전기방사된 나노섬유의 Pattern 연구

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Pattern of polymer nanofibers produced by electrospinning

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1. Introduction

In recent years, interest in electrospinning has been quickly increased, because electrospinning is a process capable of making polymer fibers in the range of nano to a few microns diameters[1,2]. The electrospinning was patented by Formhals in 1934[2] and most of studies reported on the subject of electrospinning have been focused on its phenomena[3] and on processing parameters[4-5].

Generally, electrospun web is of white color. The preparation of the patterned web seems to occur as using patterned collector in electrospinning. The objective of this study is that electrospinning can directly prepare the patterned web with light and shade. The basic principle is to make use of the electric potential difference of a collector surface. The patterning of the electrospun web is proposed in detail.

2. Materials and Method

Poly(ε -caprolactone) (PCL) with number average molecular weight, Mn = 80,000, was purchased from Aldrich (Milwaukee, USA). This material was dissolved in the mixture of methylene chloride (MC) and *N, N*-dimethylformamide (DMF) (85/15, v/v) at room temperature to a fixed weight concentration of 13 %. All chemicals were used without further purification. The polymer solution was poured in a 5 ml syringe attached to a capillary tip of 1 mm diameter. The copper wire connected to an anode was inserted into the polymer solution and a cathode was attached to a grounded collector. The distance between the capillary tip and collector, and the applied voltage are 12 cm and 15 kV, respectively.

3. Results and Discussion

Poly(ε -caprolactone) (PCL) was dissolved in the mixture of 85% MC and 15% DMF (v/v) to form the solution. Although DMF is a non-solvent for PCL, it is a great help to electrospinning, because it has a high dielectric constant and dipole moment and randomly dissociated positive and negative in solution[3]. Various patterns electrospun web were successfully prepared as using the patterned collector and their properties are characterized by a scanning electron micrometry (SEM) and an atomic force microscope (AFM). As the results, some of these patterned electrospun web is

shown in Figure 1.

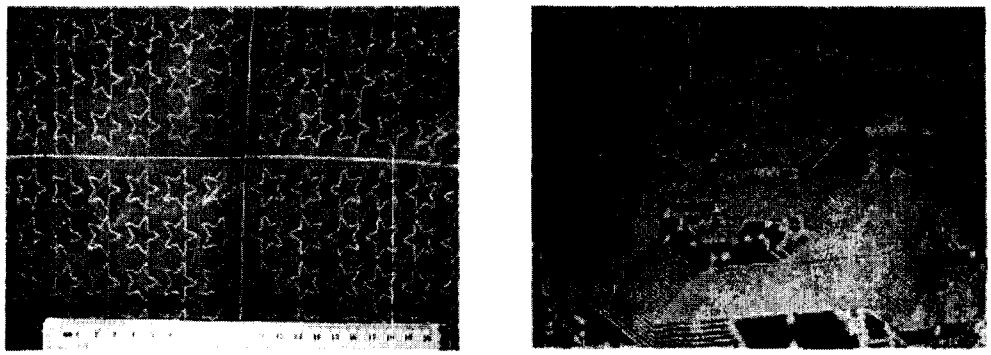

Fig. 1. Photographs of the patterned web electrospun onto A) scratched film, B) substrate.

Insulator scratched or shaped intentionally on the surface of polymeric thin film with depth of 0.1 ~ 10 ㎛ or substrate is attached to the metallic collector. This result induces an electric potential difference. Polymer fibers deposits randomly by means of the electric potential difference on the collector in the form of layered web during electrospinning. The higher an electric potential area, the more fibers deposited. Consequently, electrospun web have distinctively patterned shape.

4. Conclusions

Various patterned web could be prepared as controlling a patterned material on the surface of collector. Therefore it is of interest for a wide range of applications for decoration. This study has opened the feasibility to form interesting electrospun web with a nice-looking decoration.

5. References

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