>	<b>18,900</b>	<b>18,900</b>	<b>18,900</b>
Japan		7,300	8,300	8,300	8,300
USA		5,200	5,200	5,200	5,200
France		5,400	5,400	5,400	5,400
<b>Toho Tenax</b>	<b>Tenax</b>	<b>11,800</b>	<b>13,500</b>	<b>13,500</b>	<b>13,500</b>
Japan		6,400	6,400	6,400	6,400
Germany		3,400	5,100	5,100	5,100
USA		2,000	2,000	2,000	2,000
<b>Zoltek Group</b>	<b>Panex</b>	<b>11,000</b>	<b>13,000</b>	<b>13,000</b>	<b>13,000</b>
Europe		8,000	8,000	8,000	8,000
USA		3,000	3,000	3,000	3,000
Mexico		0	2,000	2,000	2,000
<b>Mitsubishi Rayon</b>		<b>8,100</b>	<b>8,100</b>	<b>8,100</b>	<b>8,100</b>
Japan	Pyrofil	5,400	5,400	5,400	8,100
USA	Grafil	2,200	2,200	2,200	2,200
Europe		500	500	500	500
<b>Formosa Plastics Group</b>	<b>Taiyfil</b>	<b>6,150</b>	<b>6,150</b>	<b>7,450</b>	<b>7,450<sup>1)</sup></b>
<b>SGL Group</b>	<b>Sigrafil</b>	<b>3,700</b>	<b>6,000</b>	<b>6,000</b>	<b>6,000</b>
Europe		2,700	4,000	4,000	4,000
USA		1,000	2,000	2,000	2,000
<b>Hexcel</b>	<b>HexTow</b>	<b>3,900</b>	<b>4,750</b>	<b>4,750</b>	<b>5,300</b>
USA		3,250	4,100	4,100	4,650
Spain		650	650	650	650
<b>Cytec</b>	<b>Thornel</b>	<b>2,000</b>	<b>2,000</b>	<b>3,000</b>	<b>3,000</b>
USA					
<b>Dalton Carbon Fiber</b>		<b>360</b>	<b>360</b>	<b>760</b>	<b>1,760</b>
China					
<b>Aksa</b>	<b>Aksa</b>	<b>0</b>	<b>750</b>	<b>1,500</b>	<b>1,500</b>
Turkey					
<b>Total</b>		<b>64,910</b>	<b>73,510</b>	<b>76,960</b>	<b>81,210</b>

1) 2012: 8,750 tons

Source: JEC Composites Magazine, April 2010

**Fig. 34**

**Bicomponent Fibers**

Family	Bicomponent Fibers Variants					
Side-by-Side	 50/50	 20/80	 Different viscosities	 ABA	 Trilobal	 Conductive
Core/Sheath	 50/50	 90/10	 Eccentric	 Trilobal	 Conductive	
	Islands-in-the-sea		 Islands-in-the-sea			
Matrix/Fibril	Segmented-Pie / Multi-Layer		 Segmented-Pie	 Mulit-Layer		

Source: Technical Textiles

# Fig. 35

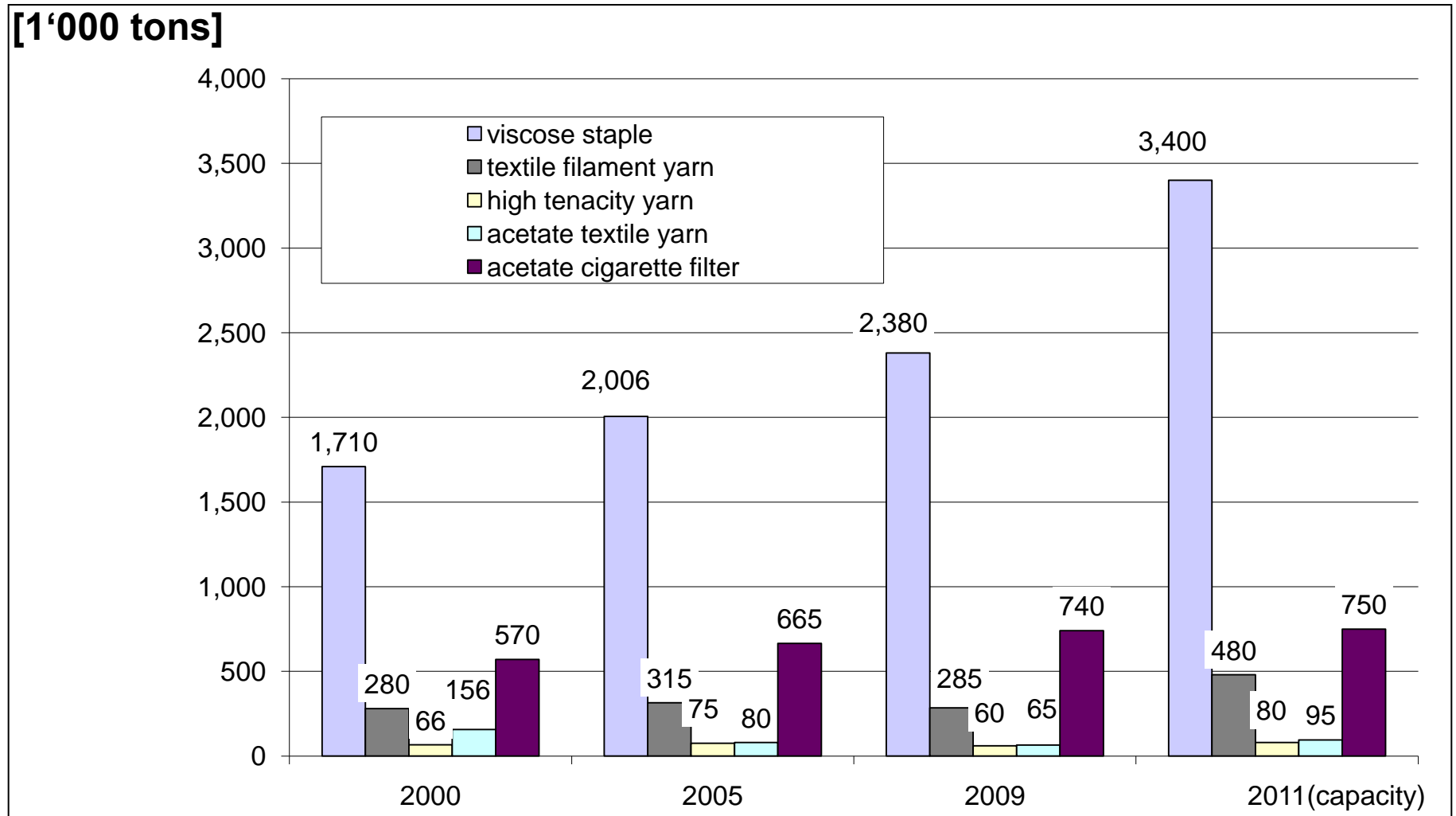
## Producers of high-performance synthetic fibers 2010

Firma/Land	Lieferform	Marke	Firma/Land	Lieferform	Marke
<b>Aramidfasern</b>			<b>PEEK-Fasern</b>		
DuPont/USA	St	Nomex	Zyex Ltd./UK	F, St, M	Zyex
	F	Kevlar	Shakespeare Monofilament/UK	M	n.a.
DuPont/UK	F	Kevlar	Shakespeare Monofilaments/USA	M	n.a.
DuPont/E	St	Nomex	Luxilon Industries/B	M	n.a.
DuPont-Toray/J	F	Kevlar	Zeus/USA	F, St	n.a.
Teijin Aramid/NL	F	Twaron	<b>PEI-Fasern</b>		
Teijin Aramid/J	F	Technora	Fiber Innovation Technologies/USA	F, St	Ultren Ultem
	St	Teijinconex	<b>LCP-Fasern (Polyarylatfasern)</b>		
Kermel/F	St	Kermel	Kuraray/J	F	Vectran
Guandong Charming/China	St	n.a.	<b>Polyacrylatfasern</b>		
Yantai Spandex/China	St	Newstar	Technical Absorbents/UK	St	Oasis
Hyosung /Korea	F	Alkex	<b>Polyimidfasern</b>		
Kolon Industries/Korea	F	Heracron	Evonik Fibres/A	F, St	P84
Kamenskvolokno/Russia	St	n.a.	<b>Polystyrolfasern</b>		
<b>Fluor-Fasern</b>			Specialty Filaments/USA	M	n.a.
Lenzing/A	St, F	Lenzing Profilen	<b>PSA-Fasern</b>		
Gore/D	F	Gore	Shanghai Tanlon Fiber/China	F, St	Tanlon
Toray Fluorofibers/USA	F, St	Teflon	<b>PPS-Fasern</b>		
<b>Elastolefin/Lastol-Fasern</b>			Ems-Chemie (Neumünster)/D	St	Nexylene
Dow Fiber Solutions/E	F	Dow XLA	High Performance Polyester/D	F	Diofort
Toyobo/J	F	Dow XLA	Teijin Monofilament Germany/D	M	n.a.
<b>Melamin-Fasern</b>			Toray Industries/J	F, St	Toray PPS
Basofil Fibers/USA	F	Basofil	Shakespeare Monofilament/USA	M	n.a.
<b>PBI-Fasern</b>			Shakespeare Monofilament/UK	M	n.a.
PBI Performance Products/USA	F, St	PBI Gold	Teijin Monofilament/USA	M	n.a.
		PBI Matrix	Glassmaster/USA	M	n.a.
Giangsu Huaya Group/China	St	n.a.	<b>PBO-Fasern</b>		
<b>PBO-Fasern</b>			F = Filamentgarn, St = Stapelfaser, M = Monofilament, n.a. = nicht verfügbar		
Toyobo/J	F, St	Zylon			

Source: Technische Textilien

**Fig. 36**

**Global production of cellulosic fibers (excluding lyocell fibers)**



Source: Fiber Organon / USA

# Fig. 37

## Global cellulosic fiber production<sup>1)</sup> 2009

	Staple		Textile yarns <sup>2)</sup>		Technical yarns		Acetate yarns	
	1,000 tons	± %	1,000 tons	± %	1,000 tons	± %	1,000 tons	± %
Western Europe	330	-9	10	-20	35	-11	6	-33
Eastern Europe	-	-	10	+6	8	-7	6	+7
USA	-	-	-	-	-	-	17	-25
Latin America	30	+96	-	-	-	-	2	0
PR China	1,191	+19	211	+2	-	-	-	-
India	276	+13	43	-6	9	-27	-	-
Indonesia	295	+5	-	-	-	-	-	-
Taiwan	115	+9	-	-	-	-	-	-
Japan	36	-9	12	-23	-	-	6	-54
Thailand	104	+30	-	-	-	-	-	-
Korea	-	-	-	-	-	-	6	-30
Iraq	5	+17	-	-	-	-	-	-
<b>TOTAL</b>	<b>2,382</b>	<b>+12</b>	<b>285</b>	<b>-1</b>	<b>52</b>	<b>-14</b>	<b>43</b>	<b>-30</b>

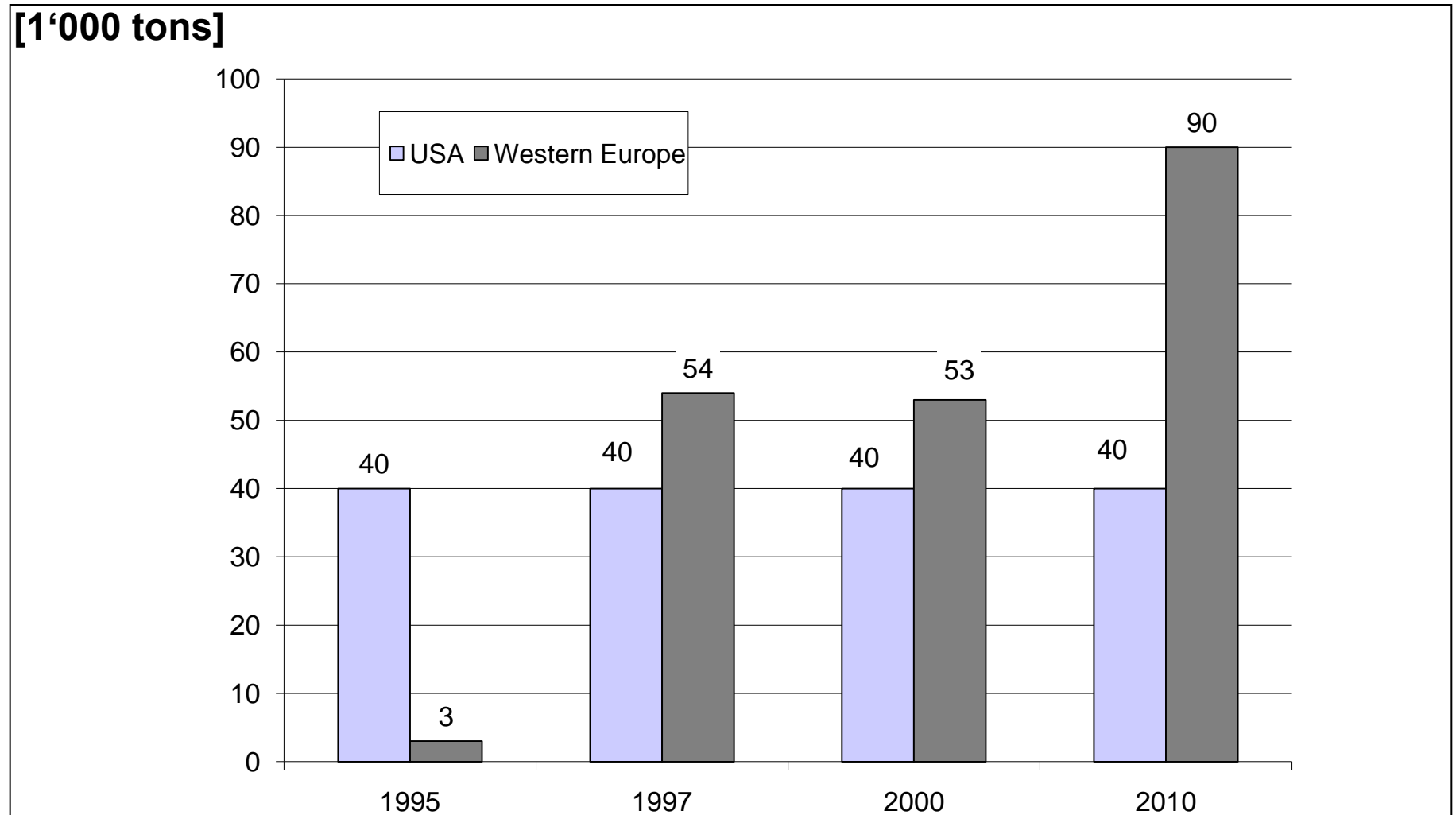
1) excluding lyocell fibers

2) including cupro yarns



**Fig. 38**

**Global capacity of lyocell fibers**



Source: CFI

**Fig. 39****PR China: production of chemical fibers 2009****[1'000 tons; %]**

	2009	
	1'000 tons	±%
<b>Synthetics</b>		
PET filament yarns	13,462	+6.8
PET staple fibers	7,488	+5.2
PA filament yarns	1,157	+7.2
PA staple fibers	69	+4.1
Acrylic fibers	684	+23.5
PP filament yarns	507	+1.6
PP staple fibers	84	+3.7
PP film fibers	428	+2.6
Other synthetics	289	+2.9
<b>Cellulosics</b>		
Staple fibers	1,191	+18.9
Filament yarns	211	+2.4
Acetate filter tow	115	-0.9
<b>Total</b>	<b>25,685</b>	<b>+5.5</b>

Source: Fiber Organon / USA