



Standard Guide for Testing Fabric-Reinforced “Textile” Composite Materials¹

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INTRODUCTION

A variety of fabric-reinforced composite materials have been developed for use in aerospace, automotive, and other applications. These composite materials are reinforced with continuous fiber yarns that are formed into two-dimensional or three-dimensional fabrics. Various fabric constructions, such as woven, braided, stitched, and so forth, can be used to form the fabric reinforcement. Due to the nature of the reinforcement, these materials are often referred to as “textile” composites.

Textile composites can be fabricated from 2-dimensional (2-D) or 3-dimensional (3-D) fabrics. Stitched preforms and 3-D fabrics contain through-thickness yarns, which can lead to greater delamination resistance. Textile composites are also amenable to automated fabrication. However, the microstructure (or fiber architecture) of a textile composite, which consists of interlacing yarns, can lead to increased inhomogeneity of the local displacement fields in the laminate. Depending upon the size of the yarns and the pattern of the weave or braid, the inhomogeneity within a textile composite can be large compared to traditional tape laminates.

Thus, special care should be exercised in the use of the current ASTM standards developed for high performance composites. In many cases, the current ASTM standards are quite adequate if proper attention is given to the special testing considerations for textile composites covered in this guide. However, in some cases, current standards do not meet the needs for testing of the required properties. This guide is intended to increase the user’s awareness of the special considerations necessary for the testing of these materials. It also provides the user with recommended ASTM standards that are applicable for evaluating textile composites. The specific properties for which current ASTM standards might not apply are also highlighted in this guide.

1. Scope

1.1 This guide is applicable to the testing of textile composites fabricated using fabric preforms, such as weaves, braids, stitched preforms, and so forth, as the reinforcement. The purpose of this guide is to:

1.1.1 Ensure that proper consideration is given to the unique characteristics of these materials in testing.

1.1.2 Assist the user in selecting the best currently available ASTM test method for the measurement of commonly evaluated material properties for this class of materials.

1.2 Areas where current ASTM test methods do not meet the needs for testing of textile composites are indicated.

1.3 It is not the intent of this guide to cover all test methods which could possibly be used for textile composites. Only the most commonly used and most applicable standards are included.

1.4 The values stated in either SI units or inch-pound units are to be regarded separately as standard. The values stated in each system may not be exact equivalents; therefore, each

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