The International Conference on Dyeing and Finishing
EXCO, Daegu, Korea, March 13, 2009

A Study on the Physical Property of PET Dope Dyed Filament for Car Seat Fabrics According to ATY Process Conditions

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1. INTRODUCTION

PET is used in the automobile textile industry with interest due to superior properties of PET. So, the study about the physical properties of PET for industrial use according to the manufacturing process conditions is very useful on development of new industrial textiles.[2] Therefore, this study is aiming to develop car seat fabrics using PET dope dyed filament. For this purpose, PET POY 150d/48f is made on the melt spinning machine using PET chip and master batch. And 4 kinds of optimum conditions of the spinning processes was chosen. And 12 kinds of PET ATY 600d/192f are made on air jet texturing machine according to the yarn texturing conditions such as nozzle type, over feed and yarn speed. Finally, the specimens of 48EA were prepared. The measured mechanical properties are denier, tensile properties, thermal shrinkage and loop formation. And the physical properties of PET ATY 600d/48f according to the air jet texturing conditions were analyzed and discussed.

2. EXPERIMENTAL

Table 1 shows 4 kinds of optimum conditions of the spinning processes.[1] And Table 2 and 3 shows DTY and ATY process conditions. And Table 4 shows the specimens for this analysis.

Table 1. Spinning conditions

specimens No.	Temperature (℃)	Winding speed(rpm)	opu(%)
6	288	3300	0.50
7	288	3400	0.40
19	288	3400	0.50
21	295	3200	0.50

Note: OPU : oil pick up

Table 2. DTY processing condition

Machine	D/R	1st heater temp.	2nd heater temp.	winding speed
Teijin	1.65	300~320℃	235℃	600m/min

Table 3. ATY processing conditions

Filament	Processing factors	Various processing conditions	Remark
PET 150d/48f × 4	Nozzle type	Kasen, T341, T351	
	Overfeed(%)	8, 15	
	Yarn speed(rpm)	312, 356	
Total specimen number			12

Table 4. Specimens

No.	Speed(rpm)	Overfeed(%)	Nozzle type	Air pressure(bar)
1	312	8	Kasen	9
2		8	Heberlain T341	
3		8	Heberlain T351	
4		15	Kasen	
5		15	Heberlain T341	
6		15	Heberlain T351	
7	356	8	Kasen	
8		8	Heberlain T341	
9		8	Heberlain T351	
10		15	Kasen	
11		15	Heberlain T341	
12		15	Heberlain T351	

3. MEASUREMENT

Table 5 shows test methods of physical properties of ATY.

Table 5. Test methods of physical properties

Experiment	Equipment	Standard
Yarn count	Warp reel	KS K 0416
Tensile properties	Testometric MICRO350	KS K 0412
Dry thermal shrinkage	Dry heat chamber	KS K 0215
Wet thermal shrinkage	Water bath	KS K 0215
Microphotograph	Sometech VMS	

4. RESULTS AND DISCUSSION

Fig. 1 shows denier of specimens according to ATY conditions shown in Table 3. As shown in Fig. 1, among the ATY process conditions, overfeed ratio is most effected on denier. The denier of overfeed 15% specimens shows higher values than those of overfeed

8% specimens.

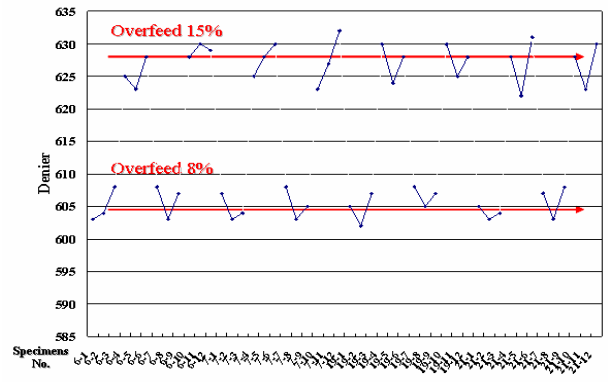


Figure 1. Denier of ATY specimens

Fig. 2 shows tenacity of specimens according to ATY process conditions. Among the process conditions, overfeed ratio is most effected on tenacity. It is shown that the lower overfeed ratio is, the higher tenacity is. This result is due to increase of the loop of ATY when overfeed is increased. Therefore, because the loop is decreased when winding speed is increased, it is shown that the higher winding speed is, the higher tenacity is.

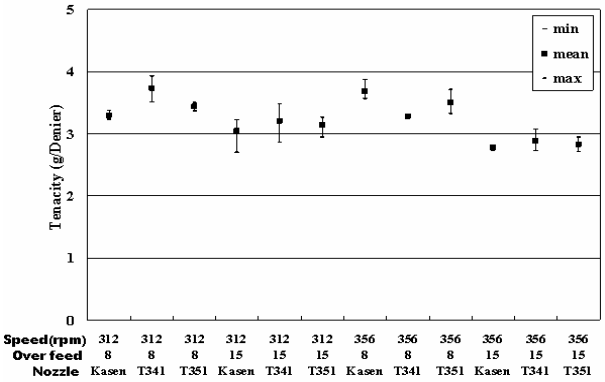


Figure 2. Tenacity according to ATY process conditions (Spinning : Temp. 288℃, speed 3400rpm, opu 0.4%)

Fig. 3 shows initial modulus of specimens according to ATY process conditions. As shown in Fig. 3, it is concluded that the lower overfeed is, the higher tenacity is because loop is increased when overfeed is decreased.

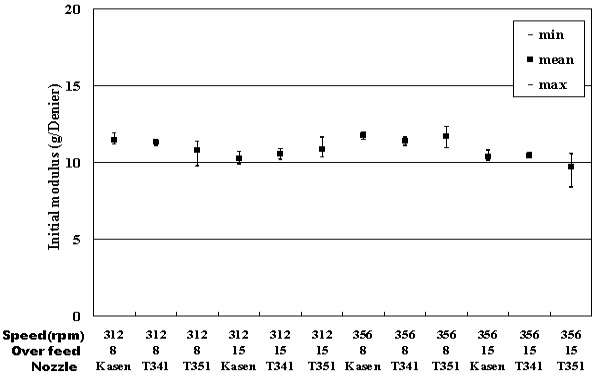


Figure 3. Initial modulus according to ATY process conditions

(Spinning : Temp. 288℃, speed 3400rpm, opu 0.4%)

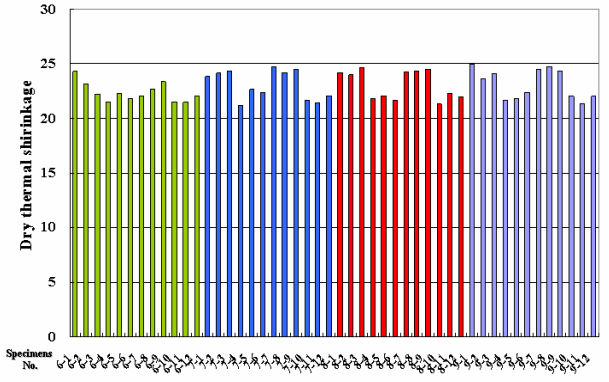
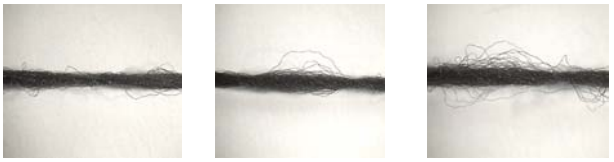


Figure 4. Dry thermal shirinkage

Fig. 4 shows the result of dry thermal shirinkage. It is shown that the higher overfeed is, the lower shirinkage is. Fig. 5 shows loop formations according to nozzle types. As a result of observation of loop formation, the specimens produced by kasen nozzle show small loop and it is estimated that the specimens will be more efficient in weaving process.



<Kasen> <T341> <T351>

Figure 5. Loop formation according to nozzle types

5. CONCLUSION

As a results of this study, it is thought that the loop occurred by ATY process was affected on the physical properties of PET ATY dope dyed yarn. So, the optimum conditions of ATY process were as following.

-. Nozzle type : Kasen nozzle
-. Over feed ratio : 8%
-. Air pressure : 9 bar
-. Yarn speed : 356rpm

6. REFERENCES

[1] Sangryong Kim, “A Study on the Physical Property of the PET Dope Yarns for Car-Seat according to the Master Batch Spinning Conditions”, Yeungnam Univ. M. S. Thesis, 2009

[2] Jiman Kang, “The Effect of the ATY processing Factors on Dimensional Stability of Awning”, Yeungnam Univ. M. S. Thesis, 2004.