POSTER

EFFECT OF TYPE OF TAR OIL ON THE CHARACTERISTICS OF CARBONS BASED ON MESOCARBON MICROBEADS

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INTRODUCTION

Mesocarbon microbeads (MCMB) form an important raw material for the production of binderless fine-grained isotropic graphite. Several studies on the development of this type of monolithic carbon have been reported (1-6) including some by the present authors also. In the present paper, the authors describe a study concerning the effect of type of Tar Oil on the characteristics of the resulting MCMB-based carbons.

EXPERIMENTAL

A low-QI coal tar pitch was heat-treated at 425°C in an inert atmosphere to generate mesophase spherules, the size of which was determined using an optical microscope. The mesophase pitch so obtained was extracted with two Tar Oils, I and II, with relatively lower and higher boiling range, to obtain two batches of mesocarbon microbeads, called MCMB-I and MCMB-II respectively. The microbeads of both the batches were subsequently calcined in an inert atmosphere, and then characterised with respect to quinoline and toluene insoluble contents and volatile matter content. These values are given in Table-1.

The mesocarbon microbeads of both the batches were finally hot-moulded into small rectangular plates of size 60 mm x 20 mm x 5 mm using a conventional hydraulic press, and the plates so obtained were carbonised to a temperature of 1000°C in a nitrogen atmosphere to result in carbon plates. These plates were characterised with respect to a number of parameters, the values of which are summarised in Table-2.

RESULTS AND DISCUSSION

It is seen from Table-1 that the heat-treatment of the precursor coal tar pitch at 425°C generates mesophase spherules with a predominant size range of 3-12 microns. Further, it is also seen that MCMB-I obtained using Tar Oil-I (having relatively lower boiling range) contain a volatile matter of 12.0 %, whereas MCMB-II obtained using Tar Oil-II (having relatively higher boiling range) contain a volatile matter of only 9.5 %. Further, Table-2 shows that the carbonisation of plates based on MCMB-I result in carbon plates of relatively lower baked density and bending strength, with values of 1.51 g/cc and 52 MPa respectively, compared to the plates based on MCMB-II, which exhibit a reasonably good baked density of 1.60 g/cc and a bending strength of 73 MPa.

The relatively inferior characteristics of carbons based on MCMB-I show that the extraction of the mesophase pitch with the Tar Oil-I leads to mesocarbon microbeads with an excess amount of relatively lower molecular weight components. On the other hand, the improved characteristics of the carbons based on MCMB-II implies that the Tar Oil-II is a better solvent, as far as the separation of MCMB out of the mesophase pitch is concerned for the purpose of high density monolithic carbon.

CONCLUSIONS

A Tar Oil of boiling range high enough to leave relatively lower molecular weight species amounting to a volatile matter content of around 10% appears to be a suitable medium for the solvent extraction of a mesophase pitch to obtain mesocarbon microbeads for the production of high density carbon or graphite.

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TABLE - 1

CHARACTERISTICS OF THE MESO-CARBON MICROBEADS

	MCMB-I	MCMB-II
Q.I. (%)	78.8	84.0
T.I. (%)	95.6	98.0
V.M. (%)	12.0	9.5
M.P.Size (μm)	3-12	3-12

Q.I. = Quinoline insolubles
T.I. = Toluene insolubles
V.M. = Volatile matter content
M.P. = Mesophase (spherules)

TABLE - 2

CHARACTERISTICS OF THE CARBON PLATES

	MCMB-I	MCMB-II
G.D.(g/cc)	1.22	1.21
B.D.(g/cc)	1.51	1.60
W.L.(%)	13.4	11.4
L.S.(%)	11.4	10.1
V.S.(%)	28.8	29.7
E.R.(mΩcm)	7.0	6.6
B.S.(MPa)	52	73
Y.M.(GPa)	12.7	16.8
S.H.	84	85

G.D. = Green density
B.D. = Baked density
W.L. = Weight loss
L.S. = Linear shrinkage
V.S. = Volume shrinkage
E.R. = Electrical resistivity
B.S. = Bending strength
Y.M. = Young's modulus
S.H. = Shore hardness