CHARACTERIZATION OF CARBON/CARBON COMPOSITES

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Ideally, composite properties should be predictable from a knowledge of constituent properties and composite geometrical parameters. In conventional resin matrix composites, some of the more important constituent properties can be directly measured on the constituents, while the remainder can be derived from composite measurements.

Carbon/carbon composites present a more complex case as the available evidence indicates that matrix and fiber properties undergo significant mechanical property changes during fabrication. Furthermore, the fiber and matrix are interacting, such that identical processing of the constituents will produce different mechanical properties from those derived from the composite. The interaction is a maximum for high preferred orientation constituents, as a small variation in preferred orientation will produce large property change. For high modulus fibers and graphitizable matrices, constituent properties in the final composite cannot be inferred from independent constituent tests, but usually must be derived from preferred orientations, and microstructures, as well as composite tests. Relationships between X-ray preferred orientation and modulus[1,2] or coefficient of thermal expansion[3] have been made, but are not convenient to use for carbon/carbon composites. Similar relationships should exist for optical preferred orientation. Quantitative reflected polarized light microscopy has been used in the past to obtain a number which describes the average orientation. While accurate if only a single orientation is present in the field of view, it provides a biased result if a distribution exists. The problem can be solved by measuring light intensity distributions. Although theoretical problems remain, preliminary studies indicate that optical measurements provide a method to quantitatively determine preferred orientation distributions which can be related to modulus, and coefficient of thermal expansion.

References

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