Development of Multifunctional Anti Aging Military Raincoat Fabric by Using Fitting Technique

Chun Xia CHEN
Yan cheng institute of industry College, Yan cheng, Jiang su 224005; Excellent Scientific and Technological Innovation Team of Jiangsu Province 2015; chx9941@126.com

Abstract: Use Woodland camouflage paint Oxford fabric as base cloth, first the light pressure processing was used on the fabric. and then use polyurethane which has high water vapor permeability performance and other various additives as face glue and Bottom glue, the fabric was compounded a thin macromolecule hydrophilic polymer PU film, the fabric was water allocation processed after stripping. At last the fabric will have high performance of the windproof, waterproof and moisture permeability. After testing, the performance index of the fabric are: the smoothness appearance of fabrics after cleaning≥grade 4.0; hydrostatic pressure≥10000mmH2O; after 20 times washing≥5000mmH2O; The surface water repellency level≥grade4.0, after 20 times washing≥grade3.0; water vapor permeability≥3500g/(m²·24h); Electrostatic charge density≥2.5uc/ m²; humid air accelerated aging grade≥4.0. Test data shows that the designed functional fabric meet the technology requirement of the standards, meet the demand of the customer’s use requirements.

Keywords: Fitting Technique; raincoat fabric; design; properties; test

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With the economic development and The continuous improvement of people's living standard, fabric and clothes continuously extended in practice , gradually formed a special fabric finishing technology. Especially the development of advanced science and technology, People proposed higher and higher, more and more requirements for textiles’ performance. And the high waterproof and high moisture permeable fabrics were popular.

1 Experiment

1.1 Fabric specifications
Width:150cm
Warp: 150D polyester filament (FDY)
Weft yarn: 150D polyester filament (FDY)
Warp and weft density:480 roots/10cm×430 roots /10cm;

1.2 Choice of raw materials:
release paper
High moisture permeable polyurethane (solid content 30 ~ 55%)
solvent (two methyl amide DMF, butanone MEK , toluene TOL)
Desiccant, curing agent, promoting enzyme, color paste, etc.

1.3 Equipment
The production equipment of Multifunctional Anti Aging Military Raincoat Fabric is provided by jiang su nanwei Yueda, The equipment consists of the following parts: surface Glue table, oven, Bottom glue table, Laminating device and winding device

2 Technological process

base cloth → light pressure
face glue configuration → release paper gluing → drying → cooling → bottom side gluing
→ semi drying

Weight:150-160g/m²
Fabric weave: 2/2twill

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2.1 Pretreatment process
The pretreatment process of base cloth are generally light pressure and water allocation. Considering the adhesion fastness between Oxford cloth and PU film, select the light pressure pretreatment on the base cloth. Considering the requirements of water resistance and moisture permeability index, water allocation finishing is processed after stripping.

2.2 Transfer and fitting
This project uses the release paper transfer and fitting process. The process shown in figure 2-1:

2.3 Ripening process flow
In order to improve adhesion fastness. After transfer and fitting the fabrics are send to the ripening room, in the environment of 65°C, ripen 48 hours.

2.4 Water allocation process flow
The specific process flow shown as below:

3. Process parameters and key technologies

3.1 Glue formula and viscosity control
The goal of this project is to produce high moisture and high waterproof raincoat fabric. The product is processed by using the single component Solvent type high moisture permeable polyurethane as the surface layer of the fabric. Because the composite base fabric is thin and light, Slip and anti blocking properties should be better for the single component polyurethane.

The tensile modulus of the standard skin coating should be about 8MPa when the elongation is 100%. According to the fabric specification the surface glue viscosity is 3000-4000cps, the bottom glue viscosity is

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Figure 2-1 Transfer and Fitting process

Figure 2-2 Water allocation process flow
4000-5000cps, The glue formula is as follows:

<table>
<thead>
<tr>
<th>Table 3-1 Glue formula</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reagent</td>
</tr>
<tr>
<td>PU resin</td>
</tr>
<tr>
<td>solvent</td>
</tr>
<tr>
<td>auxiliaries</td>
</tr>
<tr>
<td>Bridging agent</td>
</tr>
<tr>
<td>Promoters</td>
</tr>
</tbody>
</table>

3.2 The gluing quantity and laminated pressure
The test shows that the surface layer thickness increase that is the increase of coating amount. Abrasion resistant and strength also increased. But the water vapor permeability decreased; when The Link layer thickness increased can increase the peeling strength, but effect the moisture permeability and handle. Coating thickness determines the PU coating agent amount, also an important factor which determine the product’s cost. According to the fabric specifications, the coating thickness is 18-20μm. If the pressure is small, although the handle is good but it will result in no laminating or weakly laminated, If the pressure is too big, the fabric and substrate’s compression deformation will increase and the handle will become hard or stiff. For this product the laminated pressure is about 4.5Kg.

3.3 drying temperature, time and air volume
Solvent ratio, drying temperature, vehicle speed, air volume and so on are the important factors that affect the film forming properties of polyurethane, It is also an important factor affecting the waterproof and moisture permeability of fabric. If the film formation temperature is high, the solvent evaporation rate will be fast. And accelerate the movement of polymer molecular chain segment, also can raise the generating efficiency and improve the permeability. But when the speed is too high, the heating rate is too fast. Can cause the film surface temperature rise too fast, make the polyurethane film crack and generate air hole. Reduce the waterproof performance. This product use the stage heating mode drying when the temperature up to 80 °C ~ 120 °C. Speed is also an important factor affecting the film formation and fitting. If the Speed is too fast, the film formation won’t be good and it is easy to produce bubbles. At the same time, the glue viscosity is insufficient, the fastness is poor, feel hard. Generally the speed is slower controled, Film formation speed is 10~15m/min, fitting speed is 20~25m/min.

3.4 Ripening temperature and time determination
Since it is a semi dry lamination, So the curing effect of connecting layer depends on the ripening temperature and time, For this product the ripening temperature and time: 65 °C, 48h. This condition can completely cure products, and enhance the peel strength.

4 Performance test
The Products were produced by Jiangsu Nanwei Yueda Fiber Technology Co.Ltd and were sent to CNTAC Testing Center-Suzhou Zhongke Textile Technology Service Co.Ltd. The Test standards and the corresponding index and test results are shown in the table 4-1.
Table 4-1 Testing Results

<table>
<thead>
<tr>
<th>Item</th>
<th>Standard</th>
<th>Index</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Washing appearance</td>
<td>GB/T13769-2009</td>
<td>10 times washing≥4.0 grade</td>
<td>10 times washing: 4.0 grade</td>
</tr>
<tr>
<td>Hydrostatic pressure</td>
<td>GB/T 4744-2013</td>
<td>≥10000mmH₂O, after 20 times washing≥5000mmH₂O</td>
<td>14760, 5671</td>
</tr>
<tr>
<td>Surface water resistance</td>
<td>GB/T4745-2012</td>
<td>≥4.0 grade, after 20 times washing≥3.0 grade</td>
<td>4-5</td>
</tr>
<tr>
<td>Moisture permeability</td>
<td>GB/T12704.1-2009</td>
<td>Moisture permeability rate≥3500g/(m²·24h)</td>
<td>3990</td>
</tr>
<tr>
<td>Anti static</td>
<td>GB/T 12703-2009</td>
<td>≥2.5uC/m²</td>
<td>2.8</td>
</tr>
<tr>
<td>Ageing resistance</td>
<td>FZ/T75007-1995</td>
<td>≥4.0 grade</td>
<td>4-5 grade</td>
</tr>
</tbody>
</table>

Test data from table 4-1 show that the designed product’s performance on Washing appearance, Hydrostatic pressure, Surface water resistance, Moisture permeability and anti static, Ageing resistance have all reached technical requirements of the standards, meet the requirements of the normal customers, fulfill the original intention of the design.

5 Conclusions

Multifunctional anti aging military raincoat Fabric. Use Woodland camouflage paint Oxford fabric as base cloth. The Multifunctional fabric is the preferred material for making the military raincoat, the mountaineering clothes and the ski clothes. The product has the performance of windproof, waterproof, and high moisture permeability which ensure the product having competitive advantage in the market. The development of this product can improve the competitive advantage of the enterprise. It is of great significance to promote the product export and to improve the product value added.

References