NANOFRONT

Unique Nano fiber material for high spec Air filtration & liquid filtration

29-31/Aug./2019

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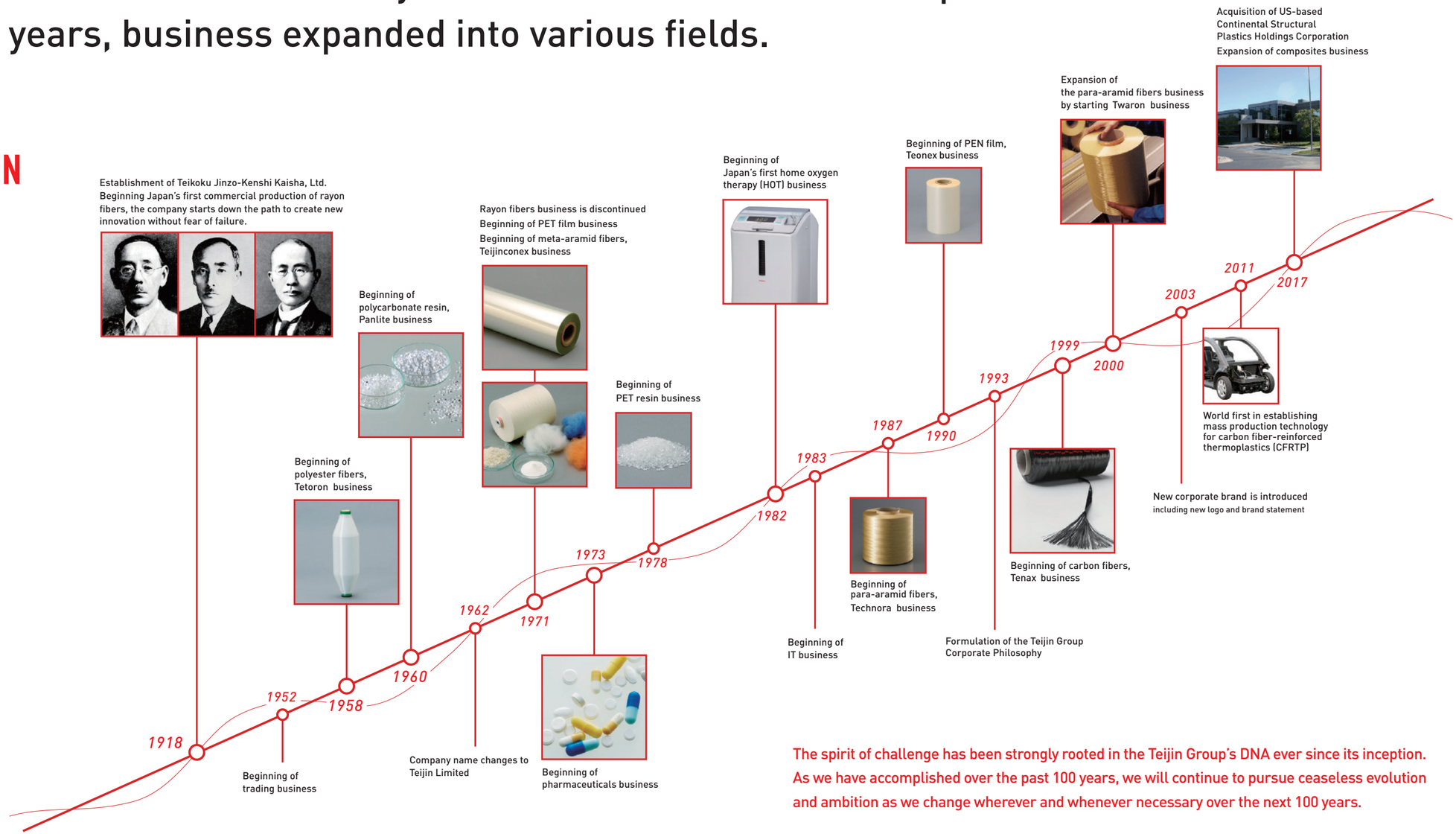
Teijin India Private Ltd.

TEIJIN GROUP OUTLOOK

Teijin was founded in 1918 as the first synthetic fiber manufacture in Japan.
During past 100 years, business expanded into various fields.

A CENTURY OF TEIJIN

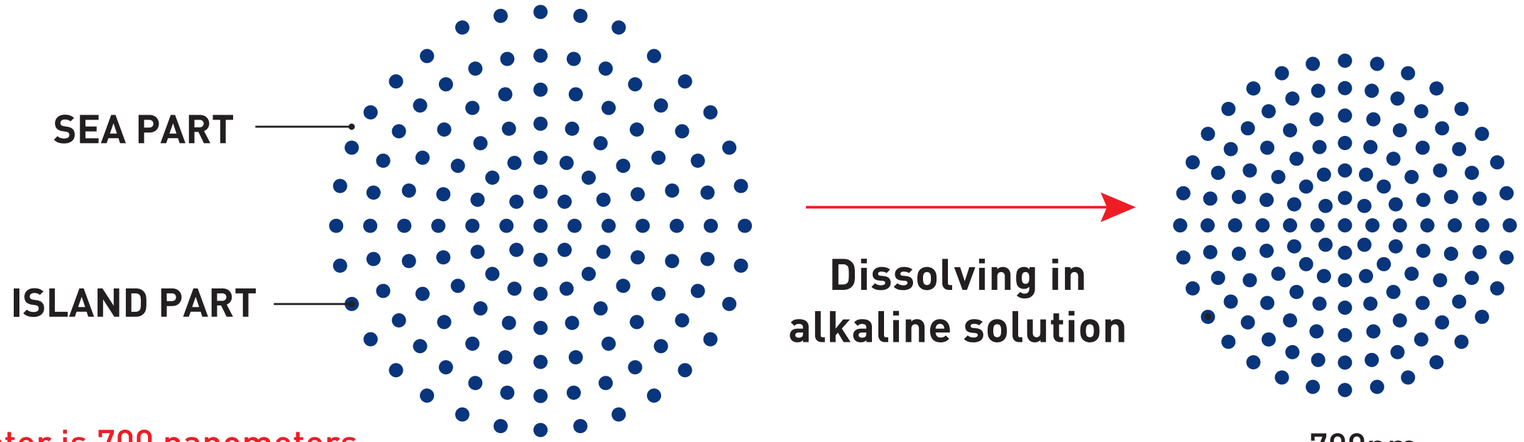
- ALWAYS EVOLVING -



The spirit of challenge has been strongly rooted in the Teijin Group's DNA ever since its inception. As we have accomplished over the past 100 years, we will continue to pursue ceaseless evolution and ambition as we change wherever and whenever necessary over the next 100 years.

TEIJIN'S NANO FIBER-Nanofront

Teijin invented stable quality of world's first 700 nanometer ultra-fine polyester nanofiber by using its unique 'New Sea/Island Separatable Fiber Technology'. It was commercialized in 2008.



▶ Diameter is 700 nanometers
Section area is 1/7500
the area of a hair

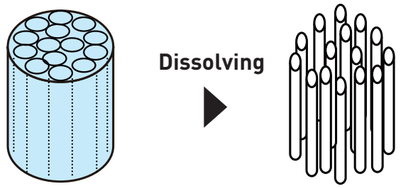
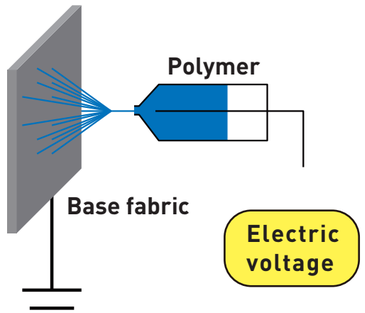
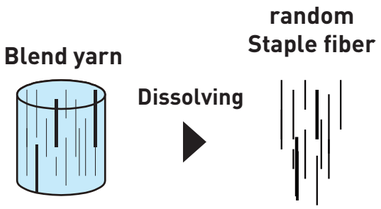
NANOFRONT
(fiber diameter:700nm)

Microfiber
(fiber diameter:2μm)

Hair
(diameter:60μm)

PRODUCTION METHOD OF Nanofront

Comparison Nano fibers

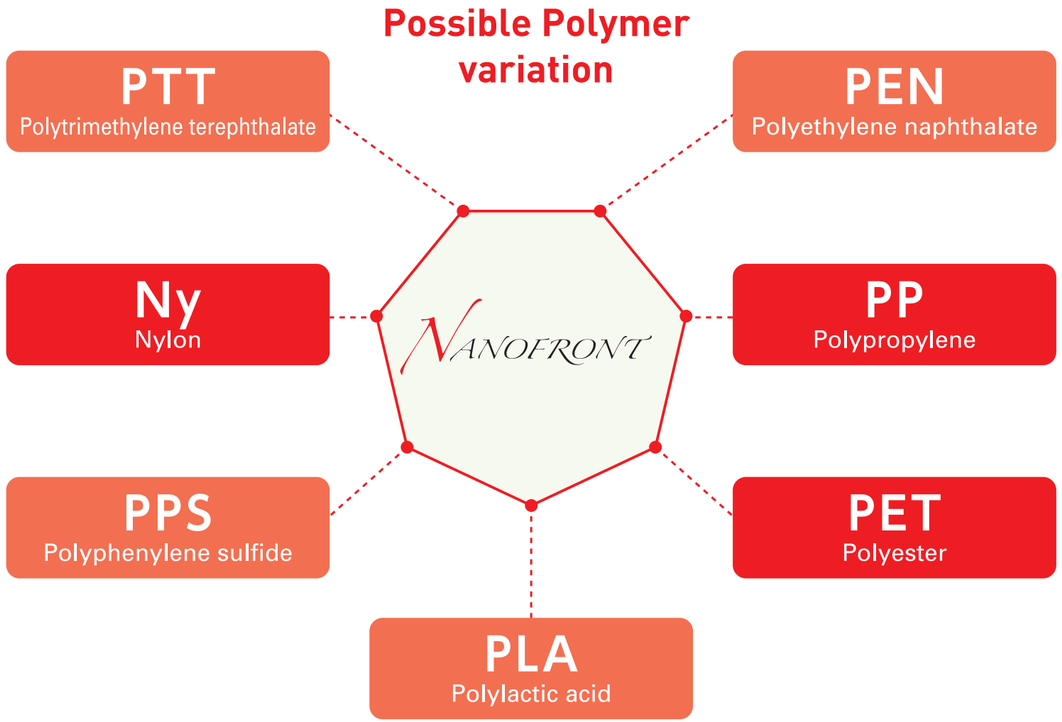
Manufacturing process	NANOFRONT Sea/Island Composite spinning → Dissolving → High multi continuous filament 	Electrospinning 	Blend spinning 
Shape	Filament	Non-woven	Staple fiber
Evenness of diameter	○	△	×
Strength	5cN/dtex	＜1cN/dtex	Impossible to measure
Applicable to knit/ woven fabrics	○	×	×

○:proper △:notice ×:improper

Advantage of Nanofront
Because origin is continuous filament
1.even diameter 2.high strength(5-6cN/dtex) 3.high production efficiency and Possible to make woven, knit, non-woven, sheet and other textiles.

POSSIBILITY OF -Nanofront

Basically all melt-type polymers can be processed into Nano fiber. On top of PET, Ny, PP are available now.



Because it Unique Nano fiber
► Slip-resistant

Because it Unique Nano fiber
► Gentle on the skin

Because it Unique Nano fiber
► Easy to wipe

Because it Unique Nano fiber
► Comfortable

The surface area of -Nanofront woven in filaments structure could be tens of times greater than conventional fibers.
This enhances water absorption, slip resistance,and opaqueness.
The texture feels soft to the skin, and irritation is reduced dramatically.
Suitable for a variety of applications, including functional sportswear,innerwear, skin care products, antibacterial filters, precision grinding cloth, etc.

Nanofront APPLICATIONS IN FILTER FIELDS

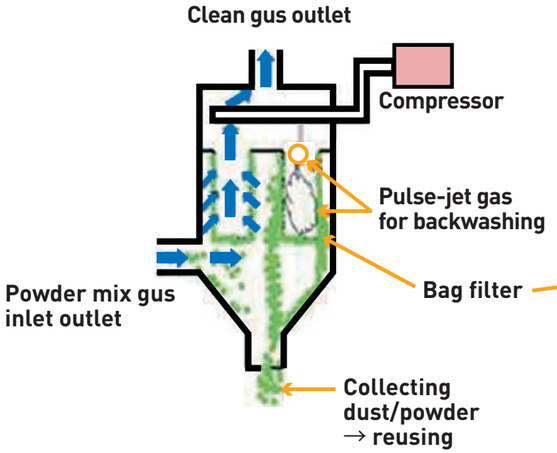
Nanofront application was expanded into filtration fields.

01

Bag filter :

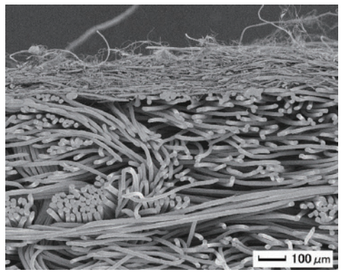
PET Nanofront,

(in near future PPS as well)



Inside of dust collector

Nanofront felt

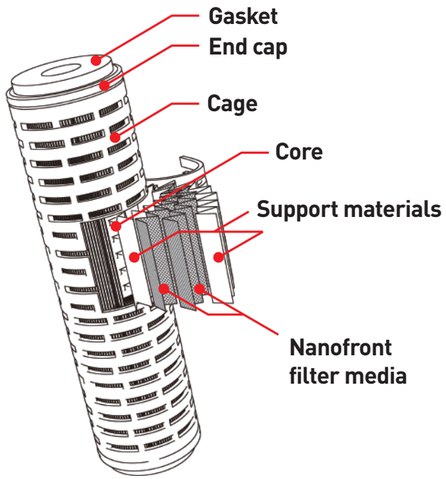


02

Liquid cartlidge filter :

PET,Ny,PP Nanofront

PLEATED TYPE



01. Nanofront BAG FILTER,BACKGROUND OF THE DEVELOPMENT

In China air pollution is getting worse. Along with this, controlling regulation is getting severer from around 2014.
In order to pass regulation, replacement of conventional non-woven filter media is required.
But at the same time, energy consumption and bag filter life cannot be sacrificed.
As Teijin believed Nanofront bag filter should become the solution, development started.

Subjects to overcome

1.High dust collecting efficiency
2.Low pressure loss
3.Long life

Regulation Tightening

Ex. Cement finishing mill in China

Regulation mg/m3	Typical implementation situation Schedule
30	'14 To start for all applications in nationwide
20	'14 Urban, tourist city, government judgment
10	'15 Beijing, Tianjin, Hebei, government judgment
5	Under consideration

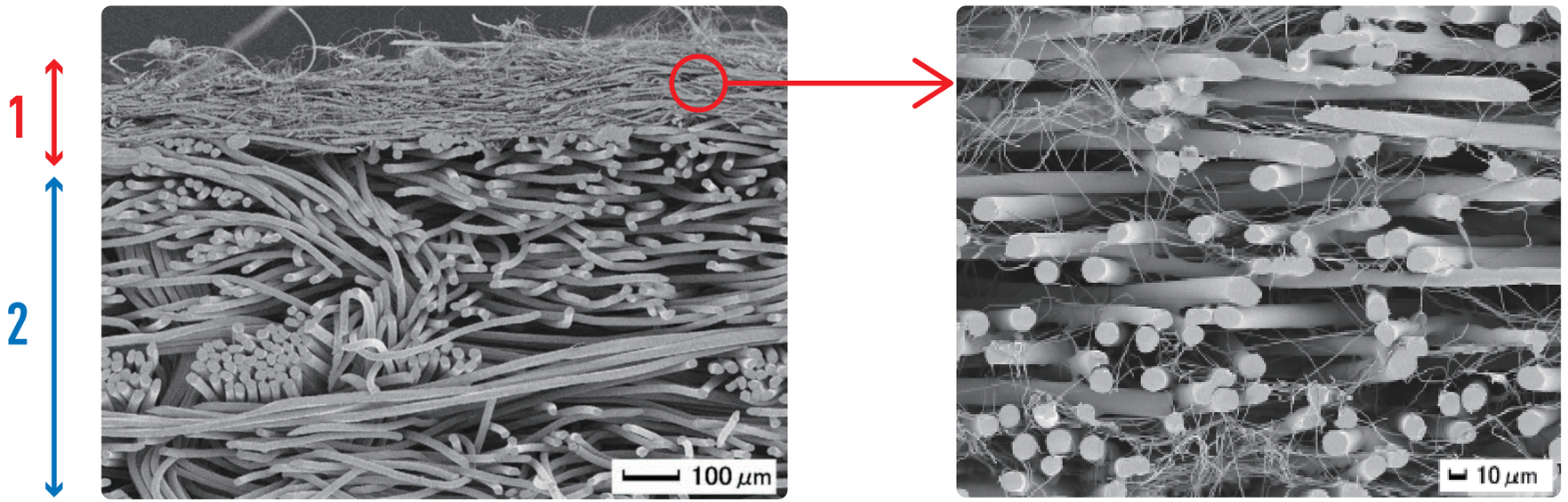
01. STRUCTURE OF Nanofront FELT

Nanofront felt is composed of 2 layers, Unique Nano fiber Sheet and Base felt.

1. Nanofront Sheet

- By dispersing even diameter of Nano fibers, achieves high dust collecting efficiency.
- By dispersing thicker diameter of fibers,it makes possible to keep even porous and high air permeability (low pressure loss)→SAVE ENERGY
- High dust collecting efficiency can prolong time to clogging→LONGER LIFE

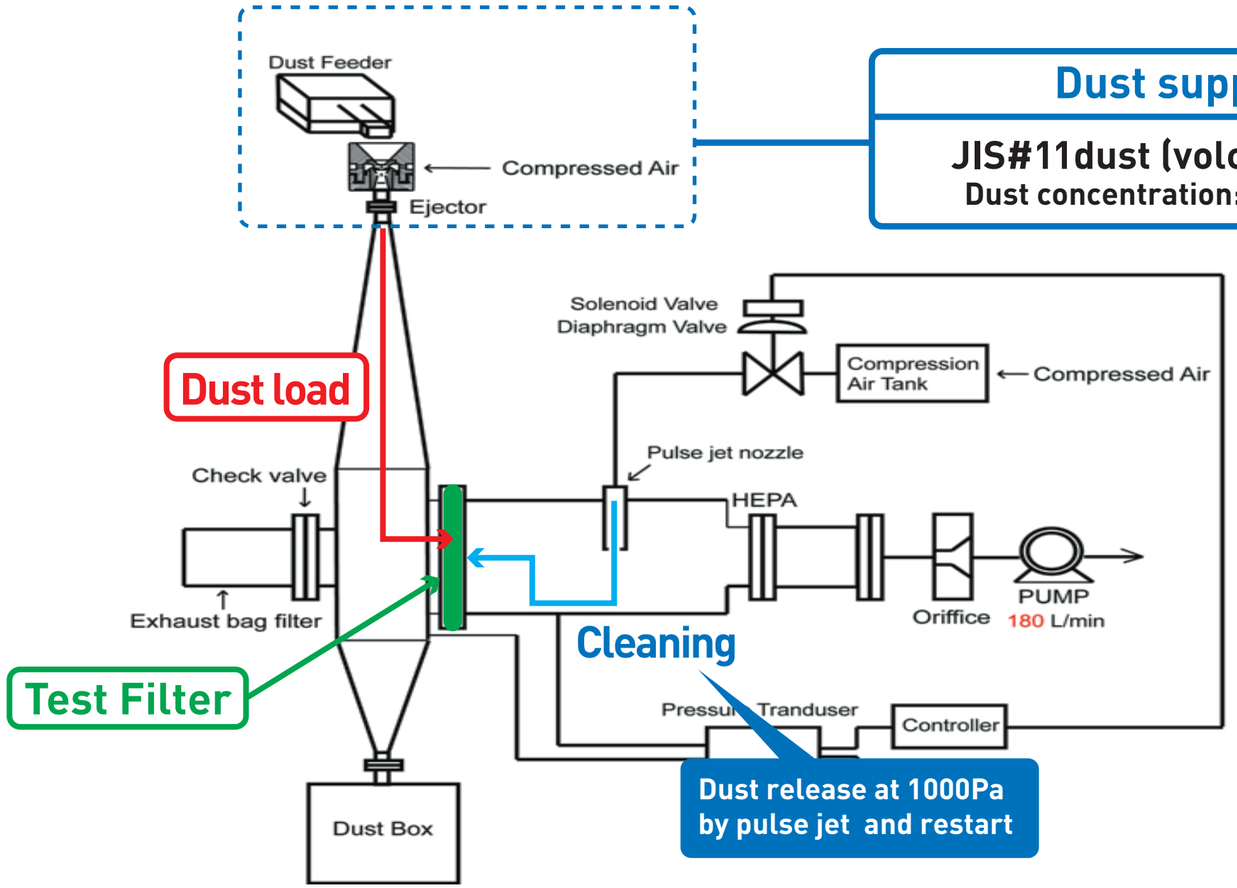
2.Base felt



01. TEST EQUIPMENT OF FILTRATION EFFICIENCY

In order to assure our assumption, we implemented test to analize filtration efficiency.

JIS Z 8909-1 **Test items:shifting of pressure loss, pulse interval, amount & ration of dust emission**



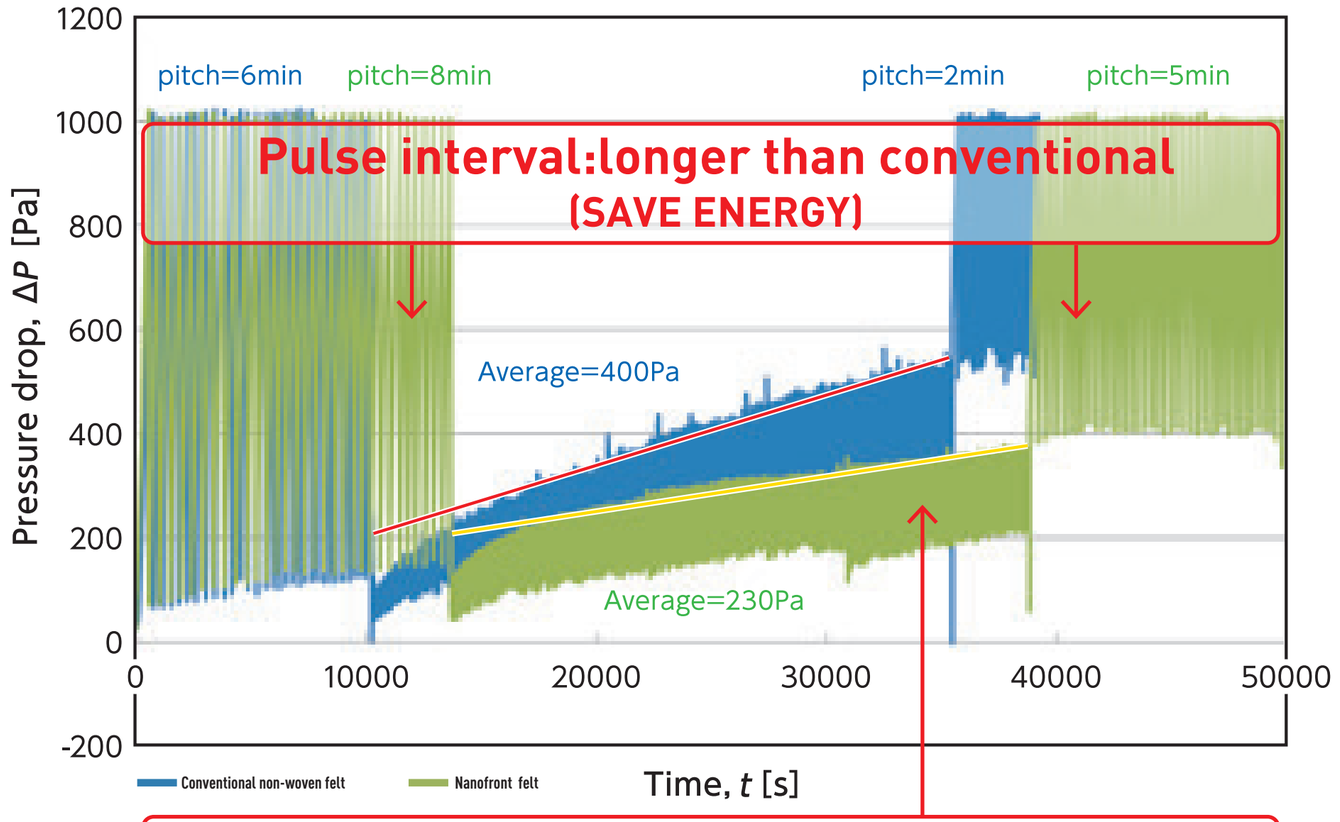
@Teijin Frontier's labo
in Nantong in China

01. TEST RESULT VS. CONVENTIONL NON-WOVEN FELT

Initial Pulse at 1,000pa 30 times

Aging Pulse every 5 sec. 5,000 times

Final Pulse at 1,000pa 30 times



Pressure loss : slower rising than conventional (save energy and longer life)

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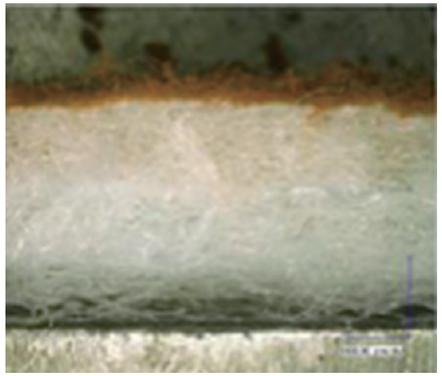
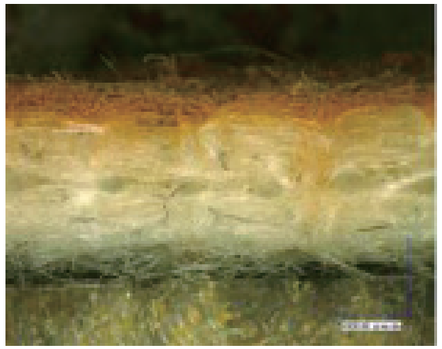


Conventional



Situation of clogging

*Figures are not guaranteed.

01. TEST RESULT VS. PTFE MENBRANE FELT AND ASSUMED REASON

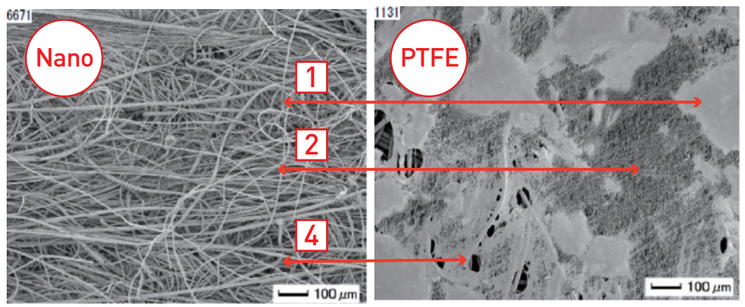
Test result in labo

(A) Initial pressure loss, successive residual pressure loss

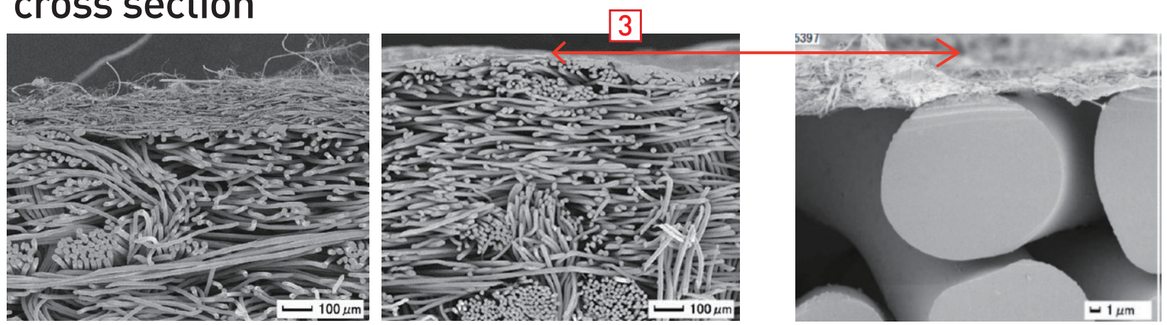
Nanofront Felt < PTFE membrane

Analysis

surface



cross section



(B) Dust collecting efficiency

Nanofront Felt ≒ PTFE membrane

Assumed reason of the result

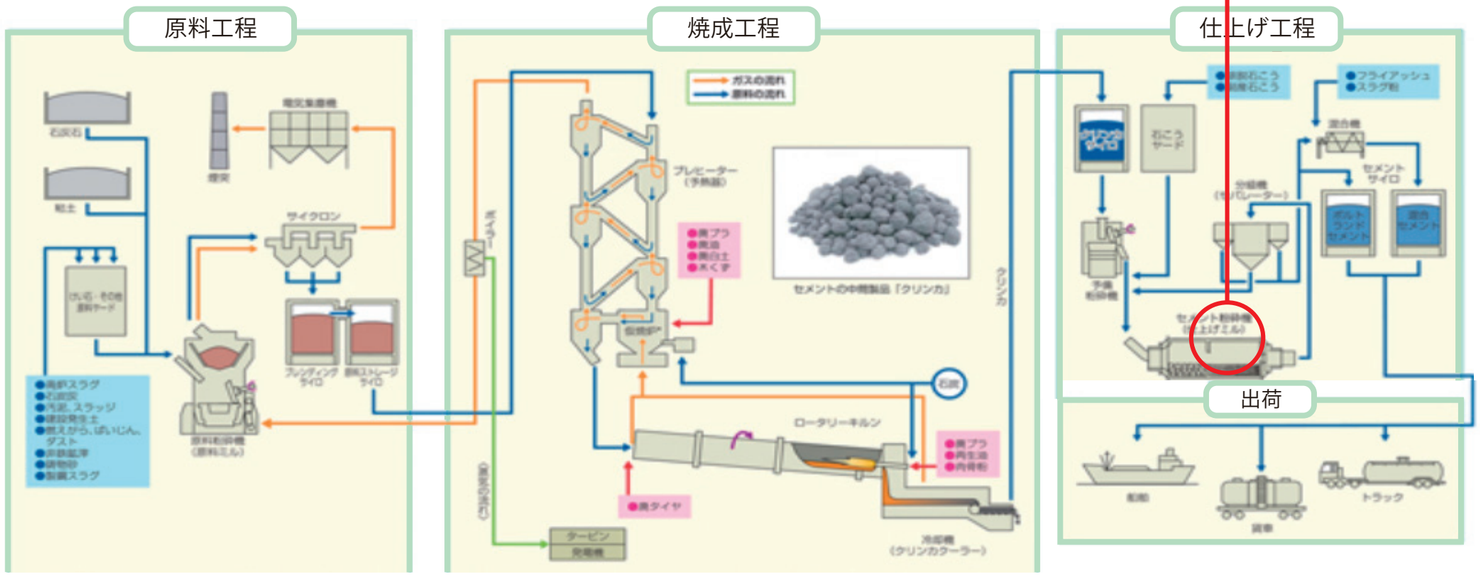
(A) Surface of Nanofront Felt is composed of fiber.
Therefore there is no film-like area [1]
and porous is not so microscopic as compared
with PTFE membrane. [2]
(B) Because Nanofront Sheet is fiber layer,
it is not so thin as compared with PTFE membrane [3]
therefore no hole which sometimes appears in
PTFE membrane. [4]

01. FIELD TEST AT CEMENT PLANT IN CHINA VS. PTFE MEMBRANE

another option to pass regulation

As obtained positive result in labo. analysis, we determined to implement field test and started from April/2017.
Site:CHENGMAI HUASHENG TIANYA CEMENT at Haian in China.
Bag filters were installed dust collectors of finishing mills.
Hainan is sight-seeing city and regulation requires dust emission under 20mg/m³ .
This is must condition.

CHENGMAI HUASHENG TIANYA CEMENT

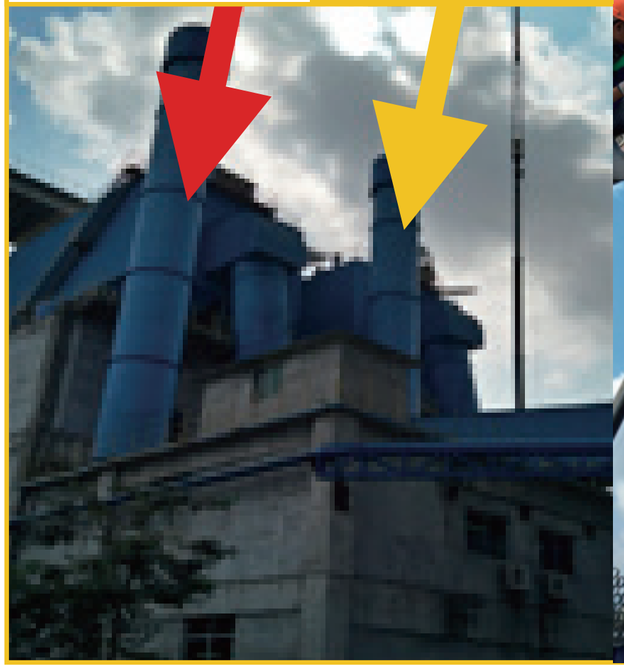


01. SCENIC PHOTO OF INSTALLATION AND RESULT

Both line #5 and #6 have the same dust collectors. 1,560 PTFE membrane bag filters were installed in #5 and 1,560 Nanofront bag filters were installed in #6.
Field test was implemented to compare both filters' performance. Dust emission of #6 has been less than #5.

#5
PTFE membrane
1,560 pieces

#6
Unique Nano fiber
1,560 pieces



Result	dust emission (mg/m³)	
	#5	#6
Apr.-17	6	2
May.-17	8	3
Jun.-17	6	3
Jul.-17	-	-
Aug.-17	6	3
Sep.-17	7	4
Oct.-17	8	4
Nov.-17	10	6
Dec.-17	11	6
Jan.-18	10	7
Feb.-18	12	8
Mar.-18	11	9
	· ·	· ·
Mar.-19	10	6

02. Nanofront LIQUID CARTLIDGE FILTER (1)

One of other applications of Nanofront filters is Liquid Cartlidge filter.
On top of 700nm, 400nm & 200nm(newly developped) are being used.

Feature

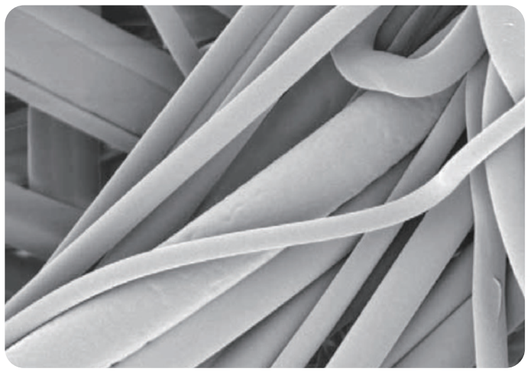
1, As compared with conventional non-woven like meltblow, Nanofront sheet is

(1) porous is smaller

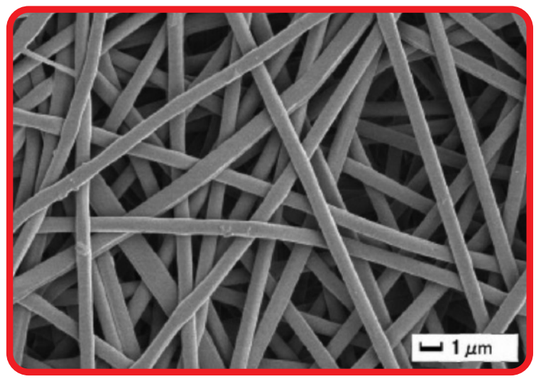
(2) porous distribution is sharp

(3) extremely thin

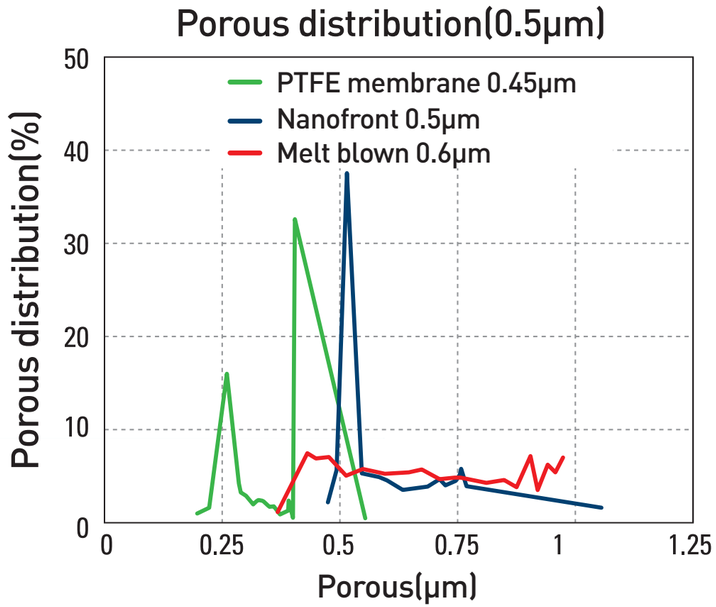
→ Accuracy of filtration is high and filtration area is wide.



Meltblow

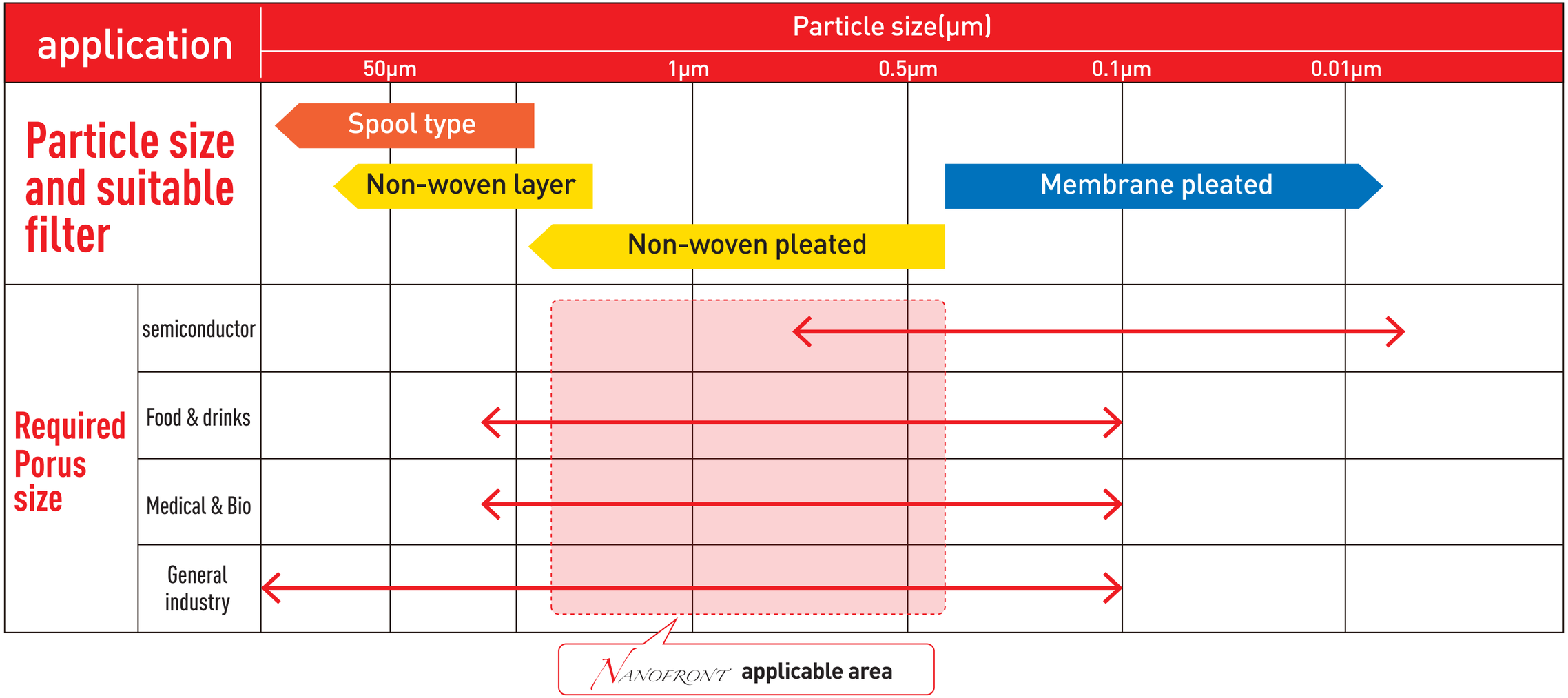


NANOFRONT



02. AREA TO COVER

Nanofront liquid cartlidge filter is suitable for non-woven pleated type and part of membrane pleated type.

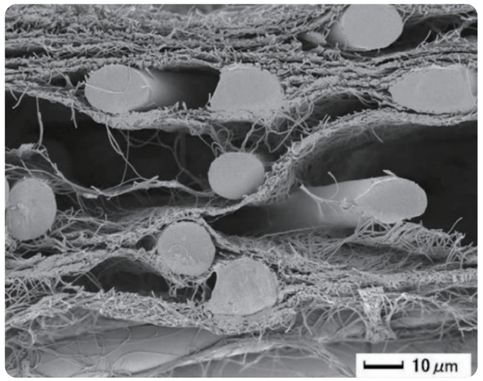


02. Nanofront LIQUID CARTLIDGE FILTER (2)

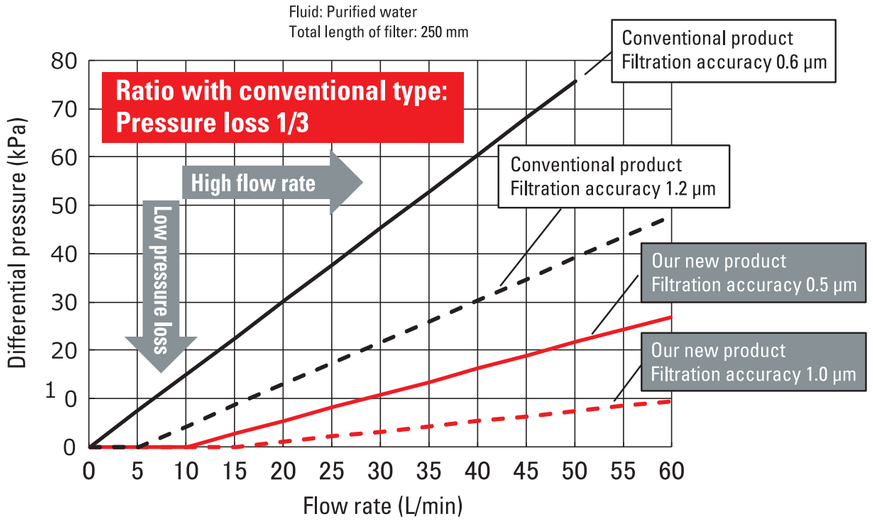
Feature

2,Nanofront sheet

- By dispersing even diameter of Nano fibers, achieves high filtration efficiency.
- By dispersing thicker diameter of fibers,
  it makes possible to keep even porus and high liquid permeability (low pressure loss).

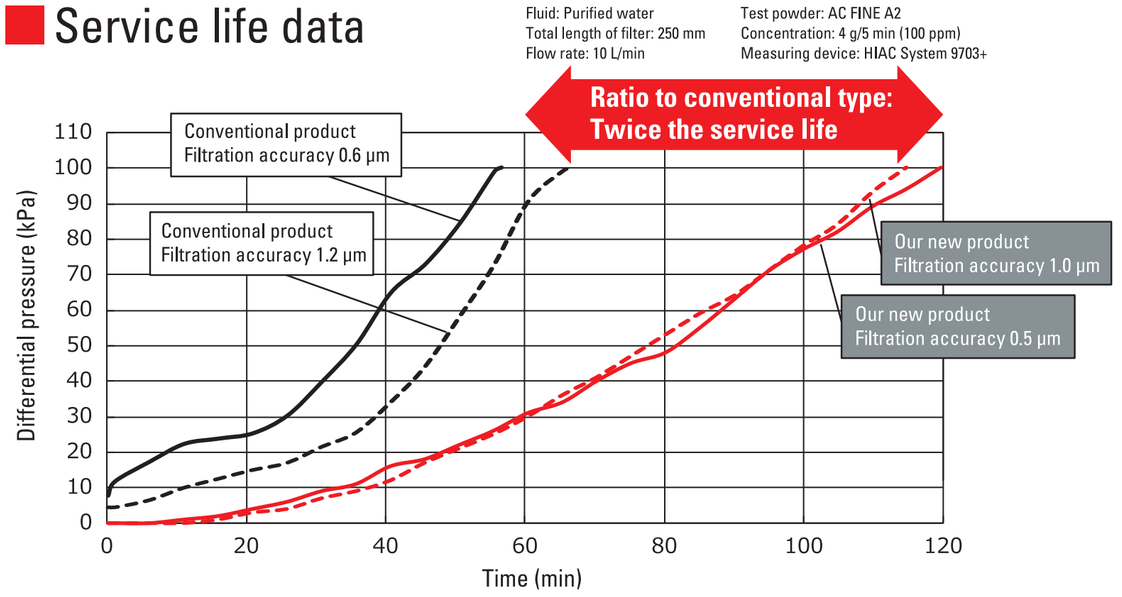


Flow characteristics data



Values for the data above do not include pipe resistance.

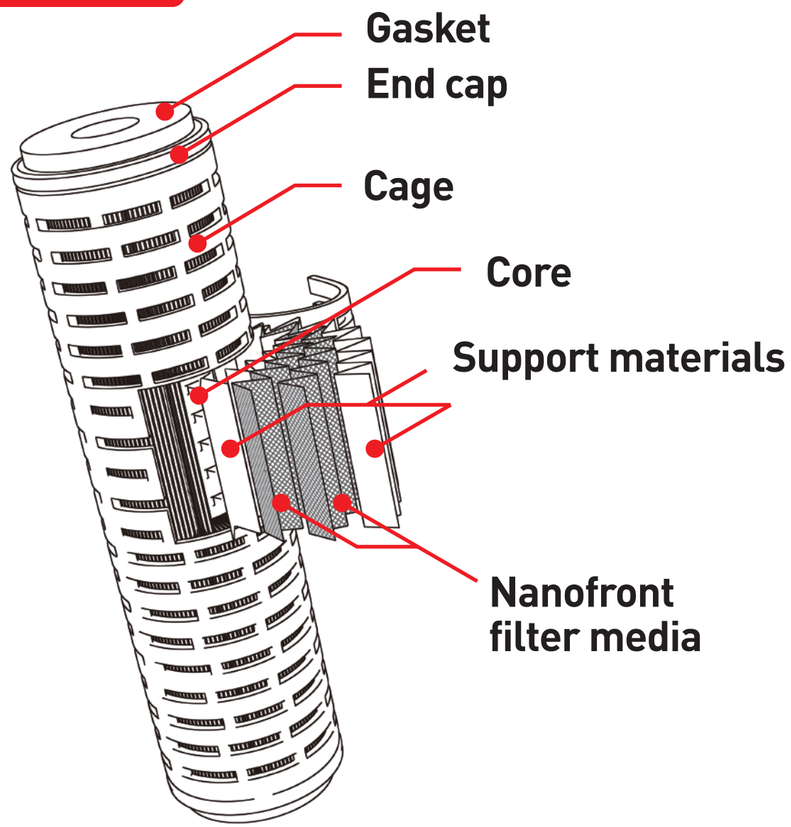
Service life data



02. LINE-UP

Average porus is between 0.5~5μm. It is suitable to filter particles between sub μm~5μm.
And as material line-up is PET, NY and PP, choice of suitable one can be possible considering fluid compatibility.

PLEATED TYPE



Polymer	Average porous
PET	5μm,3μm,1μm,0.5μm
Ny	1μm,0.5μm
PP	5μm,3μm,1μm,0.5μm

Teijin Frontier will develop various filters using Nanofront and Nano Technology continuously.

For further questions and inquiries, Please ask to :

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THANK YOU VERY MUCH FOR YOUR ATTENTION.