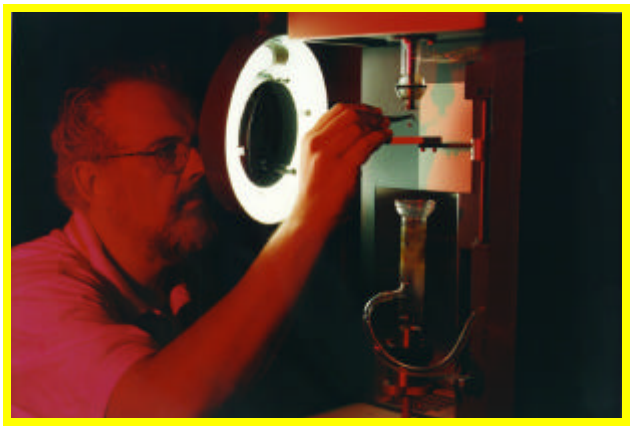
Thermal and Chemical Characterization of Composite Materials



Objective

This study will provide a concise and well-defined property profile of current and developing composite materials, using thermal and chemical characterization techniques. As a result of the study the optimization of analytical testing, requirements of materials will emerge. Various composite materials, including epoxy resins, polyurethane foams and thermosetting materials, will be evaluated. Using existing thermal and chemical instrumentation in the Chemistry Group, a material matrix will be developed. Materials will be analyzed utilizing the following methodologies, which include thermal analysis systems consisting of Differential Scanning Calorimetry (DSC), Differential Thermal Analysis (DTA), and Thermogravimetric Analysis (TGA). In addition, the use of Bomb Calorimetry will be employed to measure material heat of combustion properties. Chemical characterization will be achieved using Fourier Transformed Infrared (FTIR) spectroscopy alone and in combination with the TGA.

Why Needed

This effort will apply a diverse array of methodologies to ascertain composite material properties. Often, a single method or technique will provide useful, but nonetheless, incomplete information on material composition and/on behavior. To more completely understand and predict material properties, a broad-based analytical approach is required. By developing a database of information comprising both thermal and chemical properties, we can better elucidate material behavior under varying conditions. This is of additional importance in the aerospace community, where newly developing composite materials have little data with which to refer. For example, FTIR spectral databases available for identification of vapor phase spectra such as that generated during FTIR-TGA experiments, generally refer to well-defined chemical compounds. Because this method renders a unique thermal decomposition spectral pattern, even larger, more diverse databases, such as those found in solid and liquid phase FTIR libraries, cannot be used. By combining this and other available methodologies, a database specific for new and developing materials at the Center can be generated. In addition, characterizing materials using this approach will be extremely useful in the verification of materials and identification of anomalies in NASA-wide investigations.

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Sponsor

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