Analysis on the Physical Property of Nylon High Tenacity Coarse Fiber for Military and Technical Textiles

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1. Introduction

The demands of technical textiles are recently increased as a result, the technical and military industries are expanded. And the high performance materials for technical textiles are needed. Nylon is used for high performance textile materials.[1)] High tenacity nylon textiles have higher value of tenacity, regain and hand feel than those of PET textiles. They are widely used in technical and military textiles. This study surveys the analysis of physical properties of high tenacity nylon coarse yarns made by Hyo-sung and Invista for military and technical textiles, and the analysis of mechanical properties of fabrics made by high tenacity nylon yarns. For this purpose, basic research necessary to develop military and technical textiles production skill using high tenacity nylon yarns is achieved.

2. Experimental

2.1 Specimens

Table 1 and Table 2 show yarns and fabrics specimens used in this study.

Table 1. Specimens of nylon yarns

No.	Material
1	Robic 100D
2	Robic 210D
3	Invista 100D
4	Invista 210D
5	Robic 500D
6	Robic 1000D

Table 2. Specimens of nylon fabric

No.	Fabric		Material	Density(number/inch)
1	N/US500D CODURA 65"	Warp	Nylon 500D	48
		Weft	Nylon 500D	34
2	Robic® 500D	Warp	Nylon 500D	48
		Weft	Nylon 500D	32

2.2 Measurement of mechanical properties

The measurement methods of mechanical properties of the specimens are shown in Table 3.

Table 3. Measurement of Mechanical Properties of Specimen

Measurement item	Method	Measuring equipment
Yarn tensile property	KS K 0412	Testometric MICRO 350
Yarn shrinkage	Toray method KS K 0215	Dry-Heat Chamber Water Bath
Fabric tensile property	KS K 0520	Testometric MICRO 350
Fabric tear strength	KS K 0536	Testometric MICRO 350
Fabric mechanical property	-	KES-FB System

3. Results and discussions

Fig.1 shows the tensile properties of high tenacity nylon yarns. As shown in Fig.1, tensile properties of high tenacity nylon 100d, 210d yarns made by Hyo-sung have higher values than those of high tenacity nylon 100d, 210d yarns made by Invista. The breaking strain and initial modulus of the Robic show higher values than those of the Invista, but breaking strength and tenacity of the Robic and Invista show almost same values. It is shown that tensile properties of No.5 and 6 of specimens have higher values than those of high tenacity nylon yarns.

Fig.2 shows the shrinkage of high tenacity nylon yarns. As shown in Fig.2, wet & dry shrinkages of high tenacity nylon yarns made by Hyo-sung have much higher values than those of the Invista. It is shown that the wet thermal shrinkage of the high tenacity nylon filament is higher than that of the dry thermal shrinkage. The wet thermal shrinkage of the Robic filament is about 12% and the dry thermal shrinkage is about 8%. But those of the Invista show much lower values as about 8% and 6%.

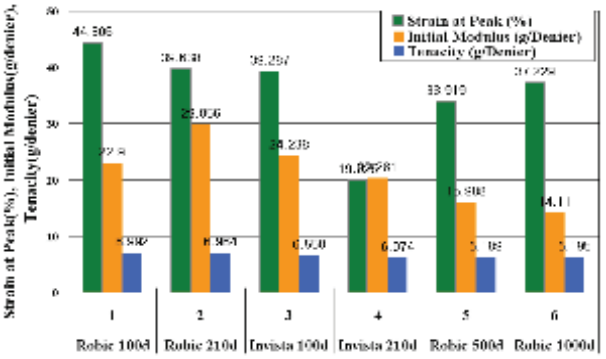

Fig. 1. Tensile properties of nylon Yarns

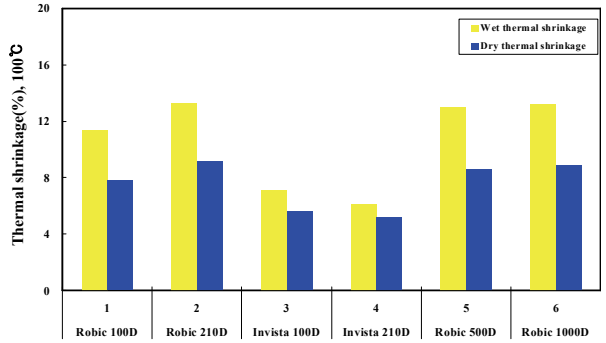

Fig. 2. Thermal shrinkage of nylon yarns

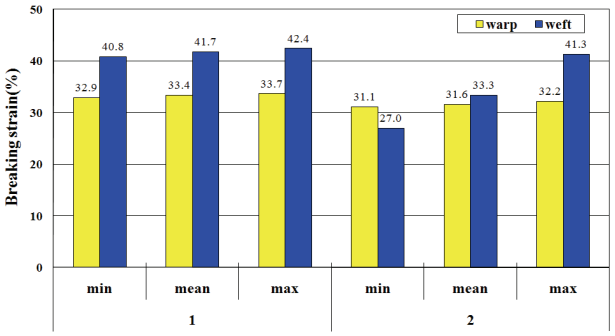

Fig. 3. Breaking strain properties of nylon fabrics

Fig.3 shows the breaking strain of high tenacity nylon fabrics. As shown in Fig.3, breaking strain of the No.2 specimen shows lower values than that of the No.1 specimen. And, breaking strain of the specimens warp shows lower values than that of the specimens weft. The reason why is due to higher density of warp direction than that of weft direction. Therefore breaking strain of fabric in warp wise direction is lower than weft wise direction.

Fig.4 shows the tensile properties of high tenacity nylon fabrics. As shown in Fig.4, breaking force values of warp direction of the No.1 specimen shows 95.9kgf, weft is 86.7kgf, warp direction of the No.2 specimen shows 83.3kgf, weft is 73.6kgf.

Fig.5 shows the shear properties of high tenacity nylon fabrics measured by KES-FB system. As shown in Fig.5, G values of warp direction of the No.1 specimen shows 3.48gf/cm.degree, weft is 3.41 gf/cm.degree, warp direction of the No.2 specimen shows 2.44 gf/cm.degree, weft is 2.59 gf/cm.degree.

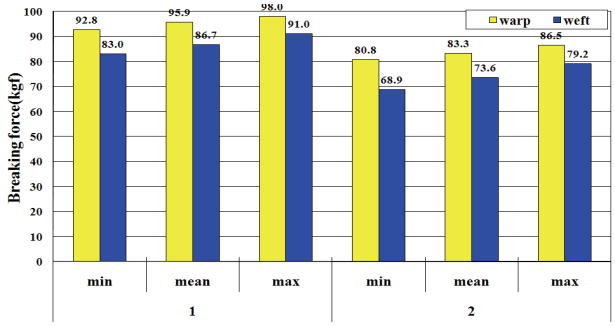

Fig. 4. Tensile Properties of Nylon Fabrics

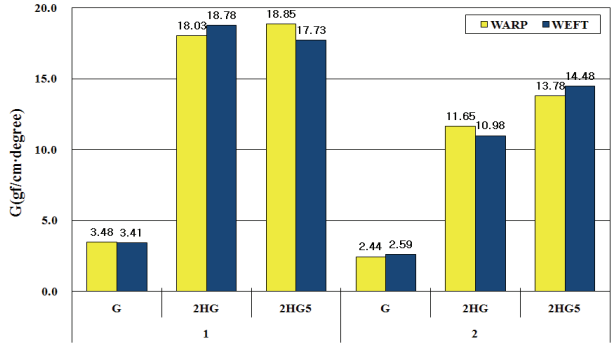

Fig. 5. Shear properties of nylon fabrics measured by KES-FB system

4. Conclusions

This study surveys of the physical property of the nylon high tenacity yarns and fabrics made by Hyo-sung and Invista for military and technical textiles. The results were as follows. Tensile properties of high tenacity nylon yarns made by Hyo-sung have higher values than those of high tenacity nylon yarns made by Invista. The shrinkage of high tenacity nylon yarns made by Hyo-sung have higher values than that of Invista. Tensile property is very important for military and technical textile but thermal shrinkage also should be considered because of the thermal treatment on the coating and laminating processes. Further research about high tenacity nylon yarns and fabrics has to be concentrated to the technical goods with high quality and low price. Also increasing demand for military and technical textiles has prospected in the future.

5. REFERENCES

1) Chang Soo Chae, Seung Jin Kim, Chan Moon, The Mechanical Properties of Nylon ATY for Technical Fabrics, Korean Fiber Soc., Vol.40, No.1, P319-320, 2007.