

Fine Denier Polyolefin Chopped Fiber

– Introduction to **AIRYMO™** –



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Development of Fine Denier Polyolefin Chopped Fiber (AIRYMO™)

Since it is difficult to reduce the yarn size of the conjugate fiber, it was known that 0.4 dtex is the lower limit of the yarn size of currently commercially available polyolefin conjugate fibers having the sheath and core structure. As a result of developing original proprietary spinning and stretching technology, UEXC succeeded in exceeding the limit and realized to produce fine polyolefin conjugate fiber "AIRYMO™" with yarn size of 0.3 dtex or less. "AIRYMO™" is attracting attention as chopped fiber that can contribute to an increase in added value of fibers by imparting excellent functionality to nonwoven fabrics.

Currently it is a development item, but UEXC assume the following applications;

- Industrial materials: battery materials, various filters, base materials for tapes, etc.
- Medical / sanitary materials: pads, substrates, etc.

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- **② Introduction to nonwoven fabric made of AIRYMO™**

① Characteristics of Fine Denier Polyolefin Chopped Fiber (AIRYMO™)

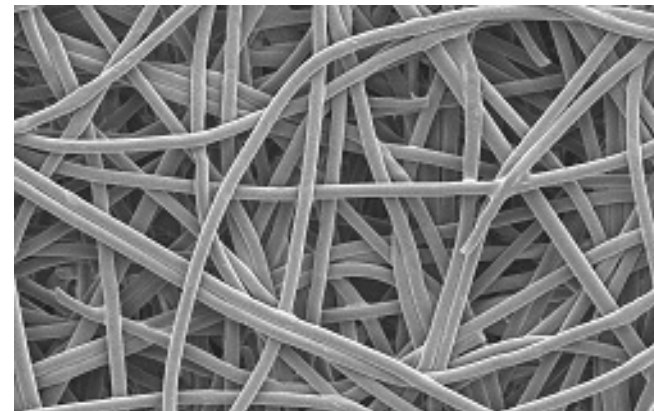
Unit of yarn size : dtex (decitex)
T : Short name of dtex
(Weight per 10,000 m (g))

- **Produced by proprietary manufacturing method** suitable for achieving fine denier
- Fine yarn size is possible up to **0.2 T (0.1 T is under development)**.
- **Excellent Uniformity** of the fiber (having less cross-sectional plaques and unevenness of size)
- **Extremely small fluctuation in yarn size (eg $0.2 \pm 0.02 T$)**.

※ Small size-range standard of $0.2 \pm 0.02 T$ is possible, compared to conventional size-range standard of $2.2 \pm 0.2 T$



Photograph of fiber cross section









SEM photograph of nonwoven fabric surface

① Definition of Fine Denier Polyolefin chopped Fiber (AIRYMO™)

Unit of yarn size : dtex (decitex)
T : Short name of dtex
 (Weight per 10,000 m (g))

Material composition (Grade name)	PE/PP	Single PP	CoPP/PP	Yarn size (Product)
RC (Conventional chops)	RCE	RCP	RCC	More than 1.7T (1.7、2.2、3.3)
SC (SIMTEX™ chops) High strength fiber	SCE	SCP	SCC (Under development)	More than 0.4T (0.4、0.8、1.3、1.7)
QC (Fine denier chops) AIRYMO™	QCE	QCP	QCC (Under development)	Less than 0.3T (0.1、0.2、0.3)

	RC			SC			QC		
Yarn size dTex	2.2	0.8	0.4	0.3	0.2	0.1			
Diameter μm	17.5	10.6	7.5	6.5	5.3	3.7			
Schematic diagram									

① Variety of Fine Denier Polyolefin Chopped Fiber (AIRYMO™)

Brand [Variety]	Resin [Composition]	Yarn size range [dTex]	Filament Diameter [μm]	Cut length [mm]
QCE	PE/PP(50/50) conjugated fiber	0.2~0.3	5.2~6.5	2, 3, 5
QCES	PE/PP(<PE40%) conjugated fiber	0.2~0.3	5.2~6.5	2, 3, 5
QCEL	PE/PP(>PE60%) conjugated fiber	0.2~0.3	5.2~6.5	2, 3, 5
QCP	PP(100%) single fiber	0.2~0.3	5.2~6.5	2, 3, 5
QCC	CoPP/PP conjugated fiber	Under development		

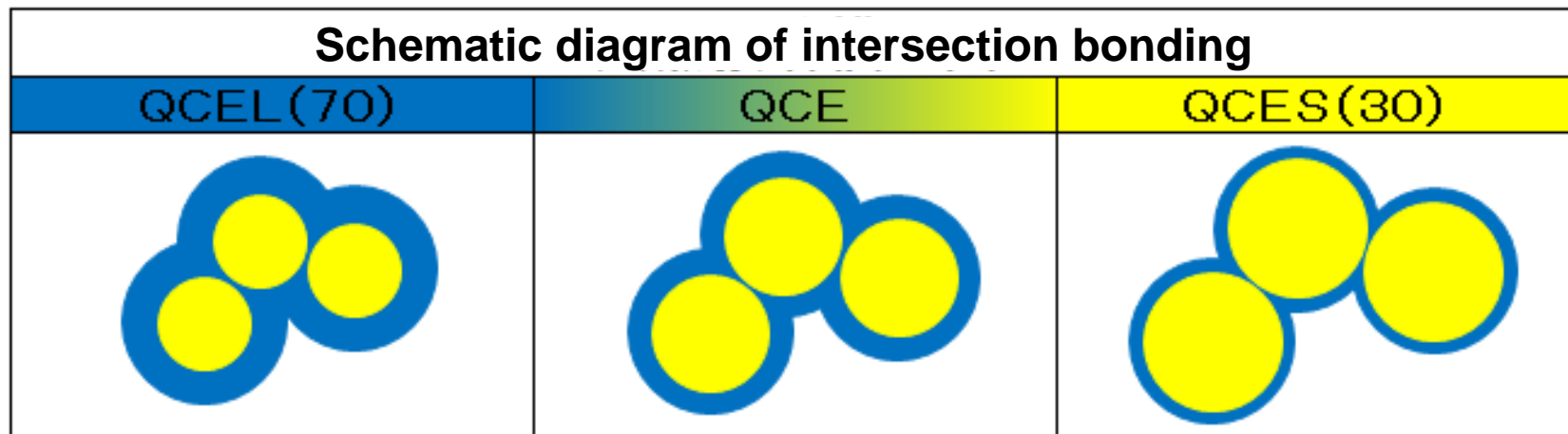
※ 0.1 dtex is under development. Cut lengths of 2, 3, 4, 5, 6, 8, 9, 10 mm are possible

Sheath core ratio	80/20	70/30	60/40	50/50	40/60	30/70	20/80	0/100
Name of variety	QCEL			QCE	QCES			QCP
Image diagram								

① Characteristics Use of Varieties of Fine Denier Polyolefin Chopped Fiber (AIRYMO™)

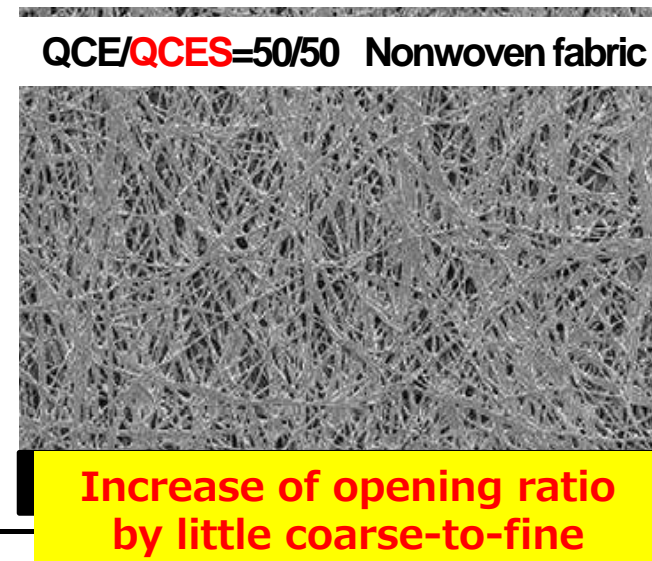
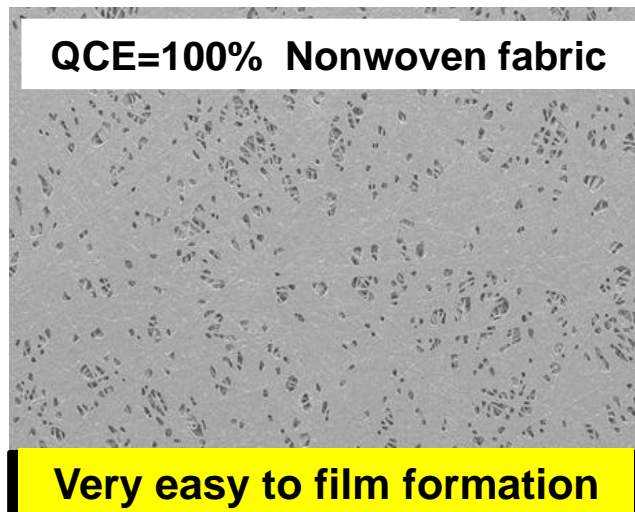
Sheath core ratio	80/20	70/30	60/40	50/50	40/60	30/70	20/80	0/100
Name of variety	QCEL			QCE		QCES		QCP
Image diagram								

- **QCEL** : Easy reduction of fabric thickness **which is suitable for film formation**
- **QCES** : Resistance to decrease fabric thickness **which ensure void formation**



② Characteristics of Nonwoven Fabric Made of AIRYMO™

- ① Since AIRYMO™ uses an oil agent according to the prescription of nonwoven fabric manufacturers, **it has excellent dispersibility and enables the production of uniform nonwoven fabrics.**
- ② **Desired void size and porosity are obtained by mixing various chopped fibers, e.g. QCE and QCES, as shown in the following SEM photograph.**
- ③ **The nonwoven fabric having a high weight per unit area exhibits extremely high strength by using fine denier chopped fiber,**
- ④ **It is possible to produce a nonwoven fabric having a low weight per unit area suitable for a thin film by using fine denier chopped fiber,**
- ⑤ **AIRYMO™ is not water absorbent and has excellent chemical resistance**



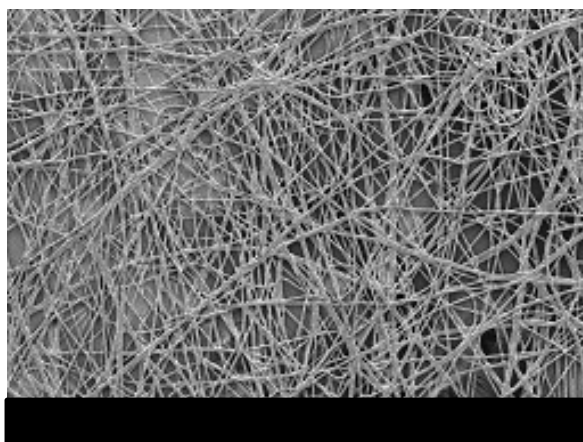
② Specification of AIRYMO™ Nonwoven Fabric

Weight per unit area [g/m ²]	Thickness [μm]	Bulk Density [g/cm ³]	Stress at maximum point [MPa] MD / CD	Elongation at maximum point [%] MD / CD
3~60	9~200	0.2~0.4	More than 25 / 15	Less than 20 / 25

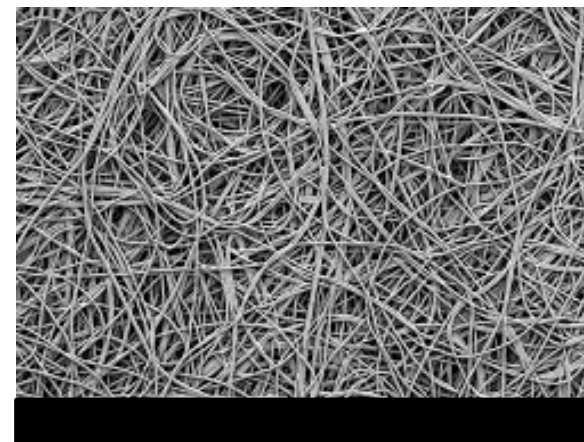
It is possible to produce nonwoven fabric with excellent mechanical properties, i.e. high strength and high elongation.

※ It is also possible to perform press-forming as secondary processing.

◆ SEM photograph of nonwoven fabric surface



<e.g. : Item with low weight per unit area>
Weight per unit area of 3g/m² thickness of 9 μm



<e.g. : Item with high weight per unit area>
Weight per unit area of 45 g/m² thickness of 150 μm

② Example of Physical Properties Table of AIRYMO™ Nonwoven Fabrics

Sample		Weight per unit area [g/m ²]	Thickness [μm]	Bulk density [g/cm ³]	Strength [N / 15mm]		Elongation at maximum point [%]	
					MD	CD	MD	CD
Material under development	A	3	10	0.31	4	1	12	18
	B	13	50	0.26	22	11	21	24
	C	23	70	0.33	34	23	18	21
	D	30	90	0.33	52	35	20	21
Conventional material		29.3	110	0.27	30	17	25	25

※ Data are not guaranteed value but measured value.

It is possible to produce nonwoven fabric with micron level thickness.

- The developed product has a **maximum strength of 1.5 times or more**, when comparing the sample having a weight per unit area / thickness close to conventional products.