INFLUENCE OF SOLVENT FRACTIONS ON VISCOSITY OF MODIFIED PITCHES

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Introduction

One of the important purposes of pitch modification is to improve its fluidity and carbonization, so as to get modified pitches with lower viscosity and higher coke yield. However, up to now, we still do not know exactly how the pitch properties of fluidity and carbonization are both influenced by other factors, and how we can control the process easily to result in modified pitches with properties we expected. In order to solve the problems effectively, it is essential to reveal the relationships between pitch molecular composition and pitch properties of fluidity and carbonization. Here we report the results of a study directed toward investigating the influences of solvent fractions on pitch viscosity.

Experimental

Modified pitches were prepared by heat treatment of one commercial coal tar pitch (S.P.:68,C.Y.:43.01%, TS:77.0%,TI-PS:12.1%,PI:10.9%) under different conditions (reaction temperature:380-430 ℃ , soaking time:6-15h, and autogenous pressure:0-1.0Mp) in a stainless steel reactor. The softening points of modified pitches were determined using a ring ball method. The coke yields of modified pitches were determined from the weight change of a porcelain crucible with about 1g pitches in it, which was carbonized without air and under 550℃ for two hours(GB8727-88).

About 5g modified pitch was put into 100ml toluene, then heated to 65℃ and stirred for four hours to give the toluene soluble fraction(TS); then the toluene insoluble fraction(TI) was stirred in 65℃ pyridine (every 1g TI fraction used 20ml pyridine) for four hours to give the toluene insoluble and pyridine soluble fraction(TI-PS) and pyridine insoluble fraction(PI).

Apparent viscosity of modified pitches was measured using a commercial viscometer(NXS-31) at 300℃ and 50r/min .

Results and Discussion

Figure1 shows the logarithm of viscosity as a function of TS fraction content for the modified pitches. The logarithm of viscosity of modified pitches decrease greatly with the increase of TS fraction content, and they have good linear relationships. So a proper TS fraction content is important to ensure good fluidity of modified pitch.

The logarithm of viscosity of modified pitches as a function of PI fraction content is given in figure2. The logarithm of viscosity increases linearly with the raise of PI fraction content. Therefore, a relatively lower PI fraction content is needed to keep a modified pitch of good fluidity.

Influences of the ratio of TS fraction content to PI fraction content on the viscosity of modified pitches plotted in figure3. With the increase of the ratio values of TS fraction to PI fraction (TS/PI), the logarithm of viscosity decreases gradually through a kind of power function curve. Meanwhile, analogous curves can be observed in the relationships of TS/PI with coke yields (figure4) and TS/PI with softening points of modified pitches (figure5). As the TS/PI values raise gradually, the softening points of modified pitches decrease along one power function curve and the coke yields of modified pitches reduce by another power function curve as well. So, an appropriate TS/PI value should be considered to gain a modified pitch with both lower viscosity and higher coke yield.

Conclusions

In the process of pitch modification, TS fraction and PI fraction content are very important to pitch viscosity and coke yield as well. Both of TS fraction and PI fraction content of pitches have good linear relationships with the logarithm of viscosity of pitches. The proper proportions of TS and PI fractions are essential to ensure lower viscosity and higher coke yields of modified pitches.

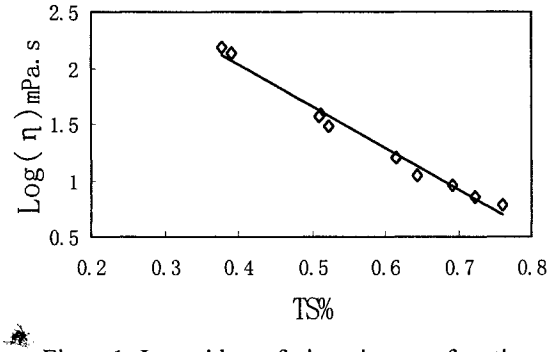

Figure1: Logarithm of viscosity as a function of TS content.

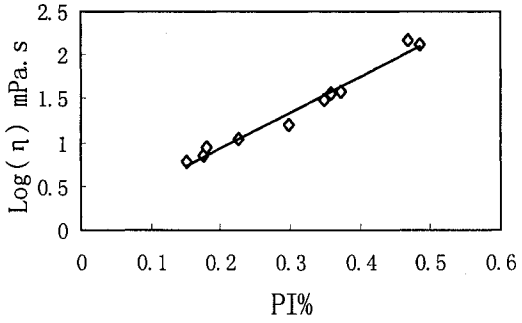

Figure2: Logarithm of viscosity as a function of PI content.

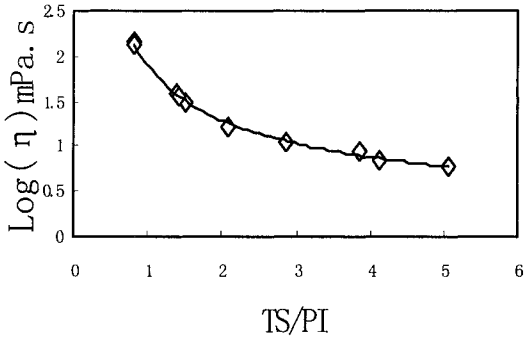

Figure3: Logarithm of viscosity as a function of the ratio of TS to PI fraction.

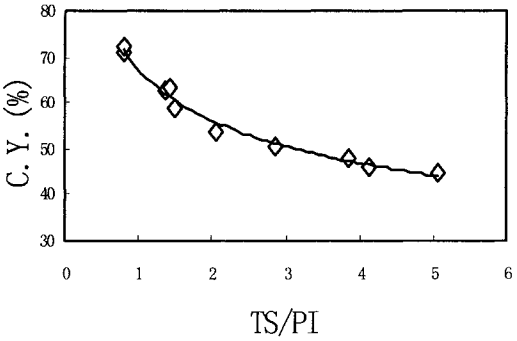

Figure4: Coke yields of modified pitches as a function of ratio of TS to PI fraction.

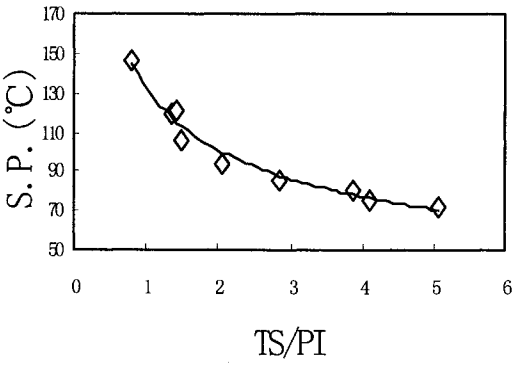

Figure5: Soft point of modified pitches as a function of ratio of TS to PI fraction.