

Introduction

During the past decade, significant progress has been made in developing advanced composites possessing high strength, high modulus, and low density, and in understanding their behavior under certain types of loading. As a result, composites such as boron-epoxy and graphite-epoxy have been successfully employed as structural materials in aircraft, missiles, and space vehicles, and have satisfactorily demonstrated their performance through extensive ground testing and in flight. Moreover, the application of these composite materials to various structural components of aerospace vehicles has demonstrated significant (10 to ~50 percent) weight savings over comparable components made of conventional metals.

Despite the tremendous advantages that advanced composites have over metals in applications requiring high strength, high stiffness, and low weight, in applications where impact by foreign objects is a design consideration, the advantages inherent in composites are overshadowed by their poor response to impact loading. The severity of this problem was demonstrated when a major aerospace company attempted using graphite-epoxy turbine blades in one of its production engines. During a test flight through a rain storm, the turbine blades were severely damaged and eroded and, although the plane landed safely, the near-disaster created an impetus for an in-depth understanding of and a search for means to overcome the problem. Numerous other reports in the open literature dealing with the response of advanced composites to various types of impact have further increased the need for a better understanding of the problem so that the survivability of composites under various types of impact loading can be increased.

Because of the seriousness of the problem, ASTM, in accordance with its tradition of providing a forum for discussions leading to understanding of material behavior, sponsored a one-day symposium on Foreign Object Impact Behavior of Composites. The symposium was organized by the ASTM Committee D-30 on High Modulus Fiber and Composites and was held on 20 Sept. 1973 in Philadelphia, Pa. The symposium was organized into two sessions: one was devoted to analyzing and studying the response of composite materials to impact, and the second to analyzing and studying the response of composite structures and structural components to impact. Among the subjects covered during the two sessions were failure mechanisms in composites subjected to impact, test methods for impact response, influence of material and processing variables on the impact response of composites, and residual strength of

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composites, and composite structural components following impact damage. The various papers covered materials such as boron-epoxy, glass-epoxy, various types of graphite-epoxy composites, composites made with PRD-49 fibers, and hybrid composites. Moreover, the papers dealt with various types of constructions, including composite sandwich and monocoque composite constructions of varying fiber orientations and layups. It is felt that the topics covered provide a better understanding of the impact response of composites and that the symposium proceedings by providing a general understanding of the various aspects will thus form a sound base for further experimental and theoretical studies of the problem.

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