Theoretical Prediction of Strength and Fracture Behavior of Blended Filament Yarns

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The existing problems in previous studies on mechanics of blended filament yarn are discussed in this article based on some experimental evidence. The importance of twist reinforcing mechanism to the strength of a twisted filament structure, the interaction patterns between different types of filaments during yarn extension, and the significance of multiple breaks along a filament are demonstrated.

Based on such concepts as chain-of-subbundle, the changing lateral constraint between filaments due to twist and its effect on filament strength, load sharing process between the broken and still surviving members during yarn breakage, a new statistical approach is proposed and a discrete computer model is introduced to predict strength and fracture behavior of a blended filament yarn. The predicted results are illustrated in comparison with the experiments in this article.

By means of this new model, issues like the strength reinforcing mechanism of twist in a filament yarn, the yarn break propagation pattern, and twist effect on yarn fracture behavior as well as shape effect of filament stress-strain curve were simulated and elucidated.

Moreover the relationship between strengths of the components and a structure, or the structure assistance effect, is investigated in this study as well.