

PREPARATION AND CHARACTERISTICS OF PITCH BASED SUPERFINE FIBER

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Introduction

The nano carbon materials are regarded as a good energy storage material and their other usage is being extended at various applications. The typical nano carbon materials are manufactured by vapor grown method from hydrocarbon gas as a precursor. The chemical vapor deposition and the arc discharge methods are included in these cases. But the control of physical characteristic of product is relatively delicate comparing with preparation method of conventional carbon materials.

By using electrospinning method, it is possible to prepare nano fiber from polymers. But rheological property of pitch is different from that of polymers, in case of electrospinning of pitch, various environmental parameters must be controlled carefully. In this study, in order to prepare nano scale carbon material, NCB(Naphtha cracking bottom) oil based isotropic petroleum pitch was spun by electrospinning method and fibers were thermal stabilized and carbonized. The superfine pitch fiber was prepared by both of the solvent electrospinning and the direct melt electrospinning method.

Experimental

The precursor pitch used in this study was N₂ blown NCB oil based isotropic pitch which softening point is 258°C and dimethylfuran soluble part was removed before spinning. At the solvent electrospinning, THF and quinoline were used as solvent with various mixing ratio. High voltage DC power generator which could adjust in the range of 0~60,000V and 2mA maximum current was used to supply electrostatic force. At the solvent electrospinning, solvent mixing ratio and pitch concentration, voltage and spinning distance were varied and their influences were investigated. Electrospun pitch fibers were thermal stabilized and carbonized and each fiber was observed by high resolution SEM. Melt electrospinning was also attempted with apparatus which was described on figure 1.

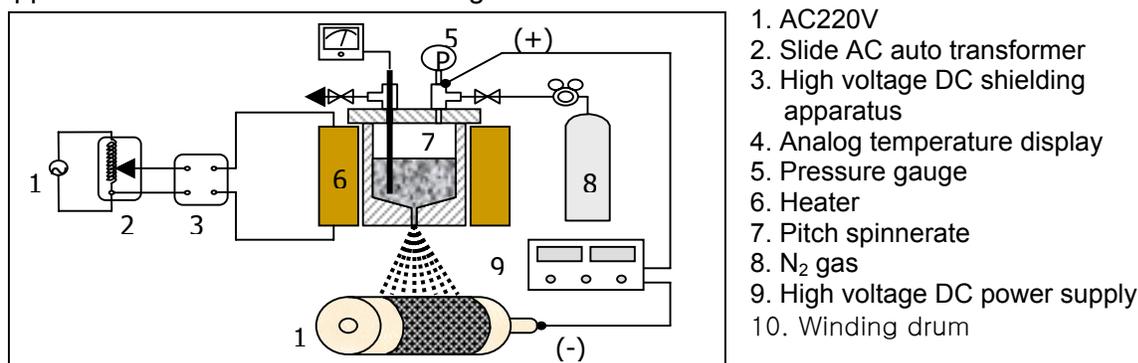


Figure 1. Schematic diagram of pitch melt electrospinning apparatus

Results and Discussion

NCB based isotropic pitch which softening point is 258°C was solved with THF and quinoline and spun by electrospinning method. The pitch spinnerability became better with the quinoline

concentration increased. This seemed to be closely related to volatility and viscosity of pitch. But when quinoline concentration was too high then spun fiber was coherent each other because of volatility of quinoline is relatively low. The superfine fibers that have less than 1 micrometer in diameter could be prepared by solvent and melt electrospinning method from petroleum based pitch. By the solvent electrospinning method, nano scale pitch fiber that is 258nm in diameter could be obtained and the superfine carbon fiber also obtained by typical stabilization and carbonization heat treatments. Figure 2 shows HRSEM images of solvent and melt electrospun pitch fiber and carbonized fibers.

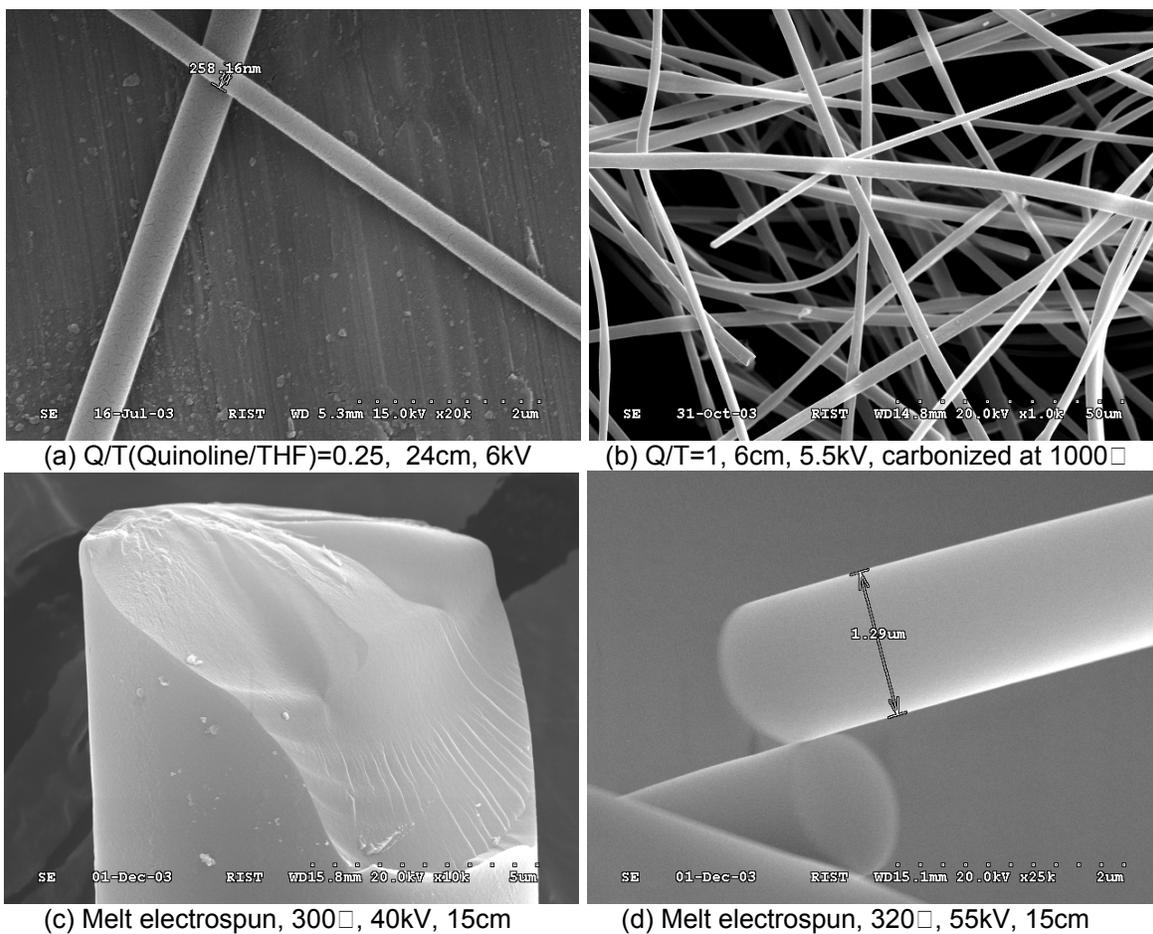


Figure 2. HRSEM images of electrospun pitch fiber

Conclusions

The superfine pitch fibers could be prepared by solvent and melt electrospinning method. The superfine carbon also obtained by typical stabilization and carbonization heat treatments. If some environmental parameters are controlled very carefully, reproducibility will be increased and to manufacture superfine pitch fiber homogeneously and continuously is possible. The further study must be carried on to find out these parameters.

References

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