

A study on the Tensile Failure Mechanism of Fabric Woven from Yarns Produced by Three Different Yarn Spinning Technologies. i.e. Ring, Airjet, Open End Spinning Systems.

Part I. Monte Carlo Simulation of Fabric Failure Process

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Though fabric has been with human for thousands of years, the micro-mechanism of the fabric failure process has never been fully understood or extensively studied until recent years. Thus there is not a clear explanation of interrelationships between fabric and yarn strengths.

The yarn production speed has been greatly improved due to the new yarn manufacturing technologies such as rotor spinning and airjet spinning. The yarns produced with these process cost less than comparable ring spun yarns, since these process have higher production speed than ring spun yarns. However, the yarns produced with this method have been getting their market share gradually. This is partly due to the facts that the mechanical properties of the fabric made of these yarns were different from those of ring spun yarn fabrics. The micro-structure of the yarns produced with these process is also different from that of the ring spun yarns.

The objectives of our study are to understand fabric failure mechanisms and to obtain a method to predict fabric strength from yarn strength and its distribution. As a tool of this, Monte Carlo simulation has been applied. For the yarn strength distribution in the fabric, the weakest link theorem has been adopted for the strength of the yarn in effective length gauge and yarn strength distribution has been approximated as Weibull distribution.