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Design and Evaluation of Three-Phase Fibrous Composite Structures

An important objective in the study of the mechanics of composite structures is the determination of the relationship between the strength of a fibrous composite and the mechanical properties and geometry of its constituents. A relationship of this type can be utilized in the definition of desirable improvements in constituent properties, as well as in the evaluation of the structural potential of various composite materials.

In this study three possible composite combinations were evaluated: (1) boron binder reinforcement for unidirectionally reinforced boron/epoxy; (2) glass binder reinforcement for unidirectionally reinforced glass/epoxy; and (3) glass binder reinforcement for unidirectionally reinforced boron/epoxy. In the first two cases the total amount of reinforcing material in the composite was held constant, while in the last case the volume percentage of filament was held constant.

Assuming nominal constituent properties, the potential magnitude of the increase in compressive strength was calculated. For properties similar to those of the boron/epoxy composites, a conversion of a small percentage of the axial filaments into transverse filaments should raise the compressive strength from 392 ksi to 550 ksi; substantial gains were also expected for the glass plus boron/epoxy composite.

Because of the gains found in the calculations for the unidirectional boron/epoxy composites, a series of these specimens, having various percentages of chopped-glass filaments added to the binder, were fabricated. The test results, despite the large scatter, appeared to indicate a strengthening. The gross effects produced by the small amounts of binder reinforcement demonstrate the critical role of the binder in the composite for the development of high compressive stresses. This criticality is substantially greater for boron than for glass reinforcement.

Note:

The following documentation may be obtained from:

Clearinghouse for Federal Scientific
and Technical Information
Springfield, Virginia 22151
Single document price $3.00
(or microfiche $0.65)

Reference:
NASA-CR-66518 (N68-13962), Design Criteria and Concepts for Fibrous Composite Structures

Patent status:

Inquiries about obtaining rights for the commercial use of this invention may be made to NASA, Code GP, Washington, D.C. 20546.

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