

# Fabrication of Polymer Nanofibers using Electrospinning

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**Key Words :** Electrospinning( ), Nanofiber( ), Electrospun fiber( )

### Abstract

Polymeric fibers with nanometer-scale diameters are produced by electrospinning. When the electrical forces at the surface of a polymer solution or melt overcome the surface tension then electrospinning occurs. Polyethylene oxide (PEO), Polycarbonate have been electrospun in our laboratory. Electrospun fibers are observed by optical microscopy or scanning electron microscopy. The average diameters of the electrospun fibers range from 300 nm to 30 nm when the electric field strength increasing from 1 kV/cm to 3 kV/cm. The average diameters of the electrospun fibers range from 200 nm to 30 nm when the concentration decreasing from 10 wt% to 4 wt%.

1. 가 가 .<sup>(1)</sup> Fig. 1

1.1

가 , 가  
nm μm 가

(electrospinning)

가

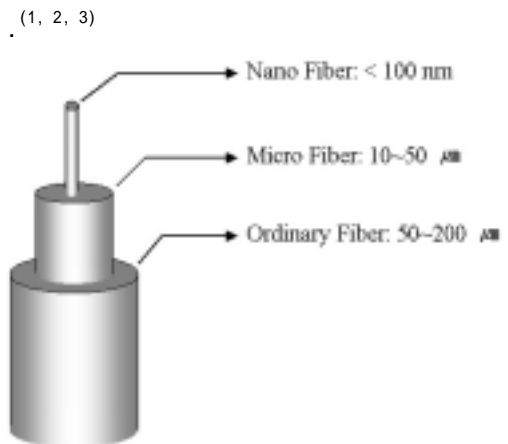


Fig. 1 Classification by fiber diameter<sup>(4)</sup>

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1.2 (electrospinning)  
1795 Bose

( ) 10 mA, 0~50 kV  
가 . (SEM : Hitachi, S-4200)  
가 (IMT, IMT2000)

(4) Fig. 2

2.2  
가

jet 가 . jet 가  
가 jet  
jet 가  
(1, 5) 가 가 jet 가  
splaying 가 jet Fig 3  
whipping jet 가  
pipette 가  
가 가  
가

20 , 50%  
0.5 mm pipette 가  
pipette 5 15 cm  
가  
30 cm steel aluminum foil (3)

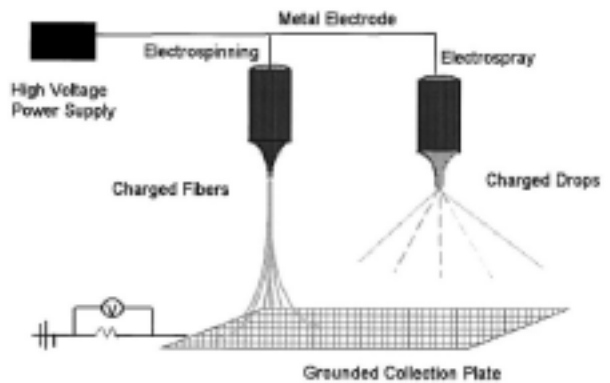


Fig. 2 Schematic diagram of the electrospinning and electro spray processes<sup>(5)</sup>

2.

2.1

Polyethylene oxide(PEO: Sigma Aldrich, 200,000) Polycarbonate Pellet(PC: Bayer, Makrolon2858) Tetrahydrofuran(THF: Junsei), Dimethylformamide(DMF: Junsei) . PEO

2~10 wt%  
PC THF DMF 6:4  
13~18 wt%  
가

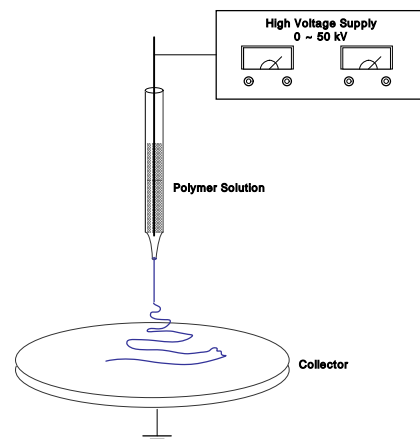


Fig. 3 A schematic of the electrospinning process

3. Nanofibers

3.1 Nanofibers

가 , 가  
 Fig. 4 PC  
 가 (Bead)  
 jet 가 가 가  
 가 가 가  
 가 가 jet  
 4.  
 4.1 가 PEO  
 10 wt%  
 10 cm  
 가 0 kV 가  
 jet

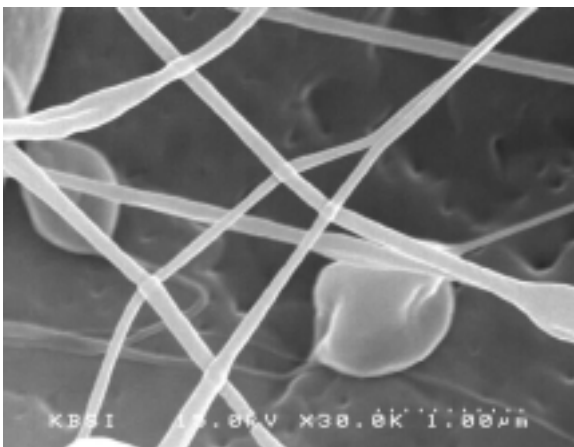
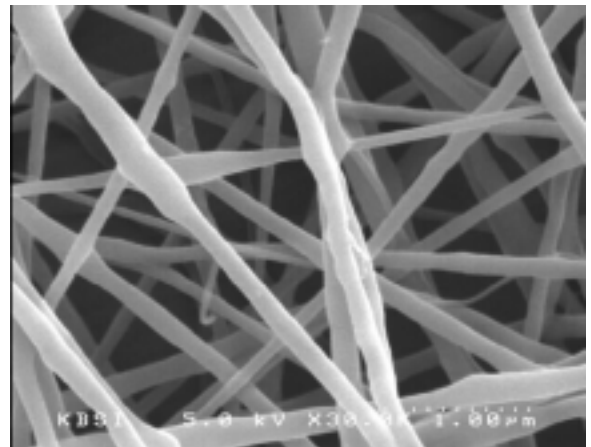


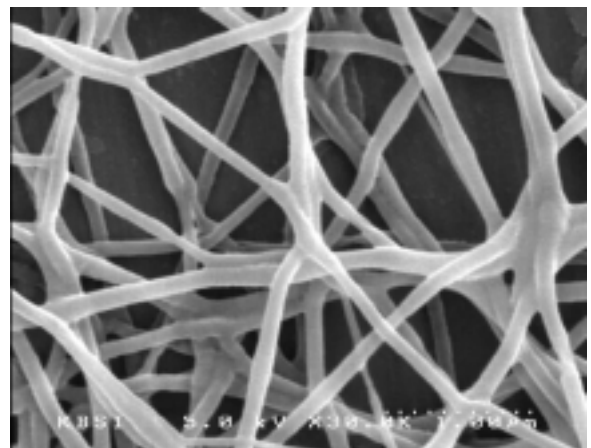
Fig. 4 Scanning electron microscopy micrograph of the polycarbonate fibers(3 kV/cm, 14 wt%)



(a) Electric field strength 1 kV/cm



(b) Electric field strength 2 kV/cm



(c) Electric field strength 3 kV/cm

Fig. 5 The Scanning electron microscopy micrographs of the electrospun fibers from a 10 wt% PEO solution dissolved in water as a function of applied electric field strength

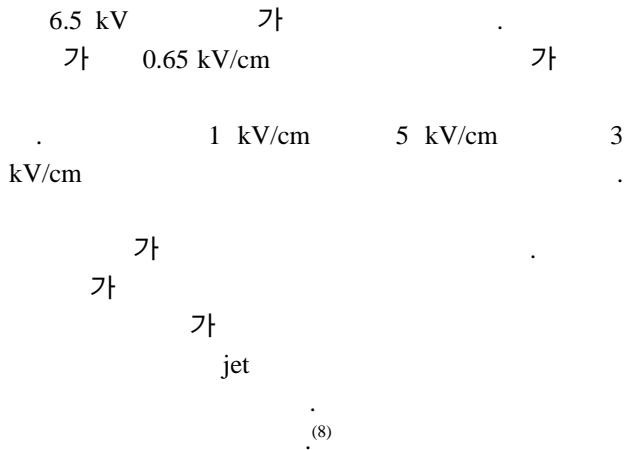


Fig. 5

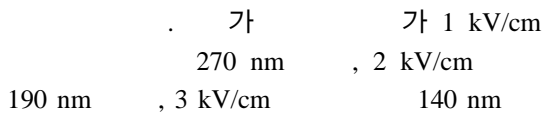
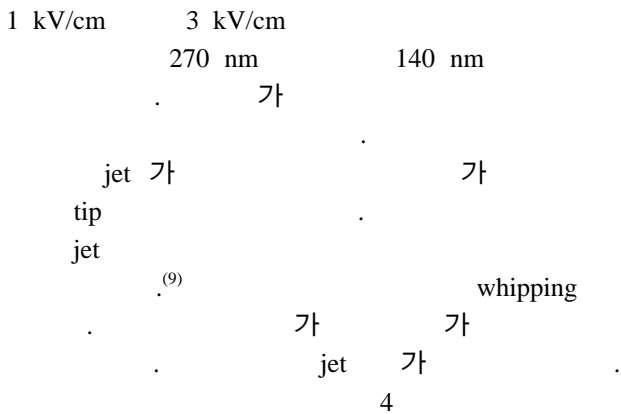


Fig. 6



(9)

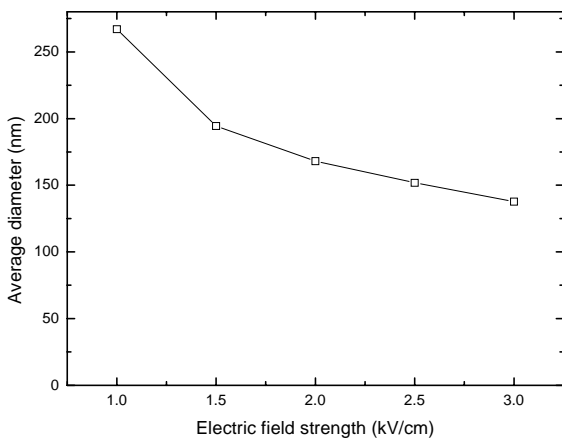


Fig. 6 The average diameters of the PEO 10 wt% electrospun fibers as a function of applied electric field strength increases

5.

5.1

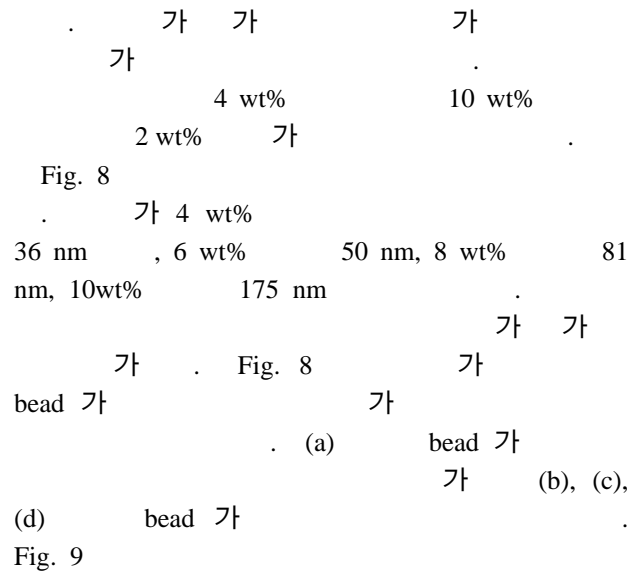


Fig. 8

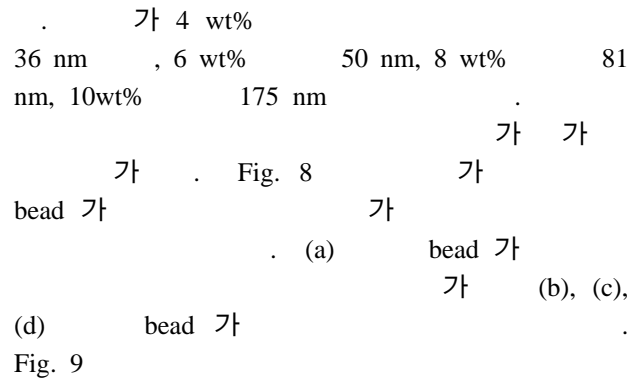
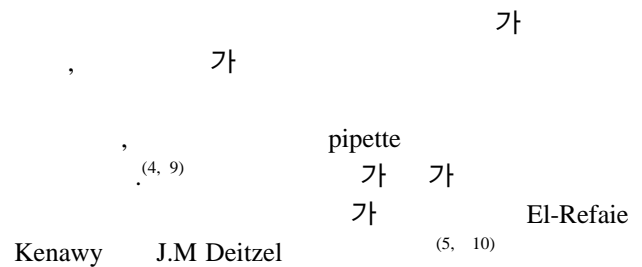


Fig. 9



Kenawy J.M Deitzel

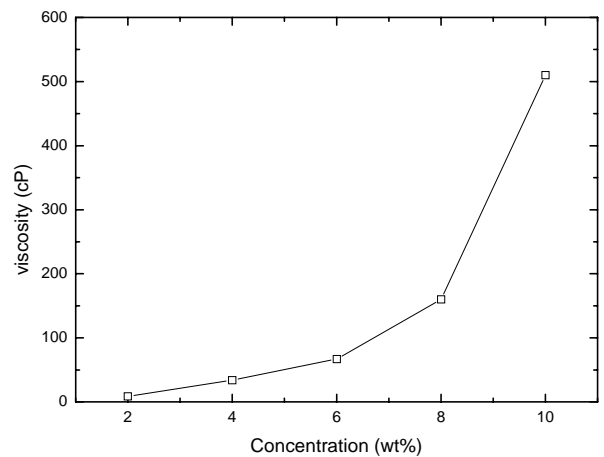
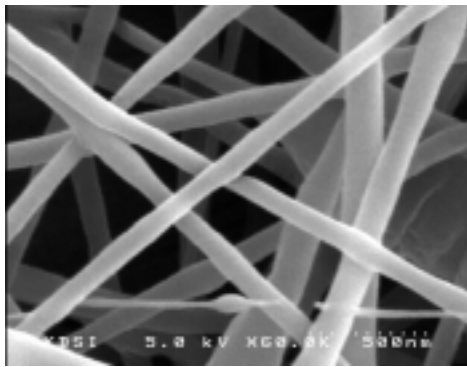
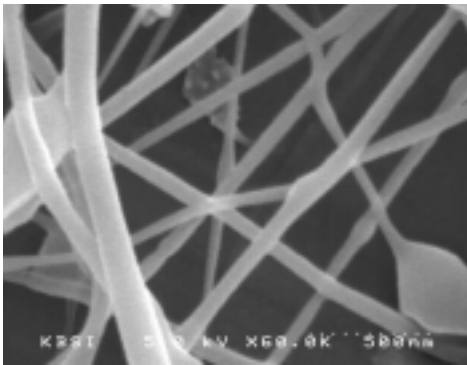


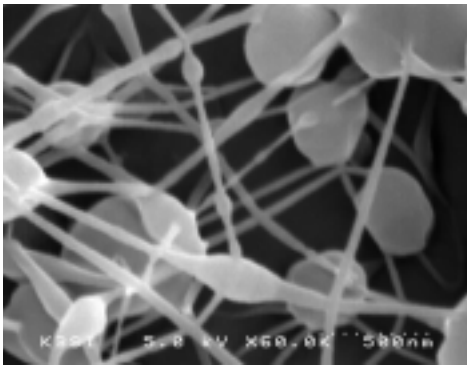
Fig. 7 The change of viscosities as a variation of concentration



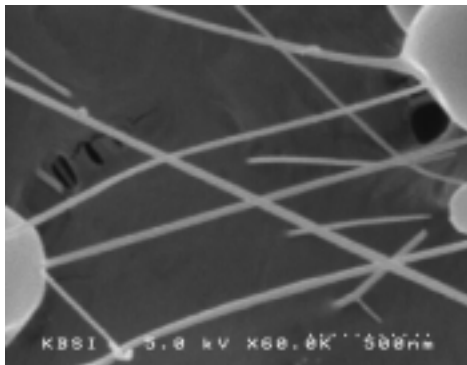
(a) Concentrations 10 wt%



(d) Concentrations 8 wt%

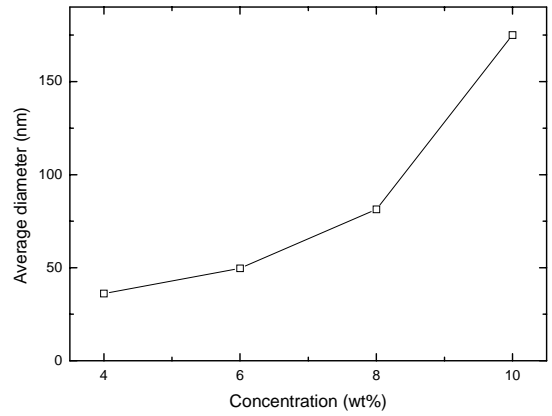


(e) Concentrations 6 wt%



(f) Concentrations 4 wt%

**Fig. 8** The Scanning electron microscopy micrographs of the electrospun fibers as a function of concentration at 2 kV/cm



**Fig. 9** The average diameters of the electrospun fibers as a function of concentration

6.

가 , 가 , 가

(1) PEO ( ) 10 wt% 30 kV/cm 가

100 nm PC (THF:DMF=6:4) 30 kV/cm 가

14 wt% 110 nm 가

PC 가 1 kV/cm 3 kV/cm

300 nm 100 nm

가 가

(3) 가 4 wt%

10 wt% 가

30 nm 200 nm

가 가

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