

CONFERENCE SUMMARIES

USA-USSR Symposium on Fracture of Composite Materials

The USA-USSR Symposium was held on September 4-7, 1978, at the Hotel Jurmala in Majori, the center of a popular health resort on the coast of Riga Bay, USSR. Approximately 60 scientists and engineers, mostly from the USA and USSR, attended the meeting. Participants from England, France, and West Germany also presented papers.

The idea of such a symposium originated with Prof. George C. Sih of the Institute of Fracture and Solid Mechanics, Lehigh University, Pennsylvania, USA, and Dr. Vitauts P. Tamuzs of the Institute of Polymer Mechanics, Latvian Academy of Sciences, Riga, USSR. The Symposium was planned by a six-member organizing committee: N. S. Enikolopov, A. K. Malmeister (co-chairman), S. T. Mileiko, Yu. N. Rabotnov, G. C. Sih (co-chairman), and V. P. Tamuzs (executive secretary).

Before high-performance composites can be widely used in long-term, critical, or high-stress applications, reliable means of characterizing the fundamental properties and behaviors of composite materials must be found. Performance criteria must be developed as part of the materials selection and design procedures with composites.

Most of the currently available properties characterization methods have been borrowed from the metal industry. Because of this, the methods are limited by their intrinsic restriction to single-phase materials. Thus they cannot adequately account for the variation in the composite constituents or in the structure of the composite—variations that have significant influence on the gross behavior of the composite structure.

Although a considerable amount of research has been conducted in an attempt to develop an understanding of composite material behavior, many of these research efforts have attempted to cover too wide a spectrum of problems with too little penetration into the fundamental aspects. To date, most research efforts have followed two principal directions. The first is to characterize the global mechanical response of the composite without any damage considerations. The second is to make detailed studies of the various failure modes that occur in the composite during application of stress

(loading). These two experimental approaches have developed almost independently, with little or no interaction.

Unfortunately, composite material behavior cannot be adequately understood without knowledge of the material damage occurring at the microscopic level. In addition, many of the materials parameters cannot be used with confidence unless the physical damage of the material can be separated from the intrinsic material behavior. This, in turn, requires a fundamental understanding of the various failure modes and of the way in which physical damage such as microcracking affects the gross behavior of the composite. Obviously, realistic analytical modeling and experimental investigation of composite fracture are desperately needed.

For these reasons, investigators in the field of composites have long felt a need to bring together a small group of experts to review the fundamentals of composite behavior, to discuss the problem areas, and to detail current developments. Thus, the USA-USSR Symposium on the Fracture of Composite Materials was organized. The topics covered at the symposium included micro- and macrofracture, statistical characteristics, fracture prediction, limitations of conventional linear fracture mechanics, nondestructive testing methods, environmental influences on composite properties, design and technical considerations, and the composite as a biomechanical material.

We plan to continue this symposium series on a biannual basis. The second meeting will be held in 1980 in the USA. The proceedings of this first USA-USSR Symposium on the Fracture of Composite Materials are being published by Sijthoff & Noordhoff in the Netherlands; copies should be available in March 1979.

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Conferences on Composites in France

Two conferences, one held in September 1978 and the other planned for September 1979, reveal the considerable interest in composite materials in France. The September 1978 conference was the first of a series of biannual national meetings that are aimed at bringing together composites researchers in France. The success of this conference in accomplishing this objective, as well as in attracting participants from several other European countries, portends well for the future meetings.

The topics selected for the September 1978 meeting were mechanical properties, analysis and design, and control. The number of papers was limited to 33 to avoid the need for any parallel sessions. Of these papers, 19 were devoted to the properties of composite materials. Most types of composites were considered—glass-reinforced plastics, Kevlar 49, hybrids, boron/aluminum, boron/titanium, and cfrp. A wide variety of testing conditions were also used, including fatigue and creep tests controlled by acoustic emission monitoring, and torsion pendulum tests to measure internal damping. Several papers were given on industrial problems with composites, and nine papers were devoted to the analysis and design problems encountered in producing composite structures. Very few papers were delivered on the control of composites, but the numerous requests for papers on this subject probably reflect the state of the art—many questions are being posed but few answers are forthcoming.

One encouraging aspect of this first French national conference was the interest exhibited by industry. Although the French academic world was well represented, people from industry far outnumbered those from other professions.

The conference to be held September 11-14, 1979, in Lyon, France, should be described as a science fair rather than as a conventional technical conference (see also Calendar on Composites page 18). Entitled "International Forum: Composites, Assemblage, and Adhesion," this meeting will consist of three distinct parts—a scientific congress, a poster conference, and commercial display stands—in an attempt to attract significant industrial participation. Conference organizers are attempting to interest all sectors dealing with bonded structures, from the basic fiber-matrix bond to the

large-scale bonded structures. In all, more than 1000 participants are anticipated.

For the scientific congress, invited speakers will discuss subjects of importance to the manufacture, design, and use of composite materials. Topics planned specifically to be covered in the plenary papers are adhesion, bonding, degradation, aging, and reliability. These themes will then be taken up in round-table discussions.

The poster conference is designed to give speakers an opportunity to display their work more clearly, using large diagrams and photographs, and to be in more intimate contact with their audiences. Individual stands are planned for each speaker where they will be able to develop their subject to small groups of participants who hopefully will have already read the written text (provided well before the conference convenes). Ideally, the poster sessions will allow the speakers to delve more deeply into the specific details of their work that are of interest to the individual audiences.

Stands will also be set up to allow commercial firms to display their materials, machines, and finished products. Participating firms will be strongly requested to ensure that in addition to any sales staff, at least one technically qualified person be available on the stand.

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Symposium on Composite Materials in the Automotive Industry—1978

A two-day symposium on the applications of composite materials in the automotive industry was held at the *Winter Annual Meeting of the Society of Mechanical Engineers*, in San Francisco, CA, on December 14-15, 1978. The meeting was sponsored by the Design Engineering Division of the Society. The symposium program consisted of three technical sessions, a panel discussion, and the Design Engineering Division luncheon.

Current interest in the application of composite materials in automobiles is primarily due to the Corporate Average Fuel Economy (CAFE) Standard which requires that all new automobiles average 27.5 mpg by 1985. Thus, the objective of the

symposium were to assess the state of the art of the utilization of composite materials in automotive components.

Invited papers were presented by representatives from automotive companies, parts manufacturers, fiber and prepreg manufacturers, government agencies, and universities. The papers covered the following general areas: prototype development and testing of automobile components, applications to U.S. Army surface vehicles, manufacturing and material interactions, transfer of aerospace technology to volume automobile production, cost performance evaluations, hybrid composites, and mechanical properties of short-fiber composites and their time-dependent behavior. The all-composite, full-size car—the Ford Panther—was also discussed in one of the presentations from the Ford Motor Company. Three major concerns were expressed: the lack of sufficient design data, the high cost of graphite fiber, and the need for manufacturing processes suitable for low-cost, high-volume production.

Dr. J. J. Harwood of the Ford Motor Company, and Dr. S. W. Tsai of the Air Force Materials Laboratory, were the featured speakers at the Design Engineering Division luncheon. Dr. Harwood addressed the “Future Trends in Automotive Materials,” presenting an overview of the potential of fiber composites, aluminum, and high-strength steels, and identifying key issues associated with each material. He indicated that the candidate materials for use in the 1980’s are fiber composites and high-strength steels; structural and nonstructural plastics are anticipated to constitute ~10% of the automobile weight by 1985. Dr. Tsai

discussed “Composite Materials in the Automobile Industry—Aerospace Viewpoint,” listing potential benefits available to the automotive industry from the aerospace-oriented effort in composite materials. He pointed out that aerospace composite engineers, in return, would be able to learn about low-cost manufacturing from the automotive industry.

The panel discussion session considered fuel economy aspects, crash-worthiness, manufacturing methods, testing and NDE, cost projections of graphite and aramid fibers, and the utilization of the DOD/NASA advanced composite design guide. The highlight of the session was a discussion of the pros and cons of improving automobile fuel economy by using fuel-efficient engines (e.g., diesel) rather than by reducing the automobile structural weight with composite materials. Some cost performance evaluations have indicated that for graphite fiber composite to become competitive with the other composite materials, the price of graphite fiber must be in the range of \$2-3/lb. However, during the panel discussion, it was noted that the price of pitch-based graphite fiber will not drop below \$5/lb, even by 1985.

The papers presented at this symposium are compiled in a publication entitled “Composite Materials in the Automobile Industry,” and copies are available from ASTM, New York.

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