

Electron Beam-Cure Polymer Matrix Composites: Processing and Properties

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Researchers from NASA and Oak Ridge National Laboratory are evaluating a series of electron beam curable composites for application in reusable launch vehicle airframe and propulsion systems. Objectives are to develop electron beam curable composites that are useful at cryogenic to elevated temperatures (-217 °C to 200 °C), validate key mechanical properties of these composites, and demonstrate cost-saving fabrication methods at the subcomponent level. Electron beam curing of polymer matrix composites is an enabling capability for production of aerospace structures in a non-autoclave process. Payoffs of this technology will be fabrication of composite structures at room temperature, reduced tooling cost and cure time, and improvements in component durability.

This presentation covers the results of material property evaluations for electron beam-cured composites made with either unidirectional tape or woven fabric architectures. Resin systems have been evaluated for performance in ambient, cryogenic, and elevated temperature conditions. Results for electron beam composites and similar composites cured in conventional processes are reviewed for comparison. Fabrication demonstrations were also performed for electron beam-cured composite airframe and propulsion piping subcomponents. These parts have been built to validate manufacturing methods with electron beam composite materials, to evaluate electron beam curing processing parameters, and to demonstrate lightweight, low-cost tooling options.