AMMTIAC Helps Major Aerospace Company Develop Research Roadmap

AMMTIAC recently provided a major aerospace manufacturing firm with technical guidance so that they could finalize a corporate research strategy. AMMTIAC provided a summary of the recent literature associated with composite materials for application in space environments. AMMTIAC's client is a leading provider of small satellites and large satellite sub-systems including advanced lightweight, high-strength composite structures. The increased use of composite materials is critical to reaching new space frontiers. AMMTIAC's literature survey and analysis helped to define a "snapshot" of the state of development for several areas of materials technology, which in turn will help direct future research activities:

- Radiation shielding using spacecraft structural laminate materials
- Carbon fiber composite prepreg filled with nano material
- Carbon nano-yarns
- Thermal cycling fatigue of high modulus cyanate ester laminate materials and epoxy bonds

The cost of placing objects into low earth orbit has been estimated to be roughly $10,000 per pound. Also, a launch vehicle's lift capability is fixed, hence any weight savings from increased thermal or structural components can be applied to improved payload capabilities. Polymer matrix carbon fiber composites are widely used in the satellite structure and thermal management to save weight.

The design of composite satellite structures must account for the effect of the space environment. Many polymers outgas when subjected to the vacuum of space. If volatile materials contained within the polymer escape due to its interaction with the space environment, a portion of the outgassed species will deposit on the satellite and form a film that can seriously degrade the performance of optical, sensor, solar cell, and thermal control materials. In addition, composites are also susceptible to dimensional changes from thermal cycling, which can result in matrix microcracking to relieve internal stresses. The problem can be compounded by particle radiation that can embrittle the matrix in some composites.

Today carbon fiber/cyanate ester-based composites are the materials of choice for thermal/structural applications. Additional large weight savings in the thermal/structural subsystems are possible with engineered materials and multifunctional materials, made possible through the emergence of nanotechnology and computational materials science.

AMMTIAC searched through its own holdings, as well as the DoD, NASA, DOE and commercial databases for recent literature concerning radiation shielding, thermal cycling, nanofiber and nano fillers with carbon fiber/cyanate ester composites. AMMTIAC supplied over 5,700 citations and 120 documents and summarized data from them. The aerospace company will use this information to facilitate efficient and effective use of research funds by strategically prioritizing attention to gaps in the knowledge base and to direct their near- , mid- and long-term research activities.

Please visit our Web site at http://ammtiac.alionscience.com or send us an E-mail at jguthrie@alionscience.com