NASA TECH BRIEF

Langley Research Center

Glass Fiber Addition Strengthens Low-Dentisy Ablative Compositions

Research has revealed that glass fibers act as reinforcement for ablative material in strengthening both the virgin and pyrolysis zones. The use of a large percentage of low-melting-temperature glass fibers, which melt and combine with the char formed during the ablation process, produces a char with reduced shrinkage and greater strength.

Approximately 15 percent, by weight, of E-glass fibers (calcium-alumina borosilicate glass with alkali content of less than 1 percent) was added to compositions under test and greatly improved char stability. The glass fibers melted at about 1090 K (1500° F) and joined with the carbon to form a very strong char matrix. It was found that the use of these fibers also reduced thermal strains which, in turn, minimized char shrinkage and the associated cracks, subsurface voids, and disbonds. The increased strength allows the honeycomb core reinforcement, normally used, to be replaced by an equivalent amount of glass fibers. This change in the fabrication of low-density ablative panels reduced the estimated cost of such panels by approximately one-third.

The technique, which is a method of providing reinforcement as well as an intermediate bond through controlled melting temperature, could be applied to hydraulic-set refractory materials and high-temperature insulation. Cement-type materials produce bonds through a hydration reaction, and when the bond is heated it initially deteriorates in strength. Further heating produces a new or ceramic bond between the oxides. Glass fibers could provide strength during the loss of the hydration bond and before the start of the ceramic bond (when the bond is extremely weak), as well as provide reinforcement to the cement.

Note:

No further documentation is available. Specific questions, however, may be directed to:

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Patent status:

NASA has decided not to apply for a patent.

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