INFLUENCE OF CONTENT OF COHERENT AGENT ON THE PROPERTY OF CARBON FIBER REINFORCED CARBON COMPOSITE

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Introduction

Carbon fiber reinforced carbon composites (CFRC) has been widely used in many fields due to their excellent mechanical properties, chemical stability and physiological compatibility[1-5].

In this work, CFRC composed of PAN-based carbon fiber, petroleum coke and coal tar pitch was prepared by hot pressing. The effect of the content of coal tar pitch which acted as coherent agent on the mechanical properties of CFRC was investigated. The morphology of the fractured surface of CFRC was also observed by SEM.

Experimental

Petroleum coke and coal tar pitch were ground together in a ball mill. Chopped (with length of 8-10 mm) PAN-based carbon fiber was blended with the mixed powder. And then the mixture was graphitized at 2500 ℃ in a hot pressing mould under pressure of 20Mpa. The density, porosity, bending strength, compressive strength were tested.

Results and Discussion

Some properties of CFRC prepared with various contents of coal tar pitch were summarized in Table 1. The density of CFRC slightly decreased with the increasing of coal tar pitch content, while the porosity increased. High content of coherent agent are favorable to both bending and compressive strength of CFRC. The density and porosity certainly decreased and increased respectively with the increasing of the coherent agent amount. Polycondensation reaction took place for coal tar pitch during graphitization. Volatile in coal tar pitch was removed during reaction[6,7,8], leaving pores in the resultant CFRC, and lowing its density. The scanning electron micrographs revealed that much more coke particles acting as so-called "coke-bridge"[8] existed among fibers in CFRC prepared with high content of coal tar pitch, thus, enhanced the combination between fiber and coke. Furthermore, the fight combination minimized the probability of the "pull-out" of fibers and avoided the quick spread of crack when CFRC was destroyed. All of these resulted in high bending and compressive strength of CFRC.

Figures 1-2 show the fractured surface of CFRC prepared with 15wt% and 30wt% of coal tar pitch respectively. Much more coke particles adhered to carbon fibers in CFRC prepared with high content of coal tar pitch.

References

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Table 1 Mechanical properties of SCFRC

number	1	2	3	4
carbon fiber (wt%)	10	10	10	10
petroleum pitch coke (wt%)	75	70	65	60
coal tar pitch (wt%)	15	20	25	30
density (g/cm^3)	1.88	1.83	1.81	1.79
porosity (%)	12.60	13.37	13.85	14.06
bending strength (MPa)	18.3	25.6	27.5	33.5
compressive strength (MPa)	33.9	42.4	52.3	60.2

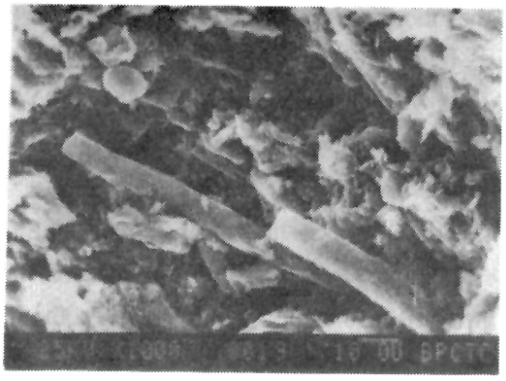

Fig.1, The scanning electron micrograph of the CFRC prepared with 15wt% of coal tar pitch

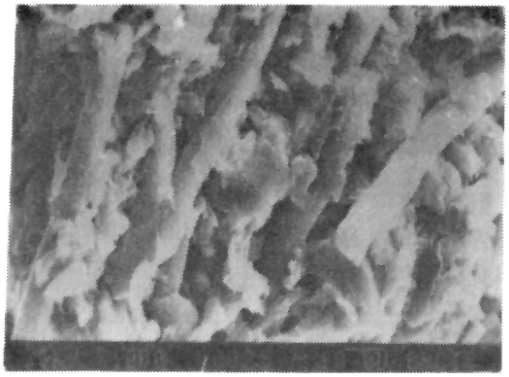

Fig.2, The scanning electron micrograph of the CFRC prepared with 30wt% of coal tar pitch.