



COMPOSITE MATERIALS HANDBOOK VOLUME 3. POLYMER MATRIX COMPOSITES MATERIALS USAGE, DESIGN, AND ANALYSIS

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COMPOSITE MATERIALS HANDBOOK VOLUME 3. POLYMER MATRIX COMPOSITES MATERIALS USAGE, DESIGN, AND ANALYSIS U.S. Department Of Defense PURPOSE, SCOPE, AND ORGANIZATION OF VOLUME 3

For Department of Defense purposes, this handbook is for guidance only. This handbook cannot be cited as a requirement. If it is, the contractor does not have to comply. This mandate is a DoD requirement only; it is not applicable to the Federal Aviation Administration (FAA) or other government agencies. Volume 3 of MIL-HDBK-17 provides methodologies and lessons learned for the design, analysis, manufacture, and field support of fiber-reinforced, polymeric-matrix composite structures. It also provides guidance on material and process specifications and procedures for utilization of the material data presented in Volume 2. The information provided is consistent with the guidance provided in Volume 1 and intended to be an extensive compilation of the current "best knowledge and practices" of composite materials and structures engineers and scientists from industry, government, and academia. This volume will be continually updated as the "state-of-the-art" of composites technology advances.

Volume 3 contains the following chapters, which are arranged in an order, which approximately follows the traditional "building-block" development approach:

Chapter 2, Materials and Processes, defines major material systems and processing methods. Effects of various processing parameters on final composite product performance are emphasized.

Chapter 3, Quality Control of Production Materials, reviews important issues related to quality control in the production of composite materials. It reviews recommended manufacturing inspection procedures and techniques for material property verification and statistical quality control.

Chapter 4, Building Block Approach, outlines the rationale for the traditional multi-level testing and analysis development approach used for many metallic and composite structures programs, particularly in the aerospace industry. It also contains guidance and example building block test programs for various applications, including DoD/NASA prototype and production aircraft, commercial transport aircraft, business and private aircraft and rotorcraft.

Chapter 5, Design and Analysis, addresses the basic design and analysis of composite laminates. The chapter provides an overview of the current techniques and describes how the various constituent properties contained in Volume 2 are used in the design and analysis of a composite structure. It presents standard analyses to provide a common nomenclature and methodology basis for users of MIL-HDBK-17. The analyses cover lamina and laminate stiffness and strength prediction, and compression buckling methods.

Chapter 6, Design and Analysis of Structural Joints, describes accepted design procedures and analytical methods for determining stresses and deformations in structural bonded and mechanically fastened

joints for composite structures.

Chapter 7, Damage Resistance, Durability and Damage Tolerance, provides an extensive discussion of these three broad topics, which in general terms relate to the ability of a structure to perform the design functions over the life of the structure. Aircraft damage tolerance requirements and compliance approaches, types of damages and damage inspection are covered in the first sections of the chapter. Following these sections, in each of the three main areas, influencing factors, design issues and guidelines, testing issues, and analysis methods are covered in detail. Most of the information was developed and is applicable to the aircraft industry, but the general guidelines and basic data provided have application to many other industries.

Chapter 8, Supportability, considers the design for and the design of repairs in composite structures based on maintainability and reliability issues. It provides guidelines to the designer of new structures for considering supportability/maintainability issues, provides information relevant to the design of

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