

POSTER

DEVELOPMENT OF HIGH DENSITY GRAPHITE FROM PITCH-BASED SELF-SINTERING CARBON POWDER

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INTRODUCTION

Mesophase pitch based carbon powder (mesophase powder) has recently emerged as a prominent self-sintering precursor for the production of fine-grained high density isotropic graphite. Though a number of publications (1-7) have appeared in the literature on the development of this specialty graphite using such mesophase powders, yet the details about the raw materials from which these powders can be produced and the subsequent processing conditions are not available (6). In this paper, the authors have made an attempt to develop this high density graphite from the mesophase pitch based carbon powder obtained from a suitable coal tar pitch taken as the starting material. The present paper is the result of this attempt.

EXPERIMENTAL

A coal tar pitch of characteristics shown in Table-1 was heat-treated to convert it into a carbon powder via mesophase formation, which was then shaped into small rectangular plates of size 60mm x 20mm x 5mm. These plates were carbonised to 1000°C and 2500°C in an inert atmosphere, and then subjected to characterisation with respect to a number of parameters, the values of which are given in Table-2.

RESULTS AND DISCUSSION

It is seen from Table-2 that the mesophase powder obtained by the heat-treatment of the coal tar pitch of characteristics as given in Table-1 leads to green plates of density 1.30 g/cc, which on baking to 1000°C result in carbon plates with a reasonably high bulk density of 1.77 g/cc, accompanying a weight loss of 11.0% and a volume shrinkage of 35.2%. Besides this, these baked plates are found to have a bending strength of 53 MPa, Shore hardness of 86, electrical resistivity of 3.6 mΩcm and an open porosity of 9.2%. Here, it may be mentioned that the green plates obtained from the mesophase powder involving a lesser severe heat-treatment than the optimum required, led to swelling of the plates during the baking operation, whereas those made from the mesophase powder involving a more severe heat-treatment, led to carbon plates of inferior quality.

In addition to the above, it is also seen from Table-2 that the further heat-treatment of the carbon plates to 2500°C leads to graphite plates of density as high as 1.88 g/cc. The cumulative weight loss and volume shrinkage at this temperature of 2500°C are observed to be 12.4 and 40.8% respectively. Besides this,

these plates are found to possess a Shore hardness of 76, electrical resistivity of 2.6 mΩcm and an open porosity of 9.6%, in addition to a homogeneous and fine microstructure as seen from their optical micrograph given in Fig.1.

CONCLUSIONS

A good quality high density monolithic graphite has been developed from the self-sintering mesophase powder obtained from a suitable coal tar pitch.

REFERENCES

1. B. Rand and C. Stirling, Extended Abstracts, 20th Biennial Carbon Conf., Santa Barbara, CA (1991), p.204.
2. R. Wolf et al., Proc. 5th Int. Carbon Conf., (CARBON 92) Essen, Germany, June 22-26, 1992, p. 964.
3. W.R. Hoffmann and K.J. Huttinger, *ibid.*, p.126.
4. W.R. Hoffmann and K.J. Huttinger, Carbon, 31 (1993) 259.
5. W.R. Hoffmann and K.J. Huttinger, Carbon, 31 (1993) 263.
6. W.R. Hoffmann and K.J. Huttinger, Carbon, 32 (1994) 1087.
7. A. Gschwindt and K.J. Huttinger, Carbon, 32 (1994) 1105.

TABLE-1

CHARACTERISTICS OF THE STARTING COAL TAR PITCH	
Softening point	72°C
Toluene insolubles	10.0%
Specific gravity	1.26
Coking value	53.9%

TABLE-2

CHARACTERISTICS OF CARBON PLATES BASED ON SELF-SINTERING MESOPHASE POWDER

	VALUES AT HTT OF	
	1000°C	2500°C
G.D. (g/cc)	1.30	1.30
B.D. (g/cc)	1.77	1.88
K.D. (g/cc)	1.95	2.08
O.P. (%)	9.2	9.6
W.L. (%)	11.0	12.4
V.S. (%)	35.2	40.8
L.S. (%)	13.2	15.4
B.S. (MPa)	53	-
S.H.	86	76
E.R. (mΩcm)	3.6	2.6

- G.D. = Green density
- B.D. = Baked density
- K.D. = Kerosene density
- O.P. = Open porosity
- W.L. = Weight loss
- V.S. = Volume shrinkage
- L.S. = Linear shrinkage
- B.S. = Bending strength
- S.H. = Shore hardness
- E.R. = Electrical resistivity

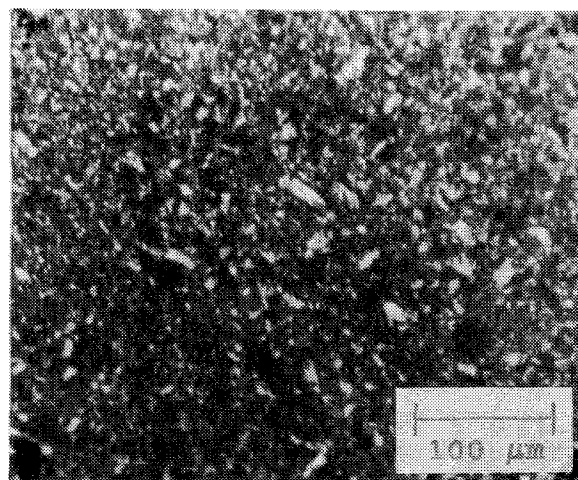


Fig 1. Optical micrograph of graphite plate (HTT = 2500°C).