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Brief 71-10217

NASA TECH BRIEF

Marshall Space Flight Center

Promising Boron/Graphite/Resin Composites

A program was conducted to develop lightweight structural composites that would have high specific strength and stiffness and would remain effective under extreme environmental conditions. Effort was specifically directed to an analytical and experimental investigation of a specially developed, mixed (hybrid) composite consisting of boron and graphite fibers in an epoxy matrix. Emphasis was placed on the mixed composite with intermingled fibers, rather than a laminated composite with alternating layers of different prepregs (combinations of resins and reinforcements in easy-to-handle sheet or other form).

As a result of this program, the following conclusions were reached:

1. The boron/graphite/epoxy mixed composite is a feasible engineering material in that it possesses excellent mechanical properties and can be easily produced within small tolerances on the constituent volume fractions.
2. Despite the improved transverse tensile modulus and in-plane shear modulus of the boron/graphite/epoxy hybrid, these improvements are not of sufficient magnitude to warrant changes in present conservative design procedures. The main benefit to be gained from this composite lies in its improved longitudinal strength and modulus. However, similar improvements can be obtained by increasing the boron volume fraction on boron/epoxy composites alone. The use of the mixed composite as a replacement for the boron/epoxy composite would be unjustified unless the fiber mixing process could be achieved at very little additional cost.
3. The most feasible applications of the boron/graphite/epoxy composite are in areas where other existing composites have shortcomings. One such application, developed in this program, is that of transitioning the hybrid composite between relatively stiff boron/epoxy load-bearing elements and more-workable graphite/epoxy closeout sections. Two basic transition combinations of this type were fabricated and tested, and were shown to yield strong, aerodynamically smooth, adhesive-free transitions in a single curing process.

Notes:

1. Specific technical questions may be directed to:
   Technology Utilization Officer
   Code A&TS-TU
   Marshall Space Flight Center
   Huntsville, Alabama 35812
2. The following documentation may be obtained from:
   National Technical Information Service
   Springfield, Virginia 22151
   Single document price $3.00
   (or microfiche $0.95)

   Reference:
   NASA-CR-102944 (N71-14267), Boron/Graphite Hybrid Composite Development Study

Patent status:

No patent action is contemplated by NASA.

Source: H. A. Evensen of
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