Overview

Mechanical properties and failure criteria are the technical elements necessary for developing good design properties Such properties are generated on IM7/PEEK, the experimental problems and solutions of hot-wet testing of graphite/polyimide laminates are delineated, and a new failure criteria for laminate strength prediction is detailed in the papers in this session

Three papers from this session are included in this STP The first is "Characterization of IM7 Graphite/Thermoplastic Polyetheretherketone (PEEK) for Spacecraft Structural Applications" by Silverman, Wiacek, and Griese This paper presents an evaluation of IM7/PEEK for mechanical properties particularly associated with spacecraft applications The mechanical properties evaluated included 0 and 90° tension and compression, shear, flexural, coefficient of thermal expansion, outgassing, moisture uptake, and moisture expansion coefficient A comparison was made with IM7/8551-7 thermoset matrix material

The second paper is "Hot/Wet Testing of Celion 3000/PMR-15 Coupon Specimens," by Blount This paper draws attention to the difficulty of performing mechanical property evaluations under hot/wet conditions without excessive loss of moisture in the specimen Attention is also given to suitable strain-gaging techniques for these test conditions

The third paper is "A Scientific Approach to Composite Laminate Strength Prediction" by Hart-Smith. This paper discusses fundamental issues in the strength prediction of fiber composite laminates and presents a failure theory for strength evaluation In the paper, the need for considering different failure criteria for the different possible failure modes in laminates, identified as fiber, matrix, and interface failure is pointed out The paper concludes that fiber shear strain is the critical parameter for fiber-dominated laminate failure and presents comparisons with biaxial test data from the literature

These technical papers presented illustrate the importance of solving the testing problems to get good allowables and the subsequent use of these allowables with appropriate analytical methods and failure criteria in the design process