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Innovative Technological Solutions for the Development of Reinforcement Woven Fabrics for Complex Lightweight Applications

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Abstract:

The various textile industries, despite their unlimited technical development, are distinguished by their flexibility compared to many other industries, where fibrous materials are manufactured with various physical properties on a large scale. That qualifies them to participate strongly in multiple technical applications, and this is what successive generations of synthetic fibers contributed to. The first-generation (classical synthetic fibers) and the second-generation (high-performance toughness and stiffness coefficient fibers and high thermal and chemical resistance fibers) have replaced other raw materials in more than twelve branches of various applications, including areas such as packtech, mobiltech, indutech, buildtech, medtech, agrotech, geotech, protech, oekotech, ...etc. At the beginning of the first decade of the twenty-first century, the third generation of synthetic fibers appeared, which called high-functional fibers or smart fibers, because of some of their own characteristics, such as their ability to prevent the transfer of various materials and bacteria, retaining warmth and ion exchange, in addition to the ability of the fibers for biodegradation.

From all the above, the research idea was formed, which is to take maximum advantage of the physical properties of the warp and weft yarns without any interlacing between them, replacing that with touch contact between them only on the interlacing points. That leaves no chance for internal friction between them. Thus, the research paper aims to build a textile product characterized by a high tensile strength value, equal in fabric directions, dimensional stability, and a good rate of porosity that allows treatment with resins, whether natural or synthetic, and secures their penetration into the fabric structure. The research problem was identified in getting rid of the intersections between the warp and weft yarns to allow the full penetration of the resins, in addition to achieving the highest rates of fabric tensile strength even before treatment.

In the executive method, bulked continuous filaments (BCF) were used as the main warp and weft yarns, which were relatively thick (den. 2000). Additional high-tenacity warp and weft yarns were used, which were relatively thin (den. 300). Their main function is interlacing with each other by using plain weave 1/1 to maintain the straightness of the main warp and weft yarns. In addition to achieving the required stability of the overall structural composition, to ensure the quality of resin processing later. In addition, the porosity of woven fabrics was achieved by using two very important operating procedures. The porosity in the longitudinal direction was achieved by drawing the main warp yarns through the odd dents of the reed (for example), while the auxiliary thin warp yarns were drawn through the even dents, and so on. On the other side, the porosity in the transverse direction between the wefts was achieved by weaving longitudinal lines like strips at regular dimensions using the real leno weave construction by using the additional thin warp and weft yarns, which helps in the formation of transverse pores between successive wefts.

By studying the results of research samples, it was concluded that the tensile strength values of the fabric without interlacing between the warp and weft yarns achieved higher and equal rates in the warp and weft directions than the corresponding samples using standard weave constructions. The lowest rates of elongation were also achieved in both directions, but they were largely equal in rate.

Keywords:

Porosity, Bulked Continuous Filaments (BCF), High Tenacity (HT), Leno, Strength, Elongation, Resin, *Technical Textiles*

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