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Developing innovative pattern designs for jacquard woven athletic footwear fabrics

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Abstract:

This study aims to experiment with different weaving structures with the same fabric construction and innovative patterns needed to fulfill customer needs for this product. However, it could affect the fabric's physical and mechanical properties. Hence, this study represents (4) samples produced from (Polyester filament, chenille P.E. (micro flat), and polyester/lycra by using double weave wadding structure techniques. The statistical analysis results for correlation coefficients show a direct correlation between the properties and the textile compositions of different pattern designs. Also, the statistically significant differences between the results are weak, which in turn is reflected in allowing the freedom of design using these different patterns by athletic footwear fabric designers and thus meeting the desires of customers for different designs for this type of athletic footwear without affecting on the mechanical properties of the fabrics involved in their manufacture. Footwear science addresses aspects of all types of footwear, such as dress footwear, working footwear, athletic footwear, or medical footwear. [Sterzing et al., 2012]. Athletic footwear with canvas uppers became a generic product during the early and mid-twentieth century. The innovative use of textiles in athletic footwear has played a major role at each significant stage in the evolutionary and revolutionary history of the branded athletic footwear industry. [Frederick and Wojcieszak, 2005]. Daily, people wear athletic footwear. This type of footwear provides the wearer with comfort and simultaneously protects their feet from harsh conditions such as cold, wet, and uneven surfaces. The fabrics used in footwear play a crucial role in athletic footwear, as they directly impact both durability and comfort. Producing athletic footwear fabrics with different pattern structures is needed to fulfill customer needs for this product. However, it could affect the fabric's physical and mechanical properties. This study aims to experiment with four different weaving structures with the same fabric construction and four different innovative pattern designs to show whether these patterns affect the mechanical properties of these fabrics negatively or not.

Problem Statement: Producing athletic footwear fabrics with different pattern structures in the same upper athletic footwear fabric could affect the fabric's physical and mechanical properties. So, it could negatively affect the mechanical properties of this kind of fabric. The main question of this research is whether producing different patterns with the same fabric construction will affect the mechanical properties of this kind of fabric or not to forecast the durability of this fabric.

Aims and objectives: This research aims to test whether using innovative pattern designs from only one weaving structure produced for athletic footwear fabrics affects the mechanical properties of fabric or not.

Hypothesis : Employing different pattern designs with only one weaving construction in the same upper footwear fabric could negatively affect the mechanical properties of the fabrics.

Methodology: The research follows the statistical analysis experimental method.

Experimental Work: All fabrics were designed on Nedgraphics CAD/CAM software. The jacquard athletic footwear fabrics were prepared at (Home Fashion Factory for upholstery fabrics, Qalyub City, Egypt), using a Rapier loom with the specifications in Table (1). Yarn of count 1/150 Denier, 120 EPI was used as warp, and Yarns of four different counts such as (600/1 dn, 1800/1 dn, 2250/1 dn, 150/40 dn) were used as Wefts, with weft sequence (3F, 2W, 1 B), three types of weft yarns were used (Polyester filament, chenille P.E. (micro flat), and polyester/lycra. All fabrics were produced in Double weave wadded structure with 120 EPI, and (128) PPI. Tables (2), (3), (4), (5), and (6) show the fabric specifications of samples.

Results : The impact of different weaving structures with the same fabric construction and innovative different patterns of jacquard woven athletic footwear fabrics on the physical and mechanical properties (weight, thickness, air permeability, tensile strength, elongation, friction resistance, and pilling resistance) was tested using analysis of variance (ANOVA). There is a direct correlation between weight (g/m^2) and its low shrinkage ratio of the tight weaving structure. There is a direct correlation between thickness (mm), air permeability ($cm^3/cm^2/s$), tensile Strength (N), elongation %, friction resistance (g), pilling resistance, and the difference ratio of binding strength between layers of fabrics. Hence, it is evident that textile compositions with tight binding can be used in the same sample in different areas without causing a defect in the mechanical properties

of the fabric. Also, textile compositions with weak binding can be used, but in small areas, so as not to negatively affect the properties of the fabric.

Conclusion: The experimental result indicates that woven athletic footwear fabrics produced from different weaving innovative patterns structures with different bending between layers could be used in the same upper athletic footwear fabrics without strong negatively affection on the mechanical properties of it. The statistical analysis results for correlation coefficients show a direct correlation between weight, thickness, tensile strength, and elongation properties and the difference ratio of binding strength between layers of fabrics. Also, the statistically significant differences between the results are weak, which in turn is reflected in allowing the freedom of design using these different patterns by athletic footwear fabric designers and thus meeting the desires of customers for different designs for this type of athletic footwear without affecting on the mechanical properties of the fabrics involved in their manufacture.

Keywords:

Pattern Designs; Woven Jacquard Fabrics; Athletic Footwear

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