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Properties of Weft Knit in Shrinkproof Finished Wool Yarn

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Ⅰ. Introduction

Wool fiber as a staple fiber obtained from nature is to be an ideal fabric for the clothes; its low initial elasticity makes wool very soft, warm, elastic, hygroscopic, water resistant and fire retardant. So, it is widely used as high quality cloth fabrics from a winter coat to summer wear, or from knitted inner wear to outerwear. To produce more quality knitted wool products, many researches on washable wool have been studied on enhancement of dimensional stability and dye uptake[1-5]. However, various properties of washable wool are still not known. Therefore, the study is designed to determine the various properties of wool knits altered by shrinkproof finishing. Electrostatic propensity, thermal resistance and pilling propensity are measured and evaluated depending on finishing methods, which will find out an optimal shrinkproof finishing method keeping the quality properties of wool fabrics.

Ⅱ. Experimental

1 Materials

Test fabrics were made with one untreated original yarn and three kinds of shrinkproof finished wool yarns: resin coated yarn, resin coated & softening yarn, and chlorinated yarn (2/48's). They were knitted by a weft knitting machine (SHIMA SEIKI SES124 S) with 48 inch width, 12 gages, and all needle knitting structure under the same knitting conditions with gage loop 5.4 mm long and degree of density.

2. Evaluation Methods

Electrostatic Propensity (KS K 0555, KS K 055544) was measured. The charged surface or nylon standard friction fabric specimen was rubbed with the friction voltmeter (RET 20N, Daici

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Trading), and the measurement of friction voltage was conducted for 60 seconds from the start of friction. Half life measurement was carried out through a static honestmeter (Static Honestmeter Type H 0110, Shishido Electrostatic Co., Ltd.). The half life through which the static electricity is cut down by half was measured for 60 seconds. The thermal insulation tester (ASTM TYPE, Eiwa Denshikeiki) was used to measure the level of thermal insulation based on the constant temperature method (KS K 0560). Pilling test was carried out by the pilling tester (IWS VIEWING CABINET MODEL 120, James H. Heal & Co. Ltd.) based on the ICI box method (KS K 0503, ASTM D 3514) 31), and evaluated in accordance with ASTM D 3514 Pilling Rating Standards.

Ⅲ. Results and Discussion

(1) Electrostatic Propensity

The original wool fiber is known to have no electrostatic problems. In order to see whether the shrink-proof finishing process causes the change in electrostatic propensity or not, measurement on half life and friction voltage was carried out. When fibers are rubbed each other, static electricity is generated. A half life is the time taken to reduce the electrostatic amount by half at that moment. From the half life of the shrinkproof-finished wool yarn knitted fabrics, the time spent for original knitted fabrics to reach the half life can be summarized as follows: the original wool (10 sec) shows the highest, followed by the resin coating & softening process (19 sec), chlorinated process (36 sec) and resin coating process (40 sec) in order. The wool finishing process makes all half life increase, and the time taken for the wool finished knitted fabrics to reach to the half life is effected by the finishing process type. The increase of half life seems to be caused by the softening finishing process implemented right after the shrink proof finishing. And, it was found that the half life increased due to only the resin finishing or the increase of the finishing time. However, the time taken for all to come to the half life was less than 60 seconds, indicating that there was no issue found in regard to electrostatic propensity.

With respect to the friction voltage occurring when the fabric was rubbed with others. Friction voltage of shrink proof finished wool knit, the highest friction voltage was found on the original wool, followed by the resin finishing, resin/softening finishing, and chlorinated finishing in sequence. However, all the friction voltages revealed less than 3,000V making a conclusion that there was no issue arisen related to shrink proof finishing process likewise the results of half life testing mentioned before.

(2) Thermal Resistance

One of the most essential functions of the clothes is to keep body warmth, so this thermal resistance feature is one of the primary features in cloth fabrics. Wool is known to have excel-

fent thermal resistance. The change in thermal resistance caused by the shrinkproof finishing process was measured. Thermal resistance of shrinkproof finished wool knit, original wool knit (41.2%) showed a little higher thermal resistance ratio than shrinkproof finished wool knit. There was little difference among resin finished wool (32.3%), resin/softening wool (30.7%), and chlorinated wool (33.3%) in terms of the thermal resistance rate. It seemed that the shrink proof finishing process did not make any difference in thermal resistance. In other words, all of them showed lower thermal resistance after the finishing process, but the finishing type did not have any impact on thermal resistance. Fabric specific heat conductivity is critical for the thermal resistance of cloth fabrics. However, once the fiber is spun as yarn or knitted fabric, thermal resistance is going to be considerably influenced by the amount of air, that is, air content. Therefore, it can be concluded that when the shrinkproof finishing process is performed, the reduction of thermal resistance appears since the air layer with low heat conductivity rate is decreased as the scale layer is reduced.

(3) Pilling Propensity

Wool fabrics are subjected to pilling because they generally have fuzzy surfaces. Pills do not tend to accumulate to distressing proportions because they break off due to the weakness of the wool fiber. More pilling occurs on fabrics composed of fine wool fibers than on fabrics composed of medium wool fibers, but the pills are easy to remove. Pilling is about forming minute fiber fuzzy pills on the fabric surface when some fibers are pulled out of fabric or yarn and entangled with intact fibers and stuck on the surface. The wool fabric is known for a good fabric having no pilling even when rubbed or washed. Pilling rating standard of shrinkproof finished wool knit, under the pilling category, all testing materials showed level fourth or fifth that is almost pilling free status. Especially, there was none of pilling found on the shrink proof finished wool knit. It is considered that the strength of wool fabrics was low so that the piling, if any, was easily rubbed out to drop. Furthermore, the decrease of scale layers due to the shrink-proof finishing process prevents the pill from forming to improve the pilling related quality.

Ⅳ. Conclusion

Measurement of electrostatic propensity, thermal resistance and pilling of shrinkproof finished wool knits, and analysis of finishing methods were carried out. There was some changes and variation found in thermal resistance, electrostatic propensity, and pilling, however, it seems to be minor within standard limits. Therefore, shrinkproof finished knitted fabrics did not bring serious changes to other physical properties comparing with original wool.

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