

# FIBER-MATRIX BONDING AND MICROSTRUCTURE OF PANOX DERIVED CARBON-CARBON COMPOSITES.

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## Introduction

Microstructure and consequently the properties of carbon-carbon composites are both governed by the reinforcement and matrix precursors. Whereas high modulus carbon fibers are used for high conductivity thermal management carbon-carbon composites, alternative reinforcement such as oxidised PAN fiber are used in carbon-carbon break-disc. These fibers are also promising reinforcement for carbon-carbon composites for mechanical applications in general. Since these fibers themselves undergo chemical and physical transformations during high temperature heat treatment, the matrix microstructure in the composites will also be affected and hence the thermophysical properties. Present paper reports the structure of the carbon-carbon composites made with oxidised PAN fiber and coal tar pitches.

## Experimental

Carbon carbon composites were made with oxidised PAN fiber with varying degree of surface oxygen complexes and coal tar pitches with varying QI contents using liquid infiltration techniques. The composites were pyrolysed to different temperatures in the range 500°C to 2700°C. The microstructure of the composites was studied using optical microscope.

## Results and Discussion

Fig. 1 shows optical micrograph of the carbonized composites made with high strength carbon fiber and coal tar pitches. Though HT carbon fiber also posses large bonding with matrix precursor, the interfilamentary matrix exhibit characteristic mesophase originated aligned coarse mosaic type carbon structure. The composite made with oxidised PAN fiber are found to exhibit two type of matrix microstructure (Fig.2) . The sheath matrix well adhered to the fibers is found to possess optically active transversally oriented carbon matrix. The matrix cracks in the composites are found to be deviated around the fibers (Fig.3). Interfilamentary matrix exhibits fine mosaic type optically active carbons

(Fig.4). Such kind of microstructure is observed even in composites heat treated to 500°C. Coarse mosaic structure is not observed at any stage. This may be due to reaction of the gaseous byproduct evolved from pyrolysis of the fibers with active anisotropic structure even at 1000°C. On further heat treatment 2700°C, this structure becomes more predominant(Fig.5) but each characteristically different then the one observed in carbon-carbon composites made with oxidised PAN fiber and thermosetting resins(1). Fig.6 shows XRD pattern of the composites heat treated to 2700°C. As evident from the figure, the material is not highly graphitic. It also confirms that the interfilamentary matrix in carbon-carbon composites made with oxidised fibers exhibits less graphitic order than would had been expected from the matrix as such heat treated to that temperature.

## References

1. Manocha, L.M., Bhatt, H., Manocha, S.M., Carbon, 1996, 34, p.841-849

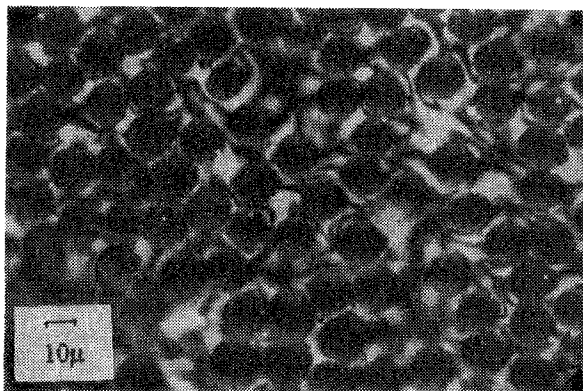


Fig.1 Polarized Optical Micrograph of Carbon Carbon Composites(HTT 550<sup>o</sup> C) made with HT carbon fiber and coal tar pitch

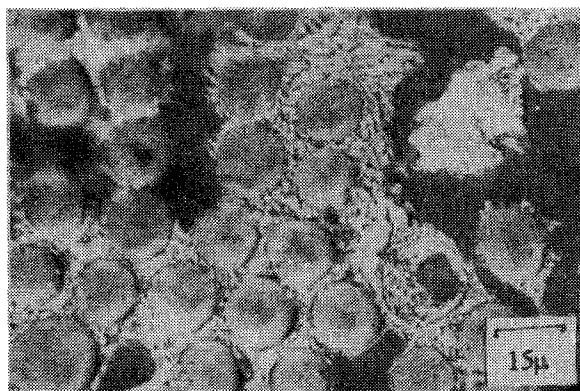


Fig.4 Polarised optical micrograph(cross section) of carbon-carbon composite(HTT 1000<sup>o</sup>C) made with PANOX fiber and coal tar pitch



Fig.2 Polarized optical micrograph of carbon-carbon composites(longitudinal section) made with PANOX fiber and coal tar pitch(HTT 550<sup>o</sup>C)



Fig.5 Polarized optical micrograph of carbon-carbon composite(HTT 2700<sup>o</sup> C) made with PANOX fiber and coal tar pitch

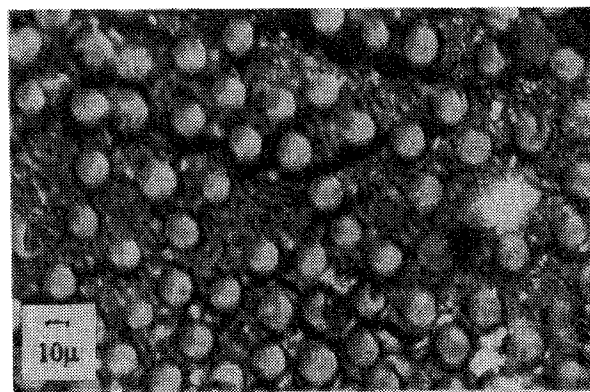


Fig.3 Optical micrograph of carbon carbon composites(HTT 550<sup>o</sup>C) made with PANOX fiber and coal tar pitch

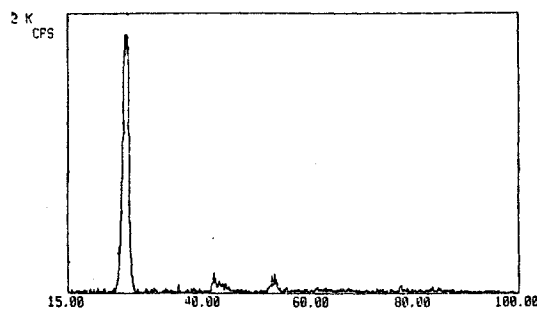


Fig.6 XRD pattern of carbon-carbon composite (HTT2700<sup>o</sup>C) made with PANOX fiber and coal tar pitch.