PEL 멜트블로운 부직포의 제조와 탄성회복 메카니즘

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Fabrication of PEL Meltblown Nonwovens and Their Elastic Recovery

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1. Introduction

The high modulus and strain of raw material resources attract the attention of many researchers because they have potential possibility to substitute traditional products[1]. The high modulus and strain material such as thermoplastic polyurethane and elastomer have been extensively used because their outstanding physical properties and high versatility[1].

In the nonwoven industry, meltblown(MB) process was introduced in 1954 and it has became an important industrial technique because this process produces microfiber structure which is suitable for many applications in industrial fields[2]. But PEL(polyester elastomer) do not generally use the meltblown process in contrast with TPU(Thermoplastic polyurethane).

In our study, we make the PEL meltblown nonwoven and investigate the morphological structures and tensile properties. Also, we compare the elastic recovery mechanism of PEL and TPU meltblown nonwovens.

2. Experimental

Table 1 is processing conditions of MB nonwovens which use TPU and PEL resin. Spinning temperature, DCD, air temperature and air pressures were well controlled with determined optimum production conditions in our research.

Table 1. Producing conditions of meltblown nonwovens.

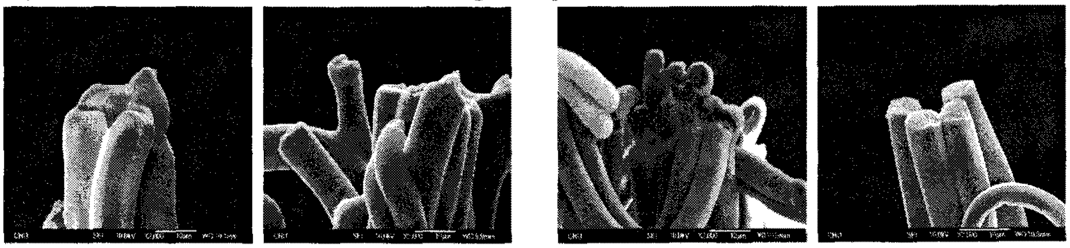
Sample ID	Resin	Spinning temperature (°C)	Air temperature (°C)	Air pressure (PSI)	DCD
A	TPU	240	240	6	25
B	PEL	285	285		20

The MB nonwovens were manufactured with side by side type. The morphological structure of samples were observed by scanning electron microscope(JSM-6300F, JEOL) and fiber diameters were measured by image analyzing software(IT PRO 3.0, Sometech). The tensile properties and elastic recoveries of samples carried out by tensile test machine(Instron 4467) with ASTM D4632 and ASTM D5459 methods.

3. Results and discussions

3.1. Morphological structure

Figure 1 shows breaking areas of meltblown nonwovens. PEL meltblown nonwoven has a larger diameter than TPU meltblown nonwoven and breaking behavior of PEL was slow. But TPU meltblown nonwoven has larger density of bonded areas than PEL sample. In breaking area, constituted fibers has longer extension time than TPU samples. It suggested that TPU nonwoven has high initial modulus and it also has strong strength.

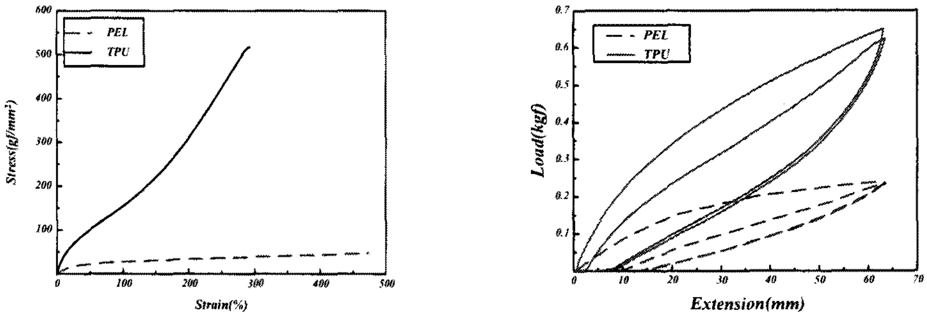


(a) (b)

Figure 1. SEM images of breaking areas(a : PEL, b : TPU)

3.2 Tensile properties and elastic recovery

Figure 2 shows the stress-strain responses of samples. TPU sample has higher strength and initial modulus than PEL smaple. But the breaking strain of TPU sample has lower than PEL meltblown nonwoven. In Figure 2-(b), elastic recovery of PEL higher than TPU sample about 4 times.



(a) (b)

Figure 2. S-S curves and elastic recovery of meltblown nonwovens
(a : S-S curve, b : elastic recovery)

4. Conclusions

We produce PEL meltblown nonwoven successfully and average fiber diameter is observed about 10μm. Although PEL meltblown nonwoven has smaller strength than TPU sample, PEL nonwoven has about 500% breaking strain and outstanding elastic recovery. Therefore PEL meltblown nonwoven is widely used in medical and industrial application because of their high breaking strain and outstanding elastic recovery.

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Reference

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