ANFA Nonwoven conference 2019

PPS Trilobal Fiber for Bag Filter Application

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November, 8th, 2019

Corporate Profile

As of March 31 ,2019

Company name	TOYOBO CO., LTD.
Established	May 1882 : Establishment of *Osaka Boseki*
Incorporated	June 1914 : Start of Toyobo, merger between *Mie Boseki* and *Osaka Boseki*
Capital stock	\ 51.7 billion
Head Office	2-2-8, Dojima Hama, Kita-ku, Osaka, Japan
Number of Employees	9,572 (consolidated) 3,092 (Nonconsolidated)
URL	https://www.toyobo-global.com/

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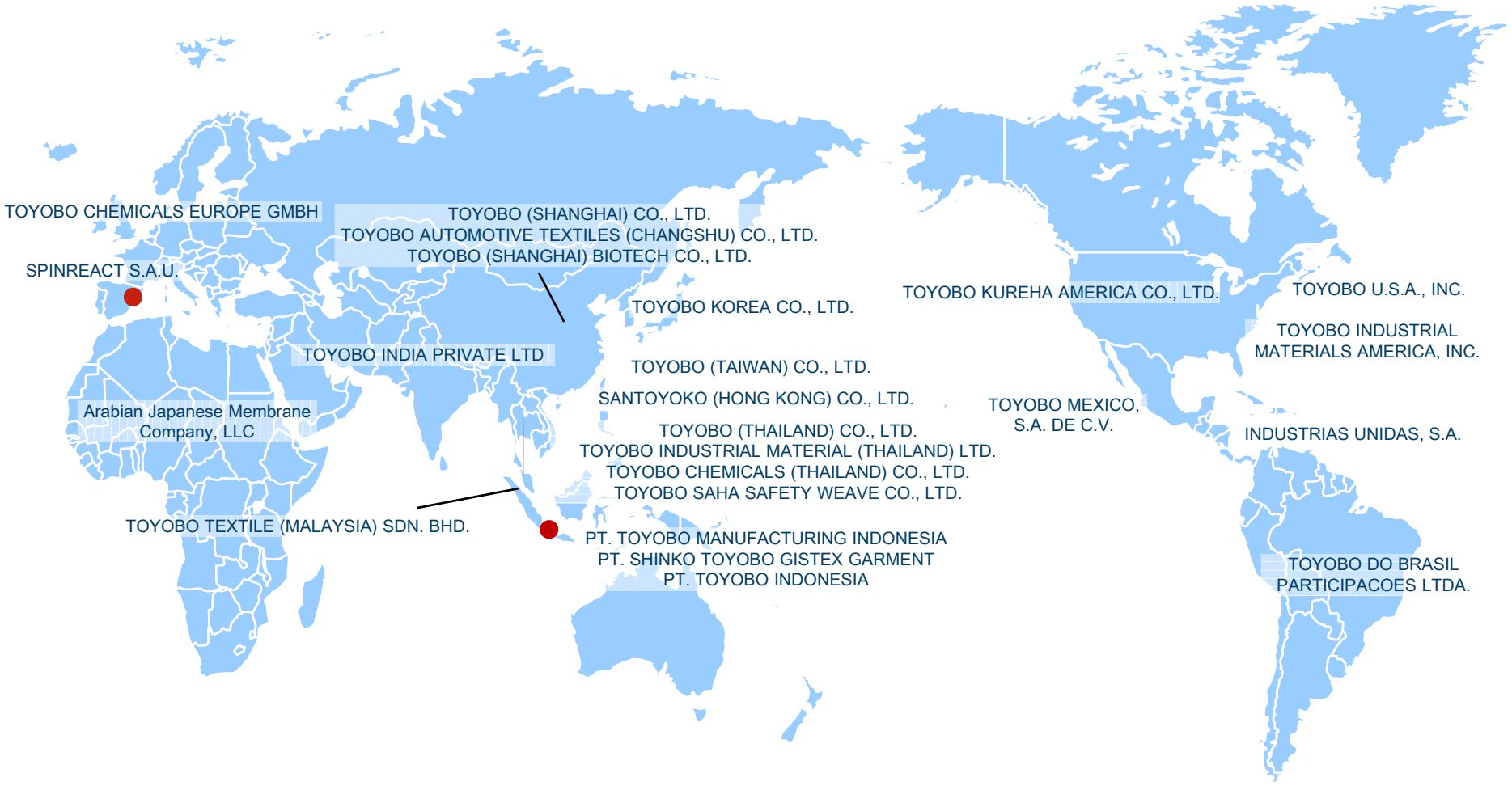
Bases for Marketing and Sales, Group Manufactures



Business Segments

Films &
Functional Polymers

Industrial Materials

Textiles & Trading

Healthcare

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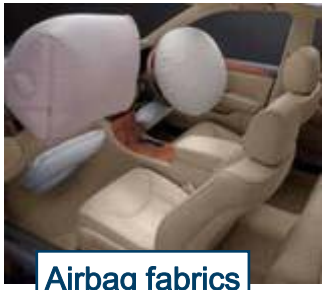
Industrial Materials

Airbag



Airbag fabrics

High Performance Fibers

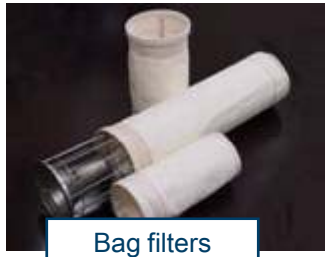
Ultra-high-strength polyethylene

“IZANAS”

PBO fiber

“ZYLON”

Life and Industrial Materials



Bag filters

“PROCON®”

3D spring-structured fiber

“BREATHAIR”

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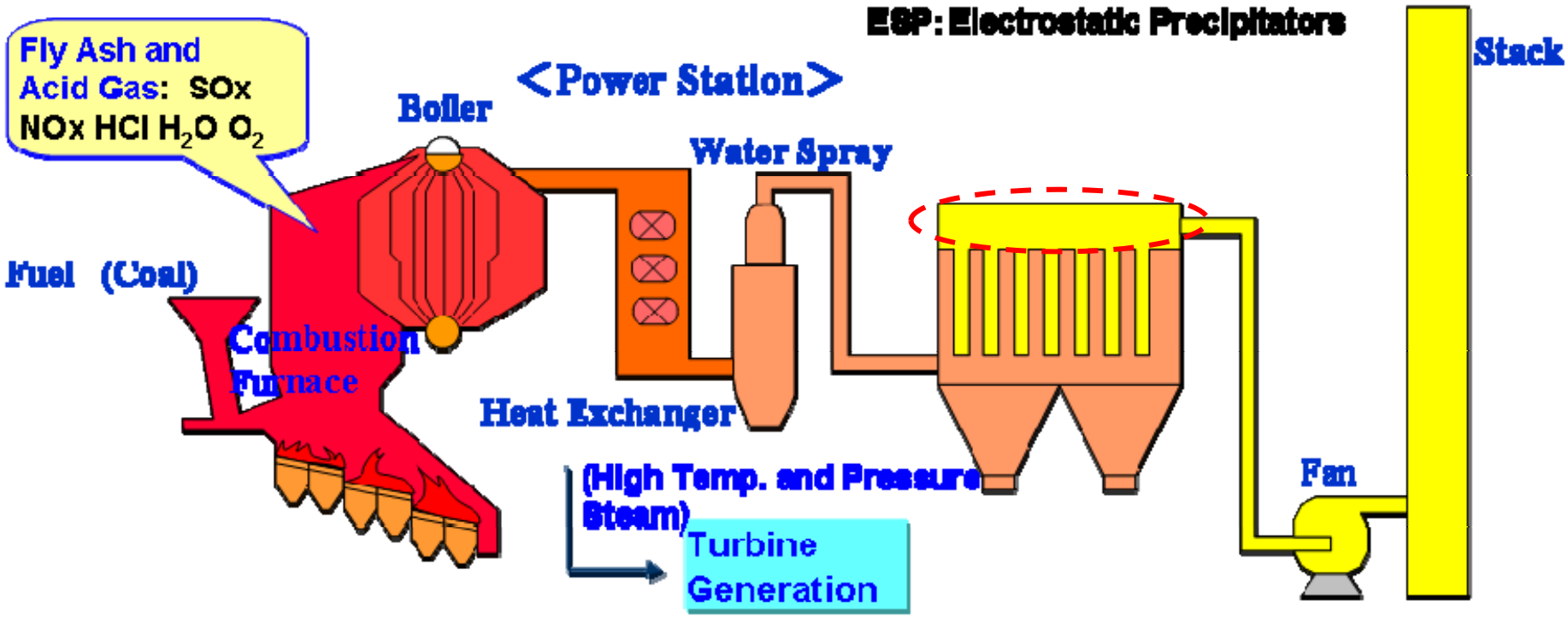
Filter bags for pulse-jet systems
Dust collector examples for coal fired power stations



Dust collector

ESP or Filter Bags

＜South Africa CFB Power Station＞

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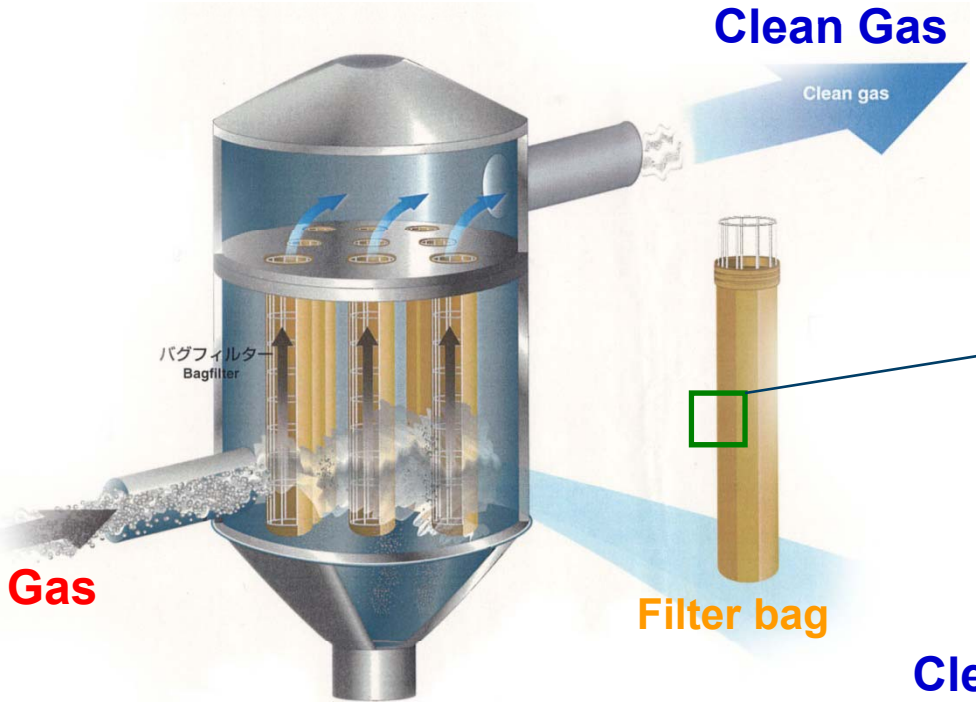
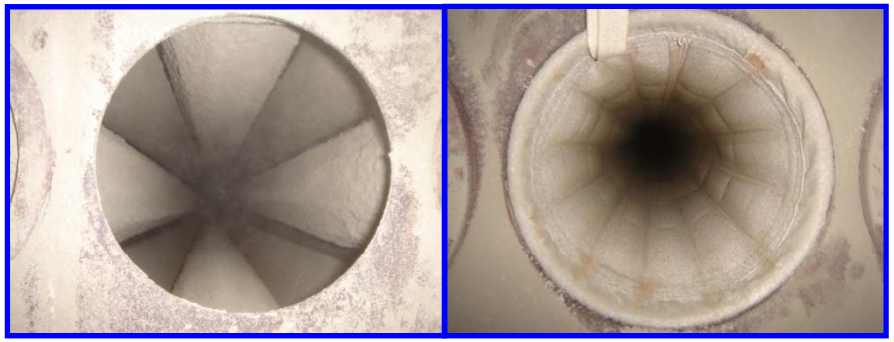
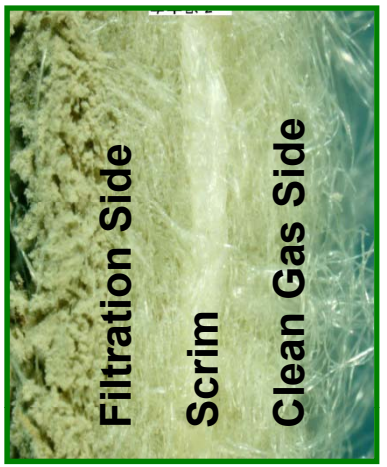
Filter bags for pulse-jet systems
Cake layer



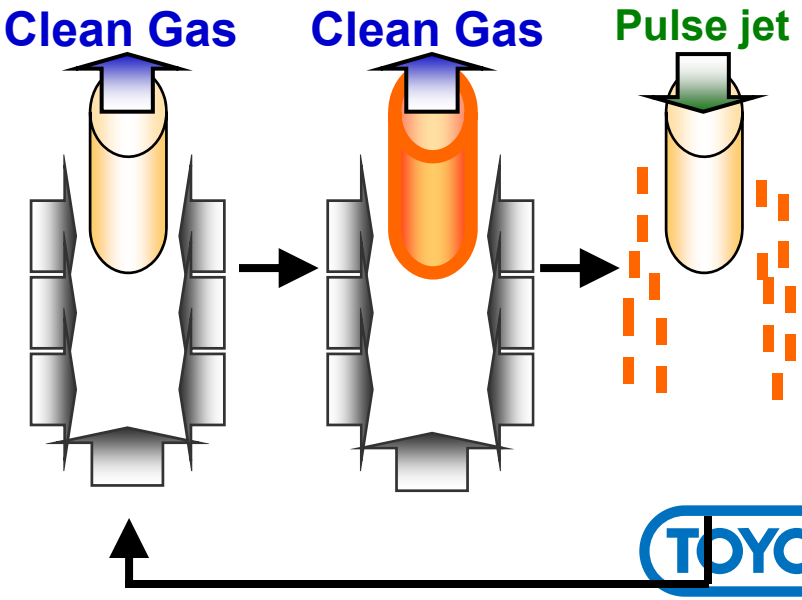
<Pulse-Jet Filtration>



< Top of PPS Bag Filter>



< PPS Filter Bag : Cross Section >



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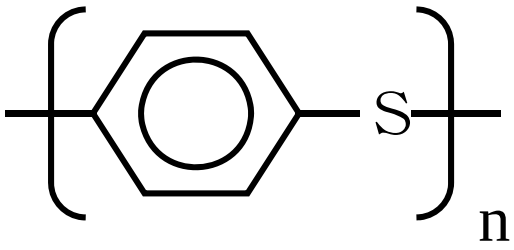
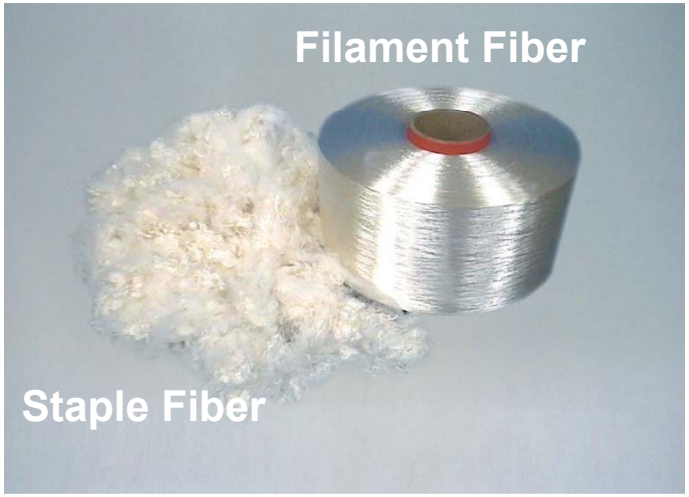
PPS Fiber

PPS



<Poly-p-phenylene sulfide>

＜PPS　Fiber＞



It is a material formed only from the Benzen ring and Surfido.

The combined energy of Phoenillen and Sruffid is large. And it is highly crystallized.

Therefore, this fiber is excellent in heat resistance and chemicals resistance.

There is little water dissolution.

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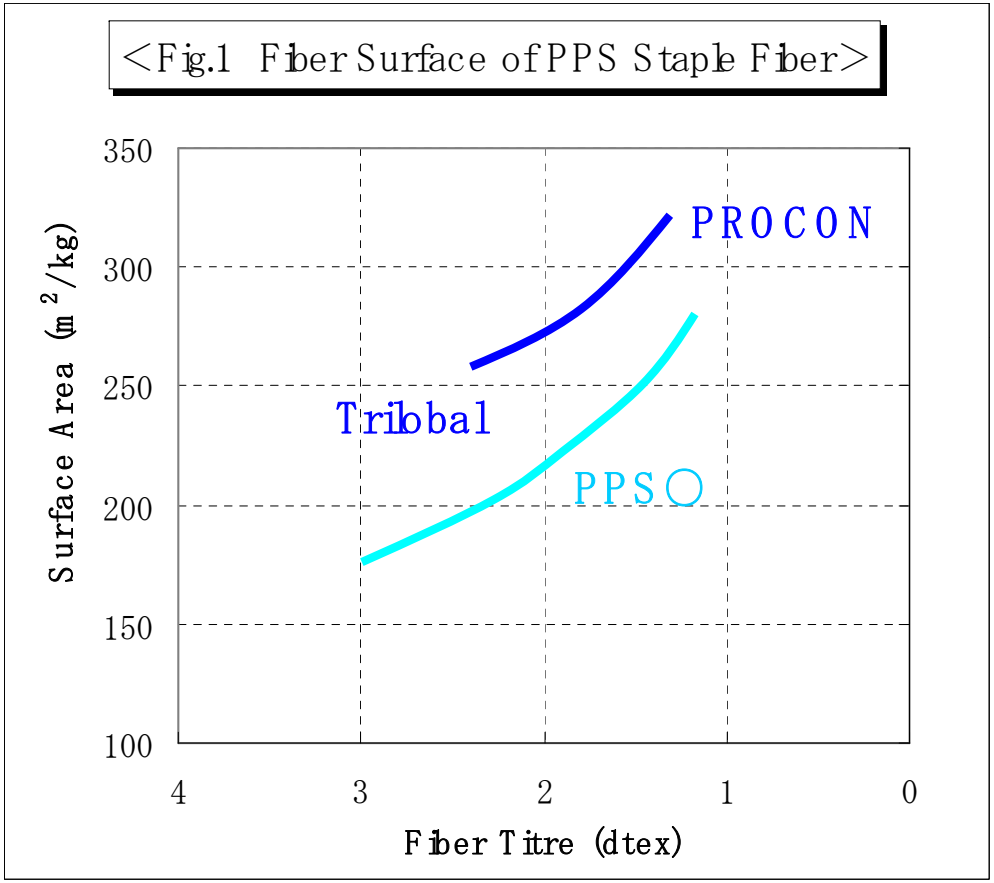
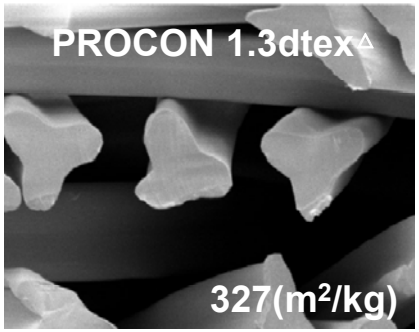
PROCON (PPS) 1.3 1.7 2.5dtex Trilobal

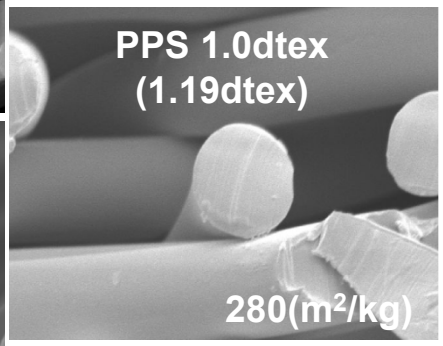


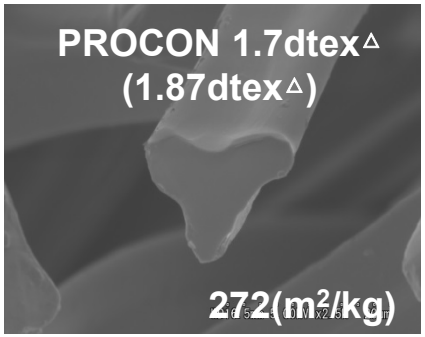
PROCON Trilobal Fiber has high surface area.

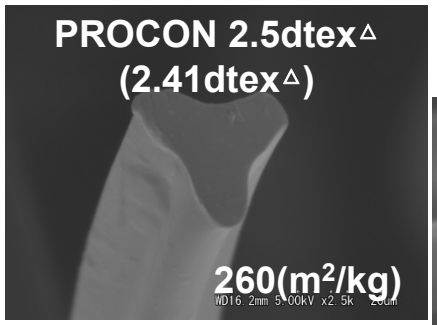
< TOYOBO > **< Regular PPS >**

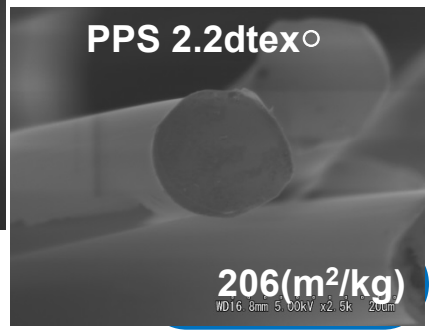
PROCON Trilobal



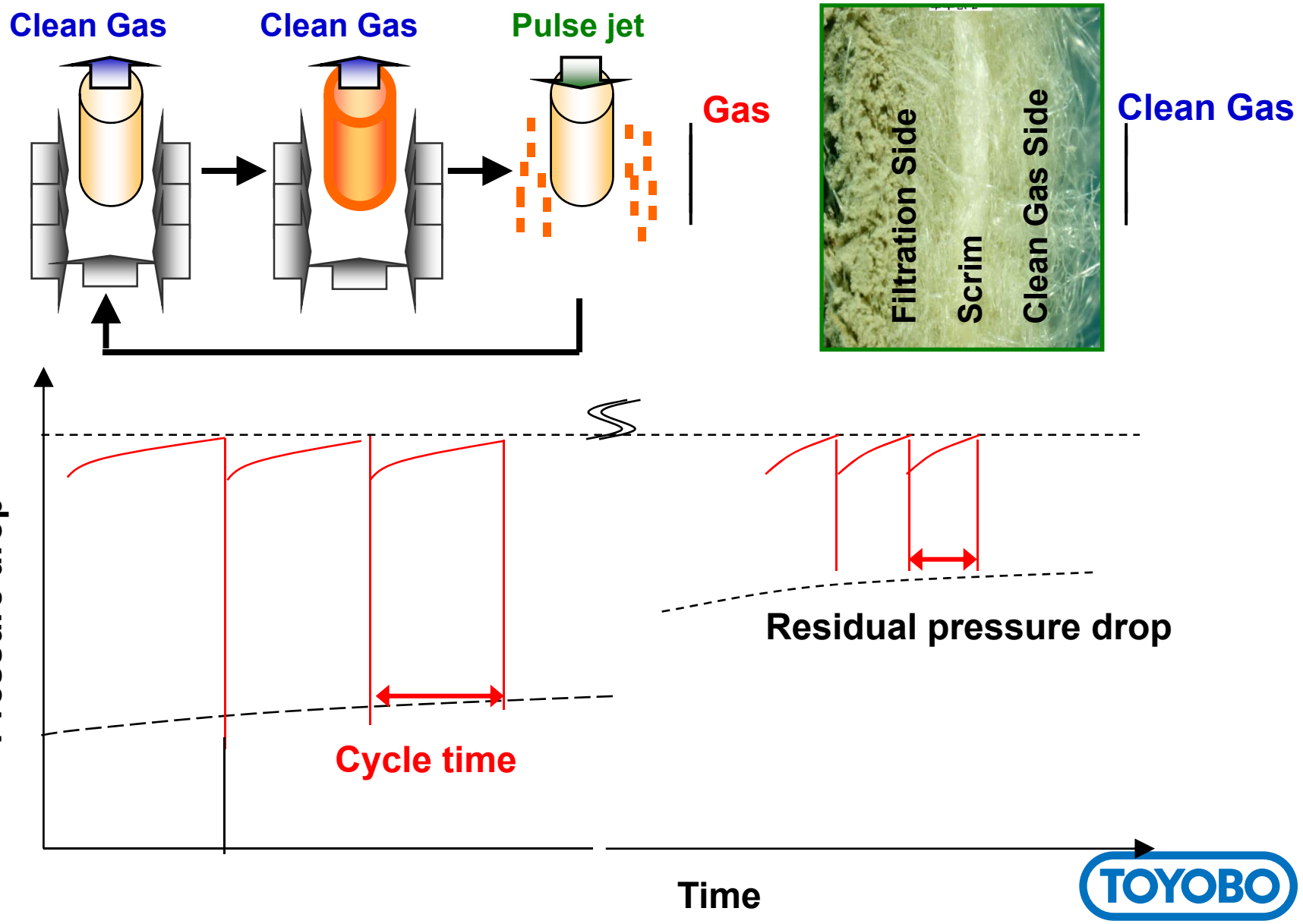








Filter bag for pulse-jet system
The residual pressure behavior of pulse-jet filtration



PPS Trilobal / VDI 3926 (ISO 11057) Result

< VDI Test Condition > Test Dust : 5g/m³(3.5μm, Pural NF)

A/C : 2m/min、 Temp. : 160℃

Number of cycles : 30+10,000(Ageing)+10(Stabillization)+2h(1,000Pa)

< TOYOBO Data (Relative Comparison) > Japanese Needlefelt Maker

Lab.Test Needle felt Samples	Weight (g/m²)	Thickness (mm)	Air Permeability (JIS) (cc/cm²·s)	Dust Emission (mg/m³)		Cycle time (sec)		Residual Pressure drop (Pa)	
				After 30 cycles 1,000Pa	Measuring 1,000Pa, 2h	After 30 cycles 1,000Pa	Measuring 1,000Pa, 2h	After 30 cycles 1,000Pa	Measuring 1,000Pa, 2h
PROCON 2.5T△ Trilobal-100%	580	1.88	9.1	1.15	0.28	662	185	102	431
PROCON 1.7T△ Trilobal-100%	578	1.92	6.9	0.94	0.11	583	275	125	342
PROCON 2.2T○ Round-100%	612	1.89	10.7	1.38	0.57	577	121	103	458

<EU Customer Data>

(l/dm² min at 2 mbar)

PROCON 2.5T△ Trilobal-100%	532	1.95	148	2.06	0.36	411	65	62	421
PROCON 2.2T Round-100%	553	1.74	136	2.32	1.00	392	47	76	467

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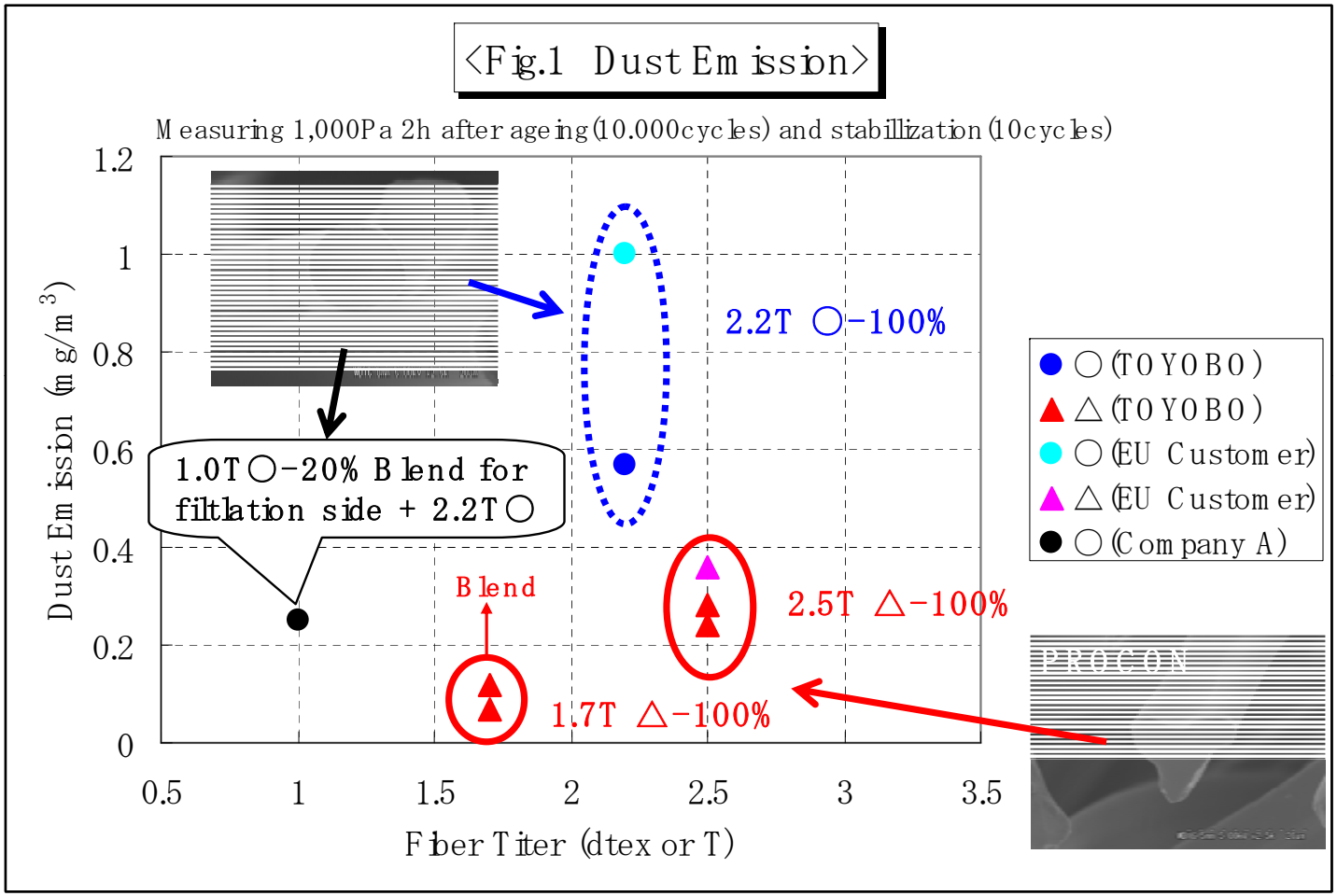
Dust Emission / VDI 3926 （ ISO 11057 ）



Trilobal showed the high filtration efficiency.

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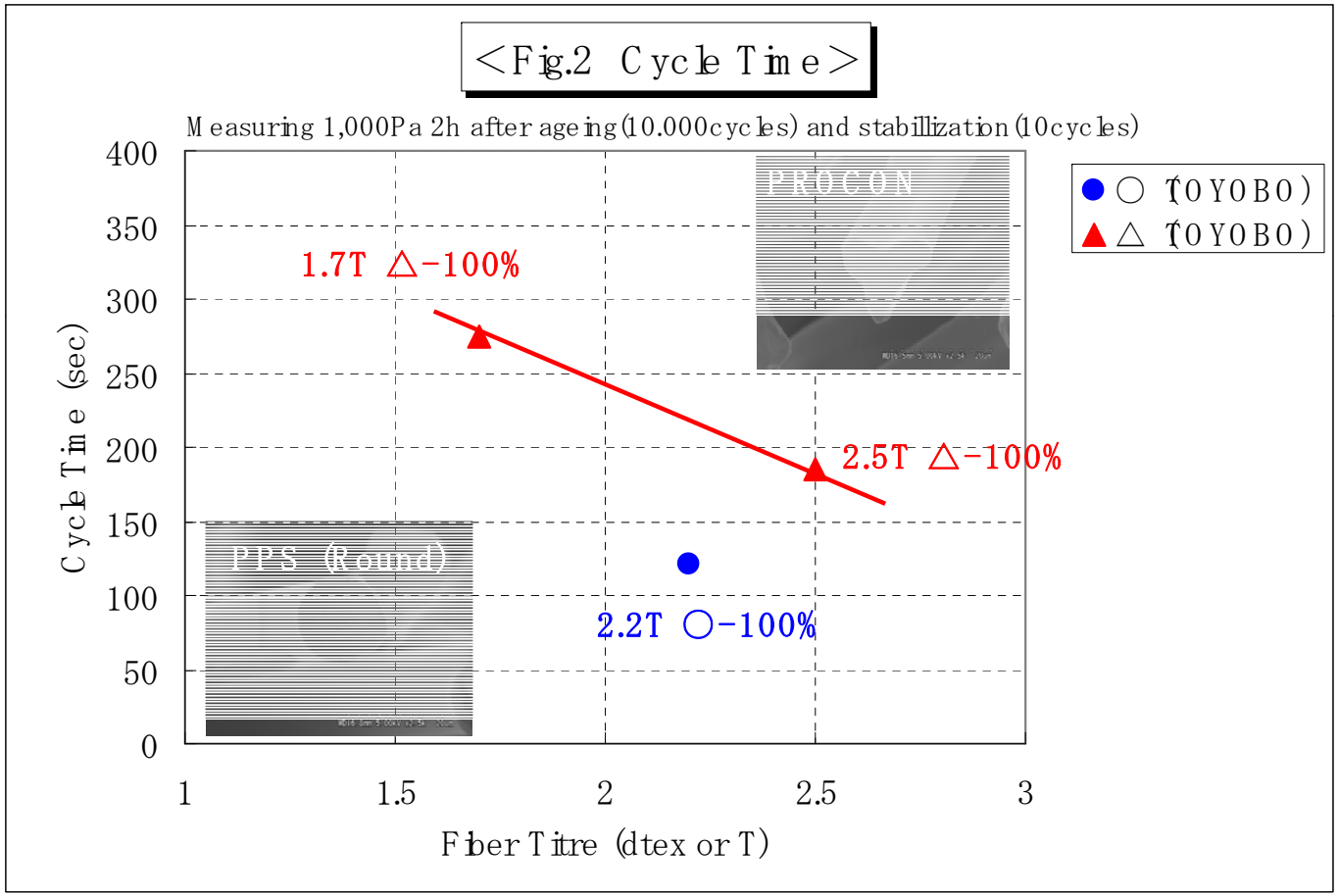
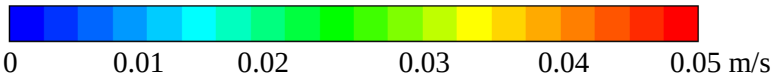
Cycle Time/ VDI 3926 （ ISO 11057 ）

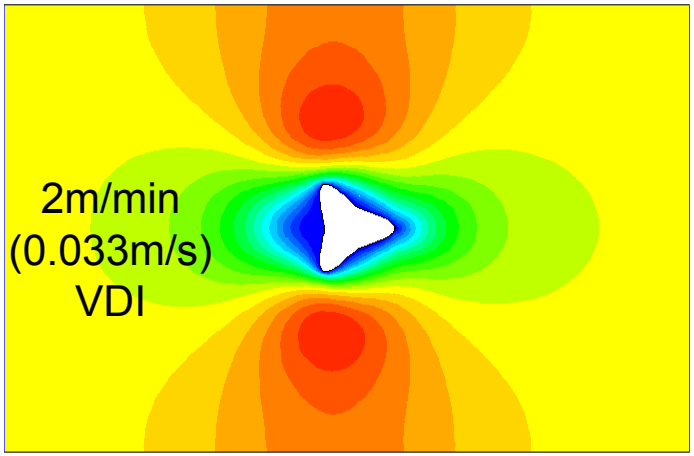


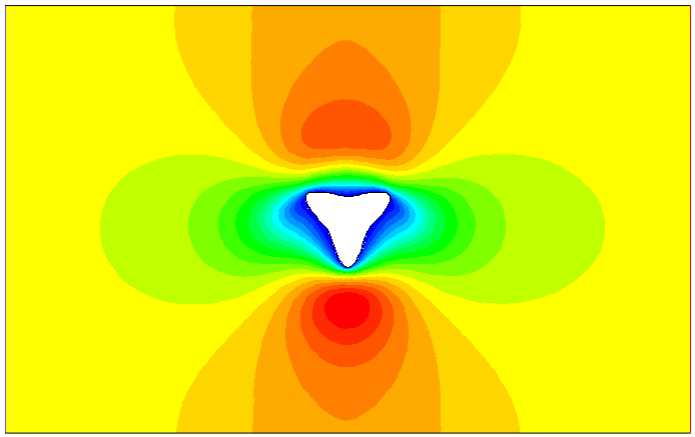
Simulation of flow velocity distribution

＊Software：Fluent 18.0(ANSYS/USA)
2 Dimensions Isothermal Steady-state Analysis

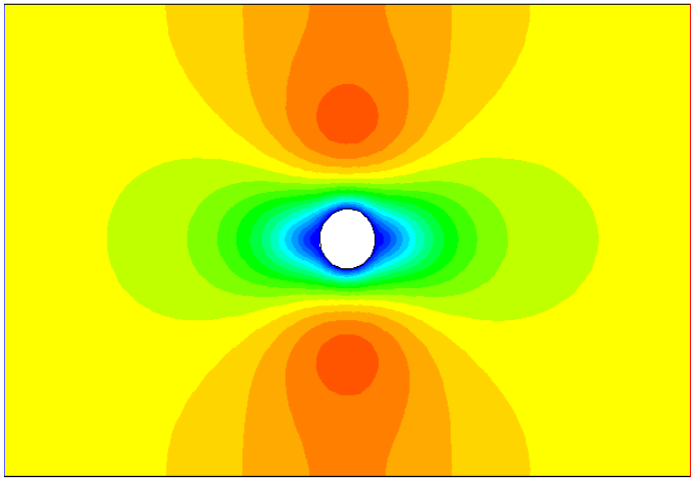


< Trilobal PPS (PROCON) >





< Round PPS (Regular) >



＜Velocity Down Area (Blue) without fiber＞

＜PROCON＞	(μm²)	＜Regular＞	(μm²)
1.3T Trilobal	360 (36%↑)	1.0T Round	232
1.7T Trilobal	431 (34%↑)	1.5T Round	285
2.5T Trilobal	515 (35%↑)	2.2T Round	333

＊ Blue Area：less than 0.015m/s (=0.9m/min)

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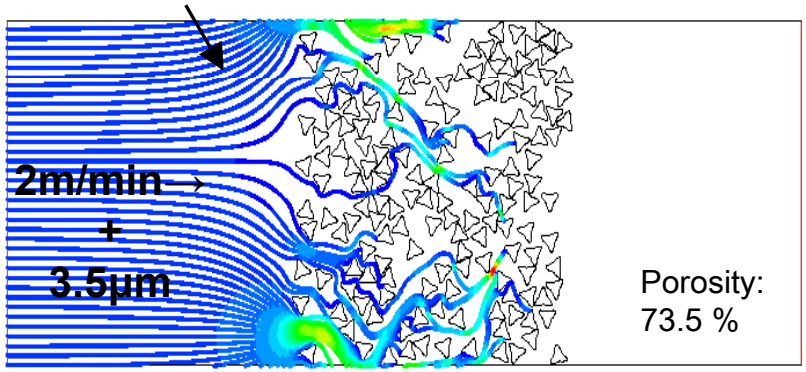
Simulation of Particle Collection

< Trilobal PPS >

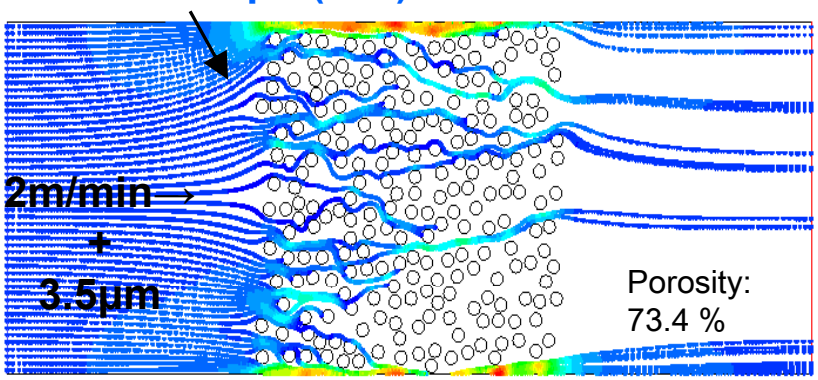
Particle:3.5μm(VDI)



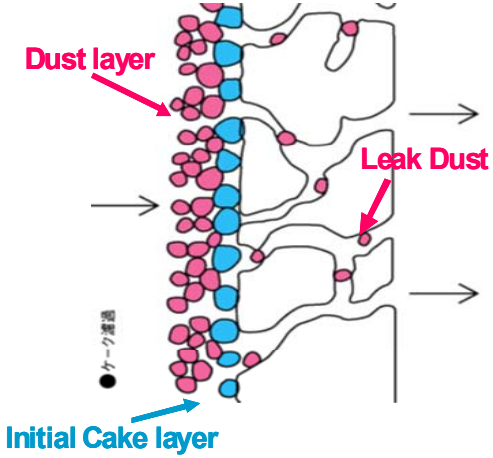
＊Random Configuration (Layout) (N=5)

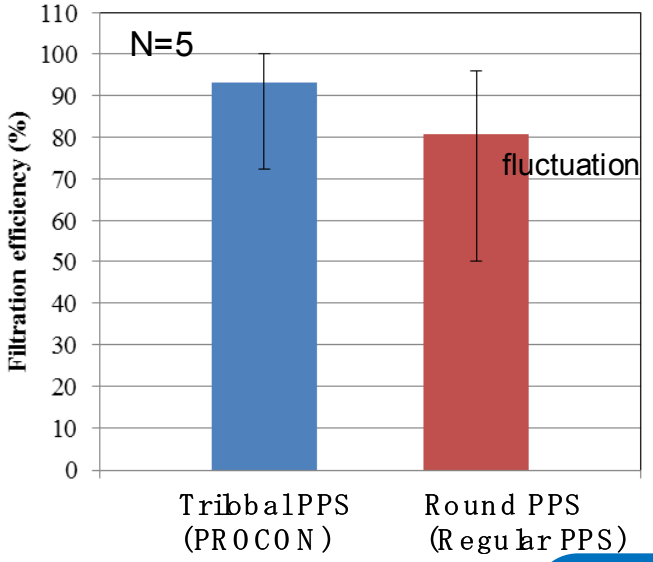
< Round PPS (Regular) >

Particle:3.5μm(VDI)



< Dust Leak through Needlefelt >





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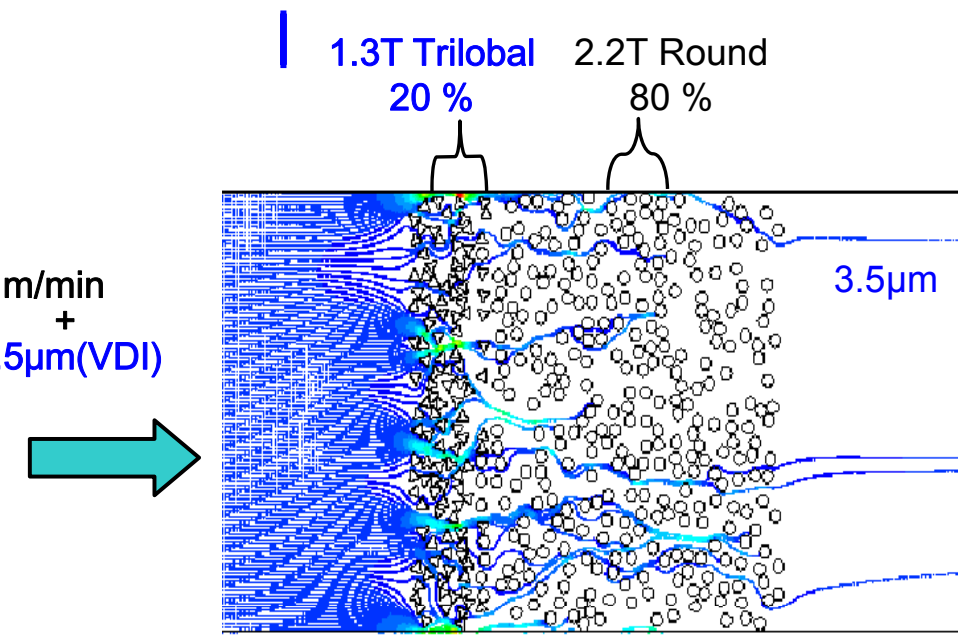
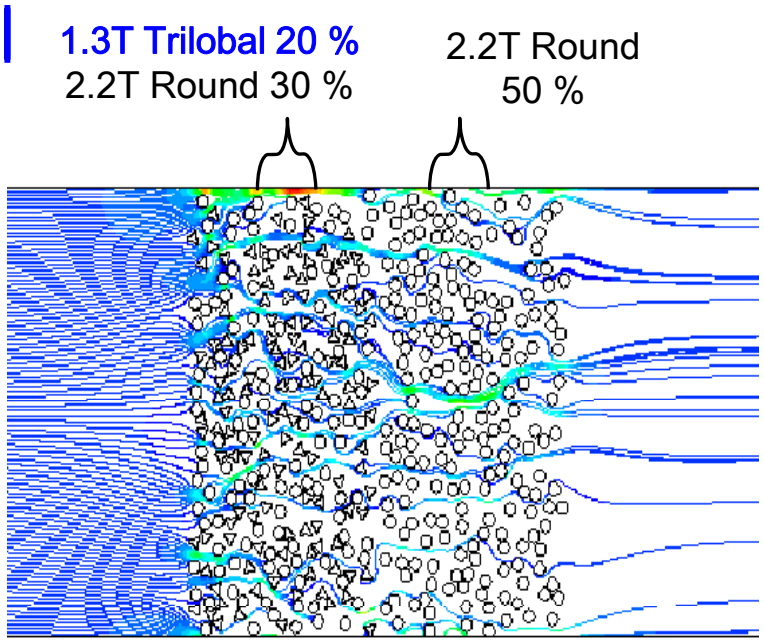
1.3T Trilobal (Layer or Blend)

< 1.3T Trilobal Layer 20wt%) >

< 1.3T Trilobal Blend 20wt%) >

2 m/min
+
3.5μm(VDI)





Porosity:73.5 %

Tortuosity (Next page)
1.41(Layer) > 1.15(Blend)

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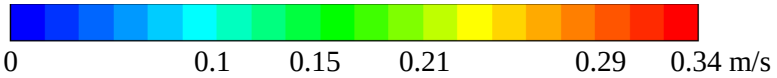
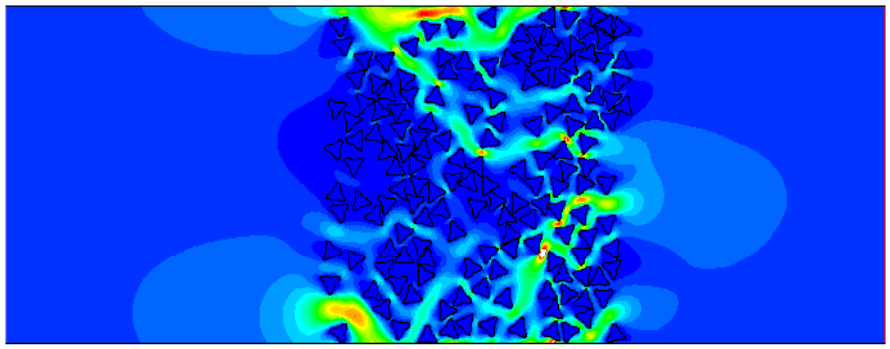
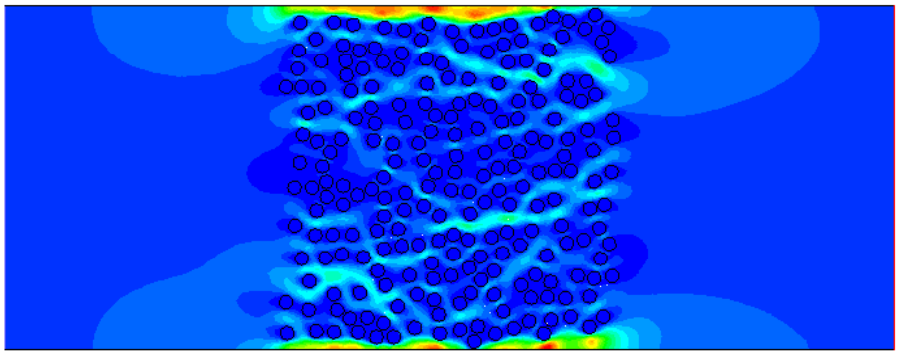
Simulation： flow velocity distribution



< Trilobal PPS >

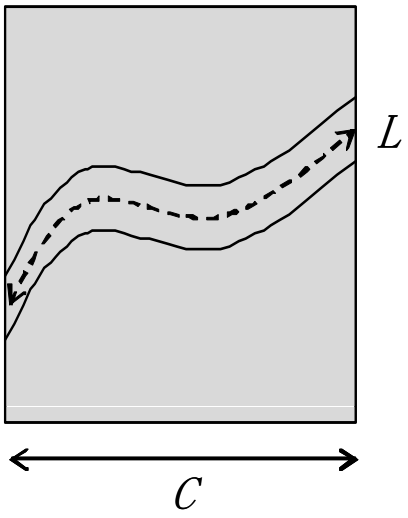


< Round PPS (Regular) >



＊Random Configuration (Layout) (N=5)

Air
+
Particle



Tortuosity

$\tau = L/C$

L：Length of the curve

C：Distance (Thickness) of Needlfelt

Tortuosity

1.9(Trilobal) > 1.7(Round)

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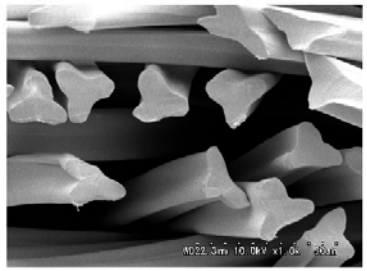
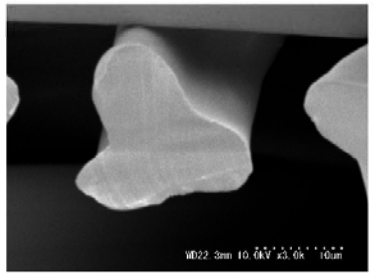
2.5T Trilobal / Needlefelt (Japanese Companies)

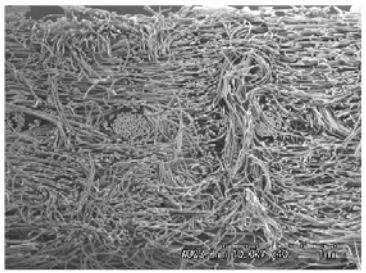
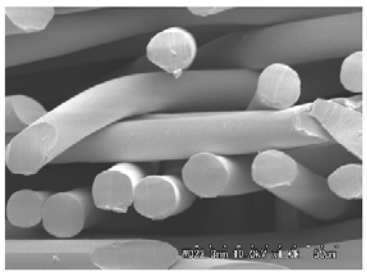
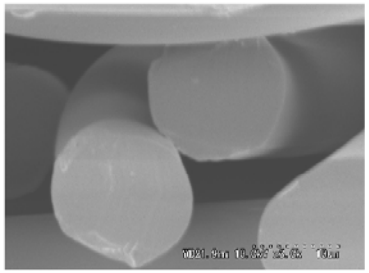
PROCON 2.5T Trilobal / Needlefelt

		Japanese A Company		Japanese B Company		
		2.2TRound-100%	2.5T Trilobal-100%	2.2TRound-100%	2.5T Trilobal-100%	
Weight	(g/m^2)	520	519	536	526	476
Thickness	(mm)	1.68	1.86	1.7	1.7	1.6
A.P.	($cc/cm^2 \cdot s$)	16.1	11.3	15.9	11.5	13.8
Strength (N/5cm)	Warp	763	627	869	915	870
	Weft	1481	1587	1640	1551	1372
Elongation (%)	Warp	26	22	28	26	27
	Weft	29	28	39	29	29

2.5T Trilobal

2.2T Round

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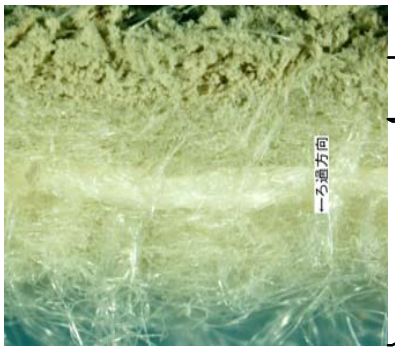
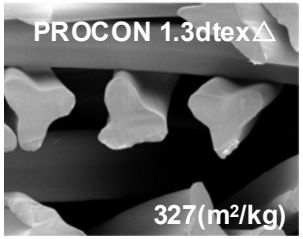
VDI : 1.3T Trilobal(20wt%) Layer / 2.2T Round



1.3T Trilobal 20%

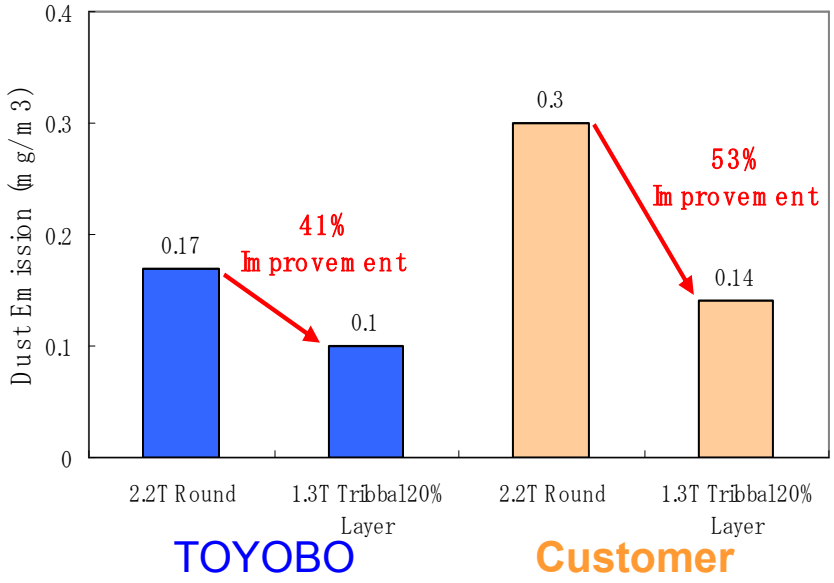
2.2T Round
80%



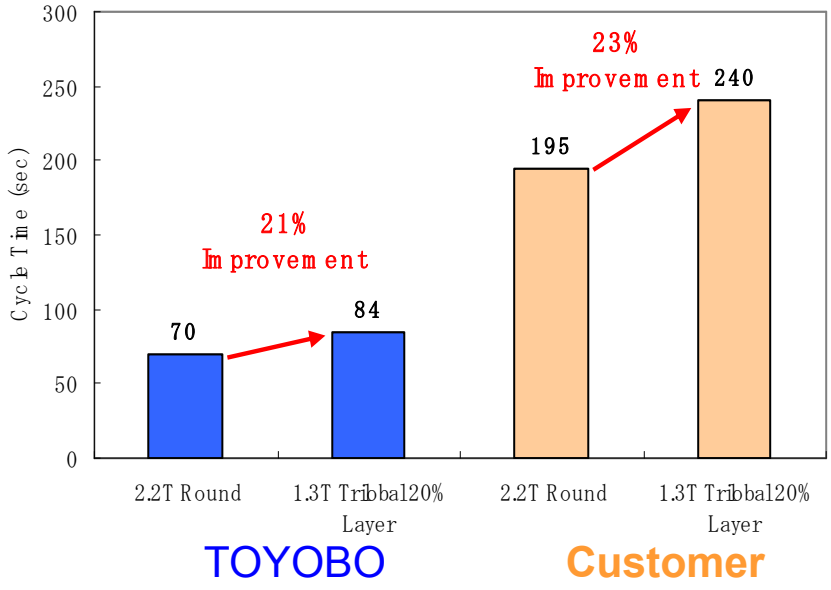
* This Sample was Produced by actual Needlefelt process in Japan

	Weight (g/m²)	Thichness (mm)	A.P (c/cm²·s)
1.3T Tri20% /2.2T○80%	519	1.9	15.4
2.2T Round-100%	532	1.8	15.7

<Dsut Emission (VDI)>



<Cycle Time (VDI>



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Reference 1) PPS Trilobal

< CFB, South Africa >

Filter Bag : **TPPS Trilobal (10-20%)**

High Temperature Filtration Conference in 2008

http://www.eskom.co.za/OurCompany/PhotoGallery/Pages/Eskom_Power_Stations.aspx

TOYOBO

Reference 2) Trilobal

< CFB, Australia　660MW x 2 >

Filter Bag : **PROCON　2.5T Trilobal**

2.5T Trilobal / PTFE Scrim / 2.2T Round

Unit 5,6 : 40,000 bags

Bag Life : min.32,000 (hours)

Pulse Jet-on Line

Operating Temp. : 150℃ (max. 180℃)

O_2 : ?

H_2O : 7.1 (vol%)

SO x : 150 (ppm)

NO x : 380 (mg/m^3)

ACR : 1.2 (m/min)

Emission : 4 (mg/m^3)

https://en.wikipedia.org/wiki/Vales_Point_Power_Station

Bag Life : 2.5T Trilobal +2.2T Round (lower ΔP) > 1.0T Round+2.2T

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Thank you