Microsc. Microanal. 8 (Suppl. 2), 2002
DOI 10.1017.S1431927602103254



# MICROSTRUCTURES OF ELECTROSPUN POLYCARBONATE FIBERS WITH SOLVENT MIXTURE THF AND DMF BY SEM /TEM

J. Shawon and C. Sung

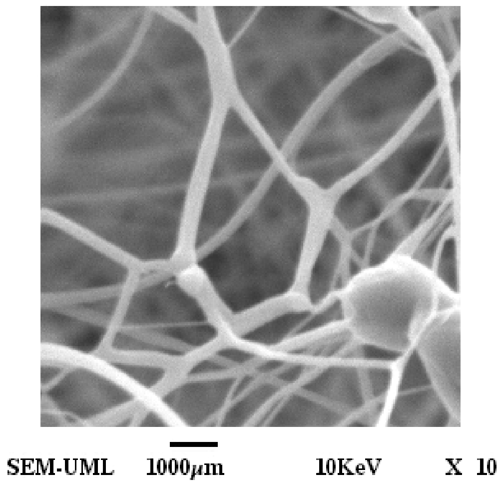
*Department of Chemical and Nuclear Engineering, Center for Advanced Materials, University of Massachusetts, Lowell, MA 01854.

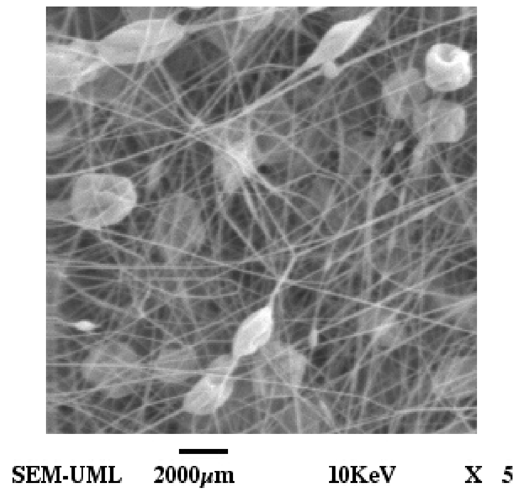
Electrospinning or electrostatic fiber spinning is a dominating process over all conventional spinning methods due to the capability of producing fibers consistently in the sub-micron to nanoscale. This novel process also promises to produce fibers with large surface area as well as small pore size for versatile uses. The electrospinning process is carried out by polycarbonate pellet (sample) with mixtures of solvents THF (Tetrahydrofuran) and DMF (Dimethyleformamide) at various ratios (like 60:40, 70:30 etc.). The solutions were prepared with 13% and 14% concentrated polycarbonate at various ratios of THF and DMF at 50-55$^{o}$C temperatures. The basic process of electrospinning is simple to implement. An electrode connected to a high voltage power supply (10-25 kV) was inserted into the polymer solution contained within a capillary tube. The collector screen (SEM stud, and TEM copper mesh grid on aluminum foil) was placed at a distance of 10 to 12 cm from the tip of the capillary tube.

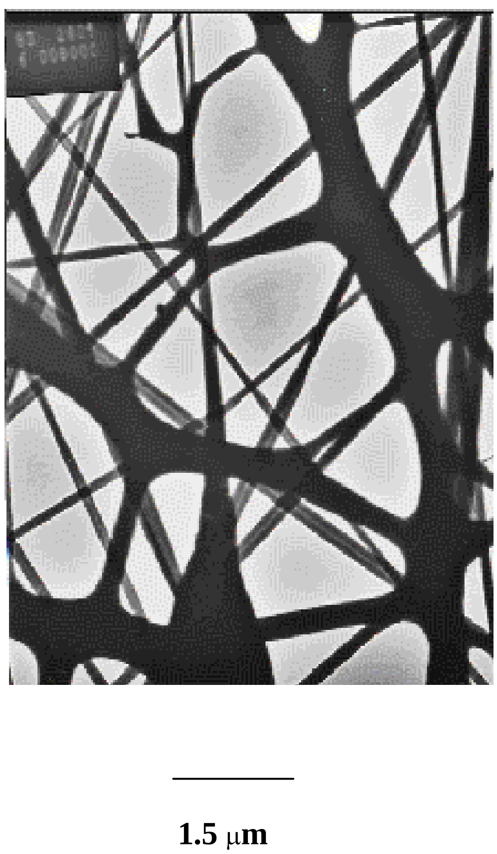
The electrospun fibers on the desired collector were then observed by SEM and TEM. The spun fibers have the characteristics of strong bonding with each other. The feature of the fibers is like the spider web. It is observed that with low concentration of THF (like 60%) and low electric potential, the fibers could not generate a well-defined network. However as the concentration of THF and the kV are increased, the spider web like samples are made.

The goal is to characterize the polycarbonate fibers by electrospinning and define a model of nanofibers (<100nm) with long length. The solvent mixture has a massive role on the morphology of the fibers. The spun fibers with 14% concentrated polycarbonate with THF: DMF at 70:30 at 25kV have the characteristics of short length as well as of strong networking between each other (FIG.1). The reason behind this characteristic is splaying. 'Splaying' is related to the evaporation of solvents; it can be predicted that the difference of vapor pressure between THF (2150 Pa at 25$^{o}$ C) and DMF (945 Pa at 25$^{o}$ C) was high at the ratio of 70:30. The prediction has become stronger when the fibers were spun at 14% concentrated polycarbonate at 25kV with different ratio of THF and DMF of 60:40 (FIG 2). The fibers do not possess the strong networking characteristics while the fiber length was long. Moreover the bead shape also shows different feature in these two conditions. With 60:40 ratios (FIG 4), the bead shape is like globule mushroom, but with 70: 30 ratios (FIG 3), the beads reveal the shape of more like spindle.

References:
1. Y.M.Shin et al., Journal of Polymer 42 (2001) 9955-9967
2. J.M. Deitzel et al., Journal of Polymer 42 (2001) 261-272



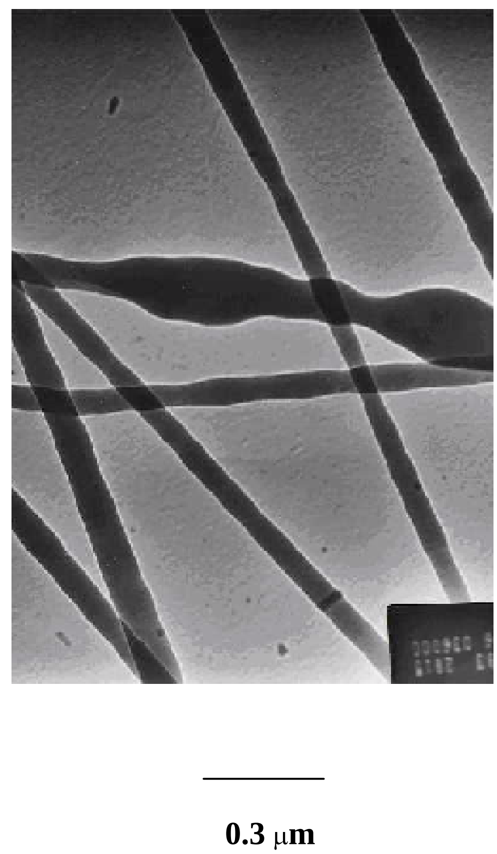




FIG. 1: SEM image of electrospun14% concentrated polycarbonate fiber with solvent ratio THF: DMF (70:30) at 25 kV.
FIG.2: SEM image of electrospun14% concentrated polycarbonate fiber with solvent ratio THF: DMF (60:40) at 25 kV.
FIG.3: TEM image of same fibers of FIG.1.
FIG.4: TEM image of same fibers of FIG.2.

https://doi.org/10.1017/S1431927602103254 Published online by Cambridge University Press