No-Oven, No-Autoclave Composite Processing

Rapid fabrication of large, single-piece composite structures

Very large composite structures, such as those used in NASA's Space Launch System, push the boundaries imposed by current autoclaves. New technology is needed to maintain composite performance and free manufacturing engineers from the restraints of curing equipment size limitations.

Recent efforts on a Phase II project by Cornerstone Research Group, Inc. (CRG), have advanced the technology and manufacturing readiness levels of a unique two-part epoxy resin system. Designed for room-temperature infusion of a dry carbon preform, the system includes a no-heat-added cure that delivers 350 °F composite performance in a matter of hours. This no-oven, no-autoclave (NONA) composite processing eliminates part-size constraints imposed by infrastructure and lowers costs by increasing throughput and reducing capital-specific, process-flow bottlenecks. As a result of the Phase II activity, NONA materials and processes were used to make high-temperature composite tooling suitable for further production of carbon-epoxy laminates and honeycomb/sandwich-structure composites with an aluminum core.

The technology platform involves tooling design, resin infusion processing, composite part design, and resin chemistry. The various technology elements are combined to achieve a fully cured part. The individual elements are not unusual, but they are combined in such a way that enables proper management of the heat generated by the epoxy resin during cure. The result is a self-cured carbon/epoxy composite part that is mechanically and chemically stable at temperatures up to 350 °F. As a result of the successful SBIR effort, CRG has launched NONA Composites as a spinoff subsidiary. The company sells resin to end users, fabricates finished goods for customers, and sells composite tooling made with NONA materials and processes to composite manufacturers.

Applications

NASA

- Space launch systems
- Composite cryotanks
- In-space structures

Commercial

- Private space launch vehicles
- Oil and gas consumables
- Aircraft
- Large marine vessels
- Civil and automotive infrastructure
- Wind blades and towers

Phase II Objectives

- Improve resin processability
- Scale up honeycomb core and sandwich structure fabrication
- Validate NONA as a composite tooling system
- Improve manufacturing readiness
- Plan for technology transition

Benefits

- Eliminates capital-specific process bottlenecks
- Enables single-piece fabrication of large composite structures
- Reduces time in tooling acquisition as well as part fabrication
- Provides high performance in an epoxy at temperatures up to 350 °F
- Allows for on-site manufacturing
- Simplifies fabrication logistics
- Reduces labor time and cost
- Increases composite part throughput
- Eliminates post-cure requirement

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