THE ACTION PROMOTING GRAPHITIZATION FOR BORON DUING THE HIGH HEAT TREATMENT OF PAN—BASED CARBON FIBER

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Introduction

Catalytic graphitization of carbon has been studied by some researchers[1-3]. It can accelerate graphitization process, and decrease graphitization temperature. It has been reported boron to be an effective catalyst, but an effective method of boron doping is still not found. In this work the method of emulsion-coating for doping boron to promote graphitization is investigated.

Experimental

The carbon fibers used in this study are HTA-3K produced by Toho Rayon company. First the CF removed sizing impregnated in boride emulsion for several minutes, and dry at 120℃ for 1hr. Then the CF impregnated are heated in temperature range 1900℃~2500℃. The tensile strength and modulus are examined with Instron 1121 tester. The crystallite parameter was characterized using a Rigaku D/Max-2400 X-ray diffractometer with CuK_a radiation.

Results and Discussion

Effect of HTT on Mechanic Properties of CF Boron-Treated Fig 1 and Fig 2 show that the tensile modulus and strength of boron-treated are larger than those of untreated CF at the same HTT.

Influence of Boride Concentration on Modulus of CF All the samples of boron-treated are heated at 2500℃. Fig 3 shows the trend of the modulus with increasing boride concentration. The curve goes up at the beginning, and then it goes down after the modulus reaches one point with boride concentration addition. The maximum modulus is 443GPa, and the strength is 4.1 GPa.

Effect of Boron on Microstructure The fiber crystallite parameters of interlayer spacing, d_{002}, crystallite size, Lc, and crystallite width, La, are given in Table 1. When the HTT is 2500℃, the results of X-ray diffraction show that boron increased in La and Lc from 7.69nm and 6.13nm to 7.93nm and 6.77nm,respectively, while the D_{002} (interplanar spacing) is decreased from 0.3429nm to 0.3427nm

Conclusions

It is found that the way of emulsion-coating for doping boron to promote graphitization is feasible, simple, low-priced and easily successively industrialized.

References

[1] JP2-200819
[2] JP2-251609
[3] Jones LE, and Thrower PA. Influence of Boron on Carbon Fiber Microstructure, Physical properties, and Oxidation Behavior. Carbon, 1991; 29(2): 251-269.

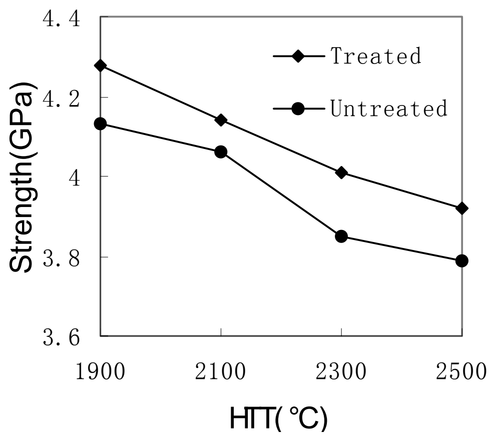

Fig1 The effect of HTT on modulus

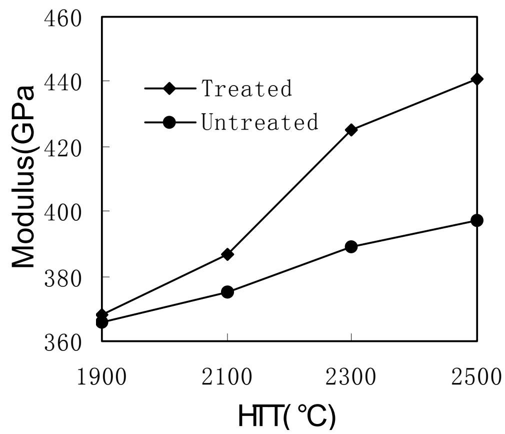

Fig2 The effect of HTT on strength

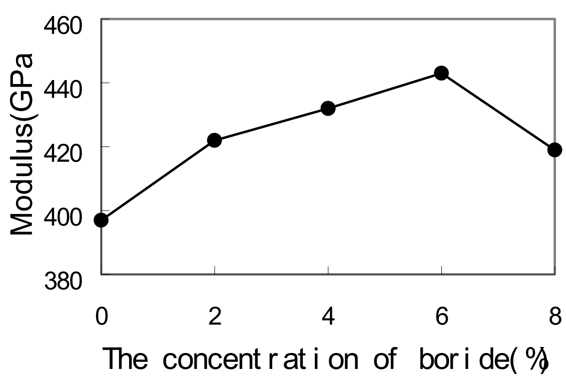

Fig3 The influence of boride concentration on modulus

Table1 The effect of boron on microstructure

sample	HTT(℃)	D_{002}(nm)	La(nm)	Lc(nm)
T-300		0.3551	3.74	1.48
untreated	1900	0.3472	6.36	2.92
	2100	0.3448	7.22	4.15
	2300	0.3445	7.34	5.15
	2500	0.3429	7.69	6.13
treated	1900	0.3465	6.11	2.86
	2100	0.3443	7.03	4.58
	2300	0.3440	7.36	5.61
	2500	0.3427	7.93	6.77