POSTER

Characterization of Coal-Tar Pitch during the Carbonization

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INTRODUCTION

A great deal of study has been conducted to the investigate the suitability of pitches as matrix precursor for carbon-carbon composites. The aim is to realize the advantages of high carbon yield and ease of graphitizability characteristic of the pitch to achieve lower processing cost[1].

On the carbonization of the carbon-carbon composites, aromatic polymerization drives the majority of pitches through a liquid crystalline state known as the mesophase in which the graphitizability of the coke is estabilished by parallel alignment of the large aromatic molecules [2,3,4,5]. The mesophase structure may be considered as the "embryonic graphite".

Therefore, the development of the microstructure of the carbon composites influenced the density increase and thermomechanical properties.

EXPERIMENTAL

The coal-tar pitch obtained from the Jung Woo Chemical Co. in Korea. Mesophase was prepared from the parent pitch whose basic characteristics are given in Table 1. To know the changes of pitch during the carbon-carbon composite manufacturing, mesophase pitches were formed under similar conditions. Under N_2 gas flow, 100g of pitch were heated with a heating rate of 2℃/min to 250℃, and then held 90 min to remove the lower molecular weight compounds. The pitch was heated continuously with a heating rate of 1.6℃/min to 400℃ or 450℃, and held various times. Various techniques, including CHN analysis, softening temperature and rheology, were used to monitor the changes for the characterization of mesophase pitches.

RESULTS AND DISCUSSION

Table 1 shows the characteristics of the coal-tar pitch. The coal-tar pitch used for this study has a C/H ratio of 1.65 and has a softening point of 116℃.

Table 2 shows the changes of density after various heat treatment. The densities were increased due to formation of mesophase pitch after heat treatment.

Changes of the softening point and C/H ratio after heat treatment were shown in Table 3. The softening points of mesophases B and C were 207℃ and 325℃, respectively. However, no softening point was shown in mesophase D. This phenomenon was considered too high molecular weight distribution in mesophase. Mesophase pitches were higher in C/H ratio than that of parent pitch. The value of C/H ratio was dependent in soaking time and temperature. Mesophase C in higher temperature has lower C/H ratio than that of mesophase B due to the soaking time dependency of the mesophase pitch.

Figure 1 shows the apparent viscosities of samples A and B. The viscosities were measured at SP+30℃. The apparent viscosities of the samples decreased with increasing shear rate which is said to be pseudoplastic (shear-thinning) behavior.

CONCLUSIONS

The mesophase formation was controlled by temperature and time. However, long soaking times at lower temperature were more important for matrix impregnation than shorter times at higher temperature in carbon-carbon composites.

REFERENCES

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Table 1. Basic characteristics of raw pitch.

Density (g/㎤)	Softening point(℃)	QI (W/O)	BI (W/O)	C (%)	H (W/O)	O (W/O)	N (W/O)	S (W/O)	C/H ratio
1.27	116	5.46	27.47	92.5	4.67	1.27	1.10	0.46	1.65

Table 2. Changes of density.

Sample	Heat Treatment	Apparent Density
A	As-Received	1.27
B	400℃/120min	1.30
C	450℃/60min	1.33
D	450℃/90min	1.33

Table 3. Changes of softening point and C/H ratio.

Sample	SP (℃)	C/H ratio
A	116	1.65
B	207	2.26
C	325	2.20
D	No softened	2.34

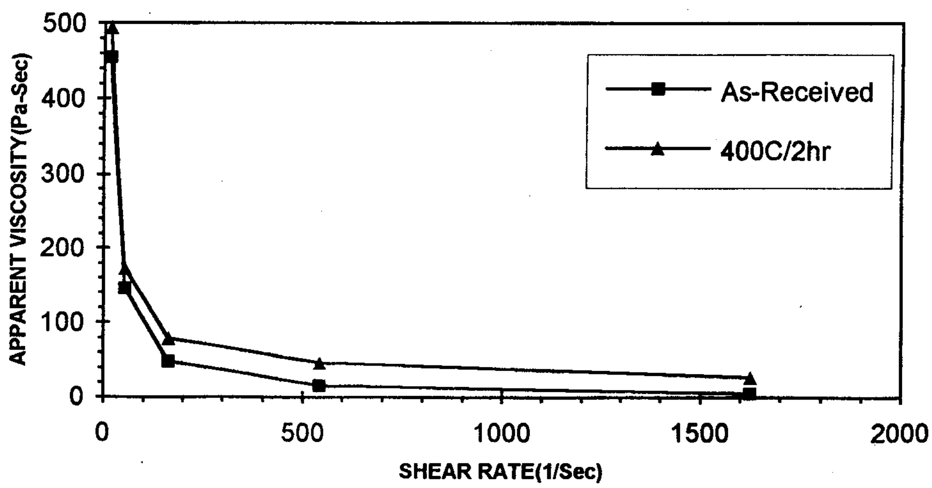

Figure 1. Viscosity of as-received and heat treated (400℃/2hrs) pitches at SP+30℃.