

Influence of Using Monofilament Yarns with Different Proportions in one/both Directions on the Stiffness of Woven Fabrics

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Abstract:

Textile products have many chemical and natural properties, but they are characterized by two unique properties together: tensile strength and elasticity. These two properties represent two sides of the same coin that characterize textile products. Both give the textile its characteristic properties. The elasticity of the fibers and yarns and the textile's structural composition greatly affected fabric bending rigidity, which is one of the most important factors in fabric handling. Sometimes, the functional properties of the textile product require a specific rate of fabric stiffness, but this rate cannot be achieved. This is because the fabrics were woven using short or continuous textile fibers (natural or synthetic) with a limited rate of stiffness that cannot be exceeded in any way due to the natural properties of the used base material.

The research idea is enclosed in taking advantage of the high rates of available stiffness in monofilament yarns to increase the rates of fabric stiffness. At the same time, the paper aims to evaluate the effect of using monofilament yarns on the stiffness property of woven fabrics, which sheds light on directing textile fabrics to new uses, especially in industrial applications that they may not have penetrated before.

The experimental samples were varied according to fabric constructions (which were specified in the basic structures plain 1/1, twill 1/3, and satin 8), participation percentages of monofilament yarns, and participation directions of the monofilaments (warp and weft directions), with the setting of all other factors such as the fabric-set. The three main standard samples of the research were woven using polyester continuous multi-filament yarns with the standard fabric construction (one sample for each construction). The other samples were woven with different participation percentages and directions of monofilament yarns.

According to the research results, the bending lengths in the warp and weft directions were greatly positively affected by the participation rates of the monofilaments. The highest increase percentages were in the direction of the participation of monofilaments, but there were also significant increases in the bending length rates in the other direction. The increase in rates generally was also higher in the warp direction than in the weft direction for the same participation rates. The fabric samples' flexural rigidity rates increased significantly compared to standard samples. Also, the fabric flexural rigidity rates for other samples achieved higher percentages because of the increasing participation percentage rates of monofilament yarns. The fabric flexural rigidity rates for all samples achieved high rates by using plain weave 1/1, then the twill weave with an average decrease of 21%, and finally satin weave 8 with an average decrease of 32% compared to plain weave 1/1.

The importance of this research, according to its results, is that it is possible to benefit from these results in the production of fabrics with the required stiffness rate according to the appropriate specification for the final product.

Keywords:

Stiffness, Shear rigidity bending, Bending length, Bending rigidity, Flexural rigidity, Stiffness, Monofilament.

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