아라미드 니들펀칭부직포의 형태구조와 강도특성

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Morphological Structure and Strength properties of Aramid Needlepunched Nonwovens

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1. Introduction

Recently, one of the most exciting developments in polymer science has been in the area of high performance fibers such as para and meta-typed aromatic polyamide(aramid). The fibers exhibit high of stiffness and strength due to the high level of molecular alignment achieved through the spinning of liquid crystalline solutions of inherently stiff molecules with poly(*p*-phenylene terephthalamide)(PPTA)[1]. The chain-extending bonds from each aromatic nucleus of a para-oriented molecule are parallel, while those of a meta-oriented molecule are at 120° angle to each other[2]. In this paper, we have manufactured aramid needlepunched nonwovens with different the portion ratio of para and meta-aramid staple fibers and investigated morphological structure and strength properties of aramid needlepunched nonwovens.

2. Experimental

Four different types of aramid needlepunched nonwovens were used in this study and they are listed in Table 1. The SEM(JSM-6300, JEOL Ltd., Japan) was used to observe the morphological structure of samples. The tensile and tearing properties of samples were measured by tensile tester(Instron 4467). Limiting oxygen index was measued with ASTM D 2863 method to examine the heat resistance.

Table 1. Characteristics of aramid needlepunched nonwovens

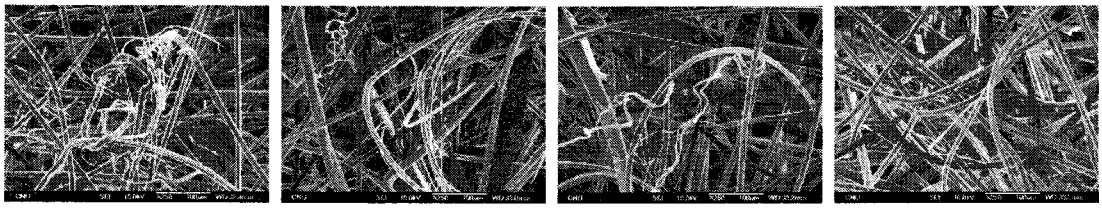
Sample ID	Portion ratio(%)		Basis weight (g/m^2)	Thickness (㎜)
	para	meta		
NP1	100	0	127.0±3.56	2.8±0.13
NP2	80	20	114.5±3.65	2.1±0.15
NP3	75	25	128.3±2.60	2.1±0.06
NP4	70	30	139.0±3.41	2.3±0.08

3. Results and discussion

3.1. Morphological structure

The surface structure of aramid needlepunched nonwovens is shown in Figure 1. The fibrillation of fiber increased with increasing para-aramid staple fiber portion. Fiber webs get

tangled by needle barb to make nonwoven fabrics.



(a) NP 1 (b) NP 2 (c) NP 3 (d) NP 4

Figure 1. SEM photographs of aramid needlepunched nonwovens(×250)

3.2. Tensile properties

As shown in the stress/strain curves of four samples with para/meta-aramid fiber portion, the tensile strength and work of rupture of sample generally increased with decreasing the para-aramid fiber portion. Due to the fibrillation on the para-aramid fiber was appeared.

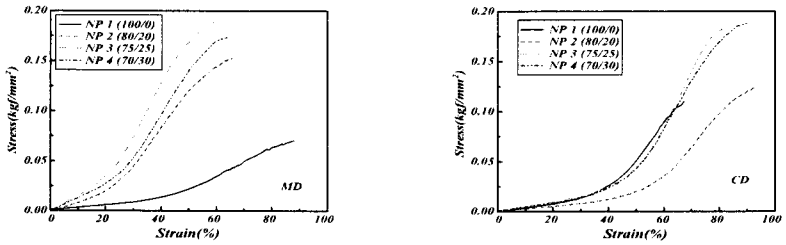


Figure 2. Stress-Strain curves of aramid needlepunched nonwovens

3.3. Limiting oxygen index

The limiting oxygen index of samples indicates the heat resistant of the nonwovens. From the Table 2, the sample with having the large portion of meta-aramid fibers showed the highest LOI value.

Table 2. Limiting oxygen index of needlepunched nonwovens

Sample ID	NP 1	NP 2	NP 3	NP 4
LOI(%)	-	32.1±0.11	32.3±0.11	33.1±0.11

4. Conclusions

In this study, the different portion of para and meta-aramid fibers have successfully manufactured the needle punched nonwovens. As result of morphological structure, the fibrillation degree of composed web increased with increasing the para-aramid fiber portion. And the increase of meta-aramid fiber portion was showed the largest LOI and highest tensile strength of samples.

Acknowledgement

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