Introduction

The conference on High Modulus Fiber Composites in Ground Transportation and High Volume Applications focused on a very important issue in composites technology, the relationship between processing, material microstructure, and the resulting material properties. Material formulations and processing techniques employed in the high volume manufacturing of composite components produce complex microstructure, but without control. The design of material microstructure, especially fiber orientation state, forms the basis for effective composites utilization, and ineffective control of microstructural parameters increases property variability and forces poorly optimized designs. Ultimately, high volume processes need to be developed which allow design and control of material properties during processing.

The first steps toward this goal are to understand the relationship between processing parameters and material microstructure and to be able to quantitatively measure and describe microstructural features which determine the macroscopic material properties. The relevant microstructure parameters which control composite properties are the constituent properties, volume fractions of constituents, interfacial adhesion between the phases, fiber orientation state, fiber aspect ratio, void content, state of resin cure (thermosets), and resin crystallinity (thermoplastics). In two-phase, continuous fiber aerospace composites aspect ratio and fiber orientation are highly controlled. Composites for high volume applications are often discontinuous fiber, three-phase systems in which fiber aspect ratio and orientation state are not controlled. The control of these two parameters and understanding the effects of their distribution on properties is a central problem in the effective use and fabrication of high volume composite materials.

The intent of the conference was to provide a forum for discussing the macroscopic behavior of typical high volume composite material systems, materials characterization methods, and the relationship between processing and material properties. The knowledge developed in these areas will form the foundation for the ultimate objective, design and control of composite properties.

The papers published in this volume address these primary topics along with more advanced property characteristics such as environmental sensitivity, fatigue behavior, and viscoelastic response. The identification and systematic research of the complex topics addressed in this volume is embryonic. It is hoped that the reported research findings will serve to stimulate new, broader based research activities in this important area of composites technology.

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