A COMPARISON OF THE ENVIRONMENTAL ATTRIBUTES OF THERMOPLASTIC VS. THERMOSET COMPOSITES

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ABSTRACT

The demand for composite materials in aerospace is stronger than ever, due mainly to the savings in fuel cost for lightweight structures. The vast majority of composites used in aerospace are thermoset based. Increased usage of continuous reinforced thermoplastic composites for aerospace are demonstrating that the environmental advantages of thermoplastic vs.. thermoset are substantial. These advantages include a substantially reduced energy usage for processing, reduced scrap in processing, reduced waste stream, improved recyclability, and reduced use of volatile organic compounds. Furthermore, composites based on thermoplastic matrix resins are recognized for the improved toughness they offer. Due to this inherent advantage, current developments show promise for designing further weight reduction over conventional materials. A thin fuselage for a single aisle aircraft made with thermoplastic composite may potentially offer improved toughness and substantial weight savings as compared to a thermoset counterpart.

This paper will outline the specific advantages of thermoplastic vs.. thermoset composites for aerospace. A comparison of the environmental effects for similar parts made with thermoplastic and thermoset composites will be performed.

2. BACKGROUND

The aerospace industry has increased usage of composites structural components for large aircraft, mainly because of weight reduction and resultant fuel savings. To date, the vast majority of composite materials for aerospace are thermoset based, especially in the US. In Europe, thermoplastics composites have been used on the Airbus A340 and A380 for several years. Some parts on these vehicles made from thermoplastic composites include the fixed wing leading edge, keel beams and others. For the most part, however, the bulk of exterior aerospace components in Europe are based on thermoset composites. In the US, there is not yet one thermoplastic based composite in large commercial aircraft exterior structures.

The current focus of the commercial aerospace composites industry is on thermosets for a number of reasons. Thermoset composites have been successfully manufactured for aerospace since the 1960's, and the knowledge database is very mature. Substantial investment has been expended in the US for man rated thermoset composite structural components. This investment includes design tools, material property databases, capital equipment, employee training, test