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NASA TECH BRIEF

Lyndon B. Johnson Space Center

Graphite/Polyimide Laminates with Near-Zero Thermal Expansion

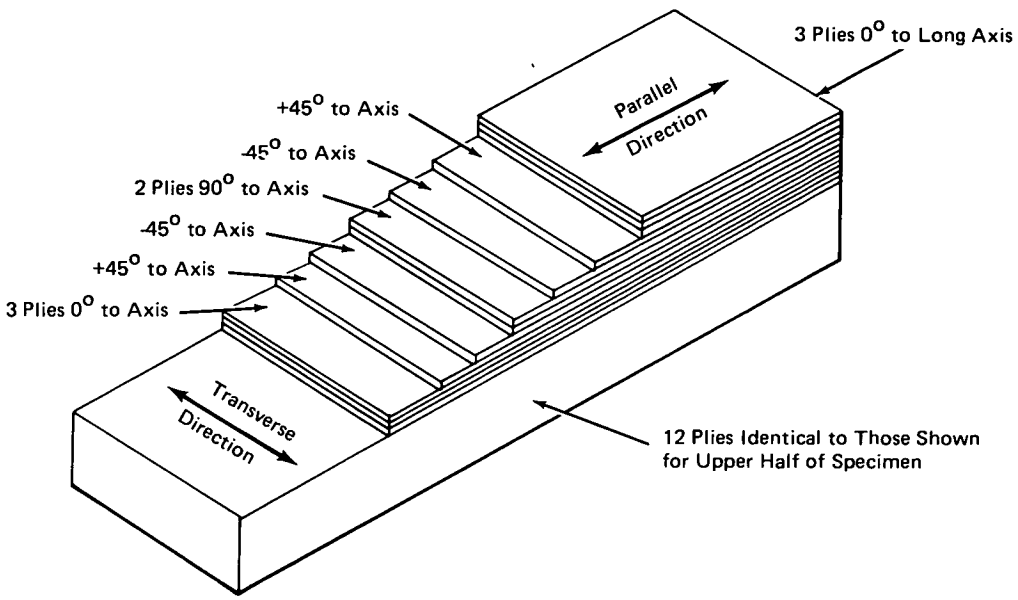

Figure 1. Graphite/Polyimide Shaft Layup

Composite structures of graphite and polyimides can be laminated to have very low coefficients of thermal expansion. Such structures are light and strong and have many uses where expansion or contraction with temperature change is undesirable. One application is with instruments that measure thermal expansion.

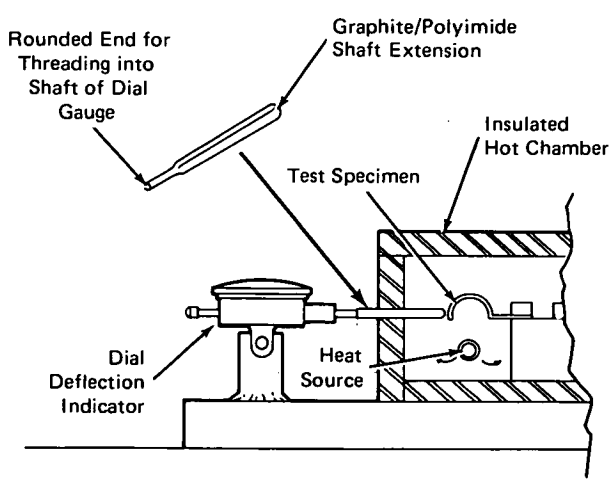

Figure 2. Dilatometer with Graphite/Polyimide Extension

The low thermal expansion is achieved through a special layup of the laminates. The unidirectional fiber-reinforced layers are oriented at angles with one another as shown in Figure 1. Depending on the materials used, coefficients of expansion for this layup are on the order of 10^{-7} over temperature ranges of 75 to 300° F (25 to 150° C).

These composites provide an order of magnitude improvement over quartz dilatometer systems (coefficient of thermal expansion about 10^{-6}) normally used to measure thermal expansion. A dilatometer has been designed (see Figure 2) that uses 1/8 x 1/8 x 2 in. (0.3 x 0.3 x 5 cm) strips of the composite as extensions between the dial indicator and the test specimen. The extensions are threaded into the shaft of the deflection indicators and eliminate thermal expansion in the deflection measuring system.

(continued overleaf)

Note:

Requests for further information may be directed to:

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Lyndon B. Johnson Space Center
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Houston, Texas 77058
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Patent status:

NASA has decided not to apply for a patent.

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A. H. Striepens of
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