POSTER

THE THERMAL-PRESS PROCESS FOR MAKING 2D C-C COMPOSITES

Cui Hong, Su Junming & Wang Jun

Shaanxi Research Institute of Non-Metal Material
P. O. Box 101, Xian, Shaanxi 710025 P. R. China

INTRODUCTION

Carbon-carbon (C-C) composites are potentially new materials for aerospace, military and civil applications, as they offer excellent resistance to high temperature and multi-function properties. The combination of their various properties such as the excellent thermal resistance, anti-ablation and electric conductivity makes it become an advanced composite with a highly developing future. However, its high-cost and long-fabrication make it difticult to commercialize and seriate through processing. Obviously, there needs much more research in the direction of simplifying the process. The specially studied 2D C-C composite of this paper has multi-functions of high temperature structure/electrothermal, short-fabrication and low-cost, which are more advanced than those of the international similar products and the traditional graphite material in most of their properties. The process of solidification and carbonization by thermal press without an interval can make a new and extremely worth developing 2D C-C material.

EXPERIMENTAL

An ideal technological process has been set through a lot of experiments in this study. That is to use the low-cost and good-processing phenolic resin as adhesive, and have the carbon cloth prepreged, the 2D C-C composite is made through the steps of laying-up, thermal press solidification/carbonization and thermal treatment at last to adjust the electrical or mechanical properties.

RESULTS AND DISCUSSION

The objective of this study is to search a new heating material replacing the traditional graphite and some rare metals for military and civil usage in high temperature. Table 1 shows the properties of the 2D C-C in this study and the comparision between it and some traditional materials.

The results indicate that the material of this study is more advanced than graphite in properties and technologies as a heating material. The main difference between 2D C-C of our study and that of Ukraine are the ρ_v(specific electricity resistance) and ILSS (Interlaminar Shear Strength). The ρ_v of Ukrainian material is in a wider range because of 6K carbon cloth used in their study and the cloth has different carbon fiber volume in two directions. As to the higher ILSS, it is analysed that the material of Ukraine is treated only at 400℃, and the content of polymer in matrix is higher and the cohesiveness between fiber and matrix is less affected by the small molecules escaping.

Being a kind of laminate material, ILSS is the weak link of the composite. The process of solidification/carbonization without an interval can improve the defects by gas escaping and the crack produced when matrix shrinks. Fig. 1

shows the microstructure of the 2D C-C in this study.

CONCLUSIONS

The technology of making 2D C-C composites is effective, that is carbon powder as a part of matrix carbon, phenolic resin as adhesive and the process of thermal press solidification/carbonization without an interval.

By all means, it is proved that the material of our study is of advanced performance, low-cost, short-fabrication and easy-producing, and it has a great deal of economical value.

REFERENCE

1. EIICHI YASUDA AND YASUHIRO TANABE, a reprint from proceedings of 34th Japan congress materials research.

Table 1. Properties of Several Materials

properties \ materials	2D C-C of this study	2D C/C of Ukraine	felt-based C/C Chinese	Dunlop brake	ATJ-S graphite
density 10^3 kg/m^3	1. 10～1. 35	1. 20	1. 80	1. 82	1. 83
ρ, $10^{-6}\Omega \cdot m$	60—130	35—240			6—10
ILSS MPa	5. 0	14. 0		9. 24	
flexure strength MPa	90. 0	95. 2	58. 2	116	50
flexure module GPa	23. 0	10. 7		32	
compress strength MPa	//120	80. 8	126. 9	103	100
	⊥ 50	29. 6			
Work Temp. ℃	900	400	>2000	1500	>2000

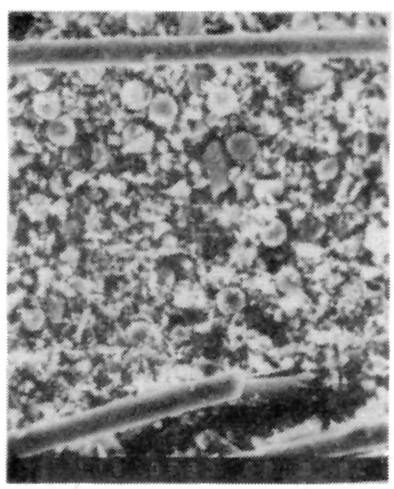

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Fig. 1. Microstructure of the material