



Spun Yarn Strength as a Function of Gauge Length and Extension-Rate: A Critical Review

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ABSTRACT

It has been known for many years that the strength of a spun yarn depends on the two important testing parameters, namely, the gauge length and rate of extension. There is no doubt that all studies relating to the influence of gauge length and extension-rate on yarn strength are invaluable both in theory and practice. In this article, a critical review of various theoretical and practical aspects of the influence of gauge length and extension-rate on yarn strength has been discussed.

Keywords: Yarn Strength, Gauge Length, Extension-Rate, Weak Link

1. Introduction

The standard measurement of yarn strength is executed at 500 mm gauge length and 20 ± 3 sec. However, during the post spinning operations, namely warping and beaming, a longer than 500 mm length of yarn experience stresses. In addition, most recently, researchers [1] have shown that the experimentally determined strength behavior of yarn at short gauge length is more appropriate to simulate the mechanical behavior of fabric than those measured at long gauge length. Therefore the results obtained at standard test methods may not correctly reflect the tensile performance of the yarns. Thus, measurement of yarn strength only at 500 mm gauge length is not sufficient. In fact, it is not also realistic to measure yarn strength at all possible lengths. This can be overcome by using the theoretical relationships of strength and strength variability between long and short specimens. Yarns undergo stress and strains during weaving and other operations that are significantly different from those applied in

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the standard tensile tests. Furthermore, the importance of yarn strength measurement at various rate of extension can be appreciated if one considers the ever expanding range of nontraditional application of yarns, viz., aircrafts, space vehicles, automobiles, reinforced composites and a host of their industrial uses. Therefore the studies of tensile testing of spun yarns various level of gauge lengths and extension-rates on yarn strength are very significant and in this paper a critical review of these aspects has been made.

2. Spun Yarn Strength as a Function of Gauge Length

2.1 Theoretical Consideration

Many researchers attributed that the presence of flaw in the yarn lead to localization of stress in excess of theoretical strength, whereby the rupture process is initiated. It thus follows that the fall in