Comparison of the Influence of Cutting Methods on Mechanical Strength Between New Glass-Like Carbon Composites and Conventional Glassy Carbon

S.Murakami , Y.Komatsu , T.Uemura , and T.Obinata
Showa Denko K.K
Omachi-shi Naganoken Japan

Abstract. Mechanical properties of four kinds of glassy cabon were compared with various machining speeds. As the result,1)Strength was highly affected by smoothness of the cut surface.2)Glassy carbon composites were less respondent to the roughness of cut surface,compared with pure G.C.

INTRODUCTION

Glassy carbon has not been used widely in industrial fields,because of its difficulties to machine,fragility,and high cost,in spite of the excellent properties such as very low permeability, highly resistant against chemicals.

In order to utilize those excellent properties in industrial uses ,such as fuel cell separators,semi-conductor processing parts and so on,we have developed two kinds of glass like carbon composites which have high strength and better machinability than a pure glassy carbon.

Since the strength of glassy carbon bodies is , in general, strongly affected by roughness of machined surface of the bodies, we investigated those relationship about four kinds of glassy carbons (above-mentioned two ones are included).

EXPERIMENTAL

Four kinds of glassy carbon plates , which are shown in Table I), were cut into 200×100mm specimens by a diamond wheel cutting tool(resin bond wheel 150ϕ mm×0.5mm thickness , 3200 rpm).

Bending strength of these specimens, each of which were cut at various speeds, were measured as shown in Fig I).

To relate edge chips occured on cut surface with bending strength, we selected index·I (see Fig2) so that we can repute the edge chips numerically.

RESULTS AND DISCUSSION

Photo I) shows one example of edge chips occured on cut surface. each specimen was likely to bear the more edge chips like Photo I), the more fast become the cutting speed.

Table 2) shows the relation between cutting speed,edge chips and bending strength each other about four kinds of samples.

Bending strength of each sample more or less depended on cutting speed (i.e. degree of edge chips on cut surface).

Table I Glassy carbons used for this experiment.

(Composition,wt%)				
phenolic resin carbon	I00	70	70	50
graphite powder	0	30	0	30
fibrous carbon	0	0	30	20
(Properties)				
Youngs Modulous (kg/mm^2)	2920	2640	3I60	2730
Electric resistivity ($\mu\Omega cm$)	4700	4230	4530	40I0
Density (g/cm^3)	I.53	I.58	I.50	I.55
Permeability (cm^2/sec)	I0	3×I0	I0	9×I0

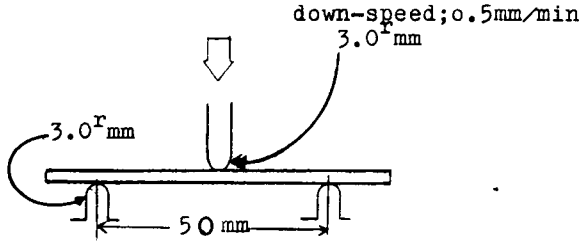

Fig I)Method of measuring bending strength

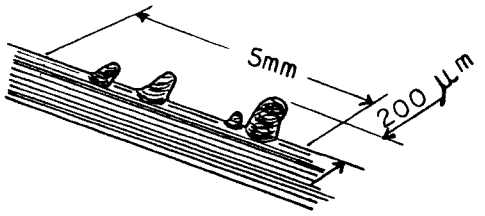

Fig2) Explanation of the index·I.

I=A×N
(in this case I=200×4)
A;maximum depth of chips.
in this case 200.
if the depth is less than I00,
A=0
N;the number of chips.
in this case 4.

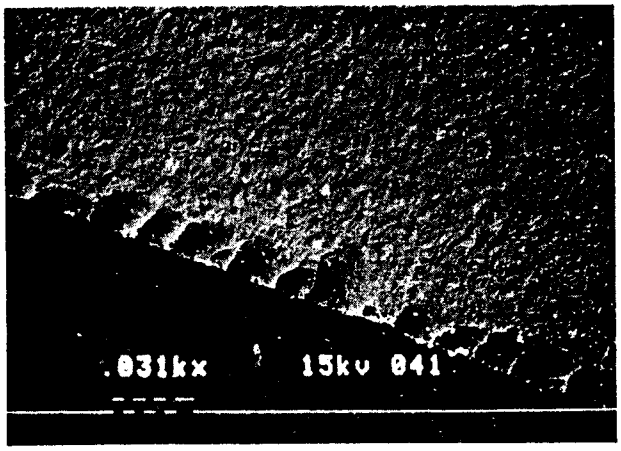

Photo I) Edge chips on cut surface.

Especially bending strength of sample-.A very strongly depended on degree of edge chips.

Relation between index·I and bending strength suggests that bending strength is af ected by edge chips in the order of A≫B≒C>D.

Compared cutting speed with index I, sample B is easiest to be machined . on the other hand, sample C is most difficult to cut.

It is estimated that easiness of cutting is in the order of B>A≒D>C.

Artificial graphite powder and fibrous cabon in the glass like carbonaceous composites are estimated that they play roles such as
A)graphite powder;it makes easier to cut the composites,increase the cutting speed .but lessen the strength of them.

B)fibrous carbon;it makes more difficult to cut the composites,deacreases the cutting speed .but raises the strength and makes the strength less respondent to edge chips.

ACKNOWLEDGMENTS

We wish to thank SHOWA UNION GOSEI K.K for providing us with newly developped phenolic resin .

REFERENCES

I. National Fuel Cell Seminar Abstracts (annual meeting in U.S.A)

2. H.O.Juchem, Ceramic Industrial J , 22 (June I976)

3.A.Broese van Groenou, J.D.B.Veldkamp, Philips Tecnical Review, 38 , I05(I978)

Table 2) The relation between cutting speed ,index·I and bending strength .

cutting speed (mm/min)	sample A I	B·S (kg/cm²)	sample B I	B·S (kg/cm²)	sample C I	B·S (kg/cm²)	sample D I	B·S (kg/cm²)
I0	0	980	0	750	200	I930	0	I8I0
50	200	790	0	660	800	I870	200	I880
I00	500	570	I00	680	I200	I900	400	I830
500	II00	280	600	6I0	2500	I6I0	900	I7I0