Out-of-Autoclave Processing of New Bismaleimide (BMI) Resin Materials For Aerospace Structures

PROBLEM / OBJECTIVE

Bismaleimide (BMI) resins are used in primary and secondary high performance composites structures. BMI resins can operate at temperatures reaching 350°F. However, current BMI's require fabrication in an autoclave to achieve aerospace quality. Many large autoclaves are currently available and used for processing and manufacturing components for existing systems. The capital investment for new autoclaves is extremely high and there are limits to the size that can be safely built and operated. Avoiding autoclave processing enables an increased supplier base and drives down capital investments and material costs. Further, autoclaves are not available on the flight line or in many forward depots, which can make repair of BMIs with the base material difficult.

ACCOMPLISHMENTS / PAYOFF

Process Improvement:

A recent breakthrough in BMI resin technology created an opportunity for cost savings and fabrication improvements for composite aerospace components. The new discovery eliminates the need for components to be cured in an autoclave, which allows the resin to be used for much larger components, and for field and depot repair. Funded by the Defense-Wide Manufacturing and Technology (DMS&T) Program, Stratton Composite Solutions is working to further reduce costs related to this capability while reducing the weight and increasing the structural performance of aerospace components.

Out-of-Autoclave BMIs enables fabrication of structures that are larger, as well as providing a viable option for field and depot repairs.

Implementation and Technology Transfer:

Development of a new BMI resin has eliminated offgassing and void formation seen during fabrication attempts to cure conventional BMIs outside the autoclave. Initial composite processing and mechanical testing demonstrates promising results for the technology. There has been extensive materials testing to recommend acceptable prepregging and processing conditions. To date, a 4 ft by 8 ft panel has been successfully processed. In addition, fabrication of a part with features found in an aerospace component is currently underway.

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Expected Benefits and Warfighter Impact:

This new capability is expected to reduce BMI composite material costs by 40 percent and manufacturing costs by 30 percent. Additionally, replacing epoxy resins with Out-of-Autoclave BMIs offers several advantages. It enables fabrication of structures that are larger than the size of current autoclaves, which significantly reduces the number of subassemblies required for a given system. This will drive the cost of aircraft structures and fabrication costs even lower. In addition, it expands the available supplier base beyond companies that have large autoclaves, offering reduced cost parts.

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