Innovative Fire Retardant Polymeric Systems. Phase II

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Research Objective: The primary objective of this study is to examine the fire performance of highly fire resistant polymer systems having applicability to the interiors of commercial aircraft. Part of this objective is consideration of the effect of fire retardant additives on fire-resistant thermoplastic polymers. A secondary objective is to compare results among several fire test methods currently used or anticipated for use in the evaluation of materials for aircraft applications. Finally, a fire hazard classification system will be recommended to address the issues of the potential fire hazard associated with such materials.

Approach: Exploration of the fire behavior of highly fire resistant materials will encompass several fire test methods, including the cone calorimeter (ASTM E1354), the OSU calorimeter (FAR 25.853) and the Intermediate Scale Heat Release Calorimeter (ICAL, ASTM E1623). While the OSU device is required for FAA certification, the cone calorimeter is used extensively in research and development activities world-wide. The comparability of these two test methods is a fundamental concern for anyone attempting to develop fire resistant materials for aircraft applications. Development of materials will concentrate on the potential enhancement of commercial fire resistant materials using new and innovative fire-modifying additives. Unique approaches to the analysis and interpretation of data from laboratory scale fire test methods has become a natural outgrowth of this research program.

Accomplishment Description: The major accomplishments of this program to date have been the approaches taken toward enhancement of fire resistance by additives, and the lessons learned from fire evaluations using laboratory scale heat release rate tests. Many interesting additives were screened as part of this program. Most of them did not impart significantly enhanced fire behavior over that of the base resin, which already was a highly fire resistant material. However, no one had previously studied the addition of fire retardant chemicals to a fire resistant polymer, generally concentrating instead on making inherently flammable materials less flammable. A few combinations of additives and polymer showed promise for continued study. Examination of the behavior of fire resistant (especially intumescent, char-forming) polymers during flammability testing became a noteworthy part of this study. While numerous research investigations using the cone calorimeter have been reported, few have attempted to rationalize the results in terms of significance to real world scenarios. Using the analysis techniques developed during this study, it is anticipated that a fire hazard classification scheme will be developed.

Significance: The results of this study will be of interest to product manufacturers, aircraft developers, fire researchers, and specifiers of regulations for aircraft interiors. The development of suitable fire resistant materials is an ongoing activity. There must be continued analysis and interpretation of the results and recommendations for future developmental efforts.

Expected Results: The addition of fire retardant compounds to a fire resistant polymer was expected to be a difficult task and those particular results from this study are not expected to be outstanding. However, the lessons learned from application of the laboratory scale fire test protocols to these products will be beneficial in a broad spectrum of applications. Additional studies comparing commercial materials and comparable fire test methods will shed light on the difficulties in interpreting fire test results.

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