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Fillers Compounding and Process Optimization of Polyamide Wet-coating ⋆

Qing Zhu [a], Tao Li [b], Jin-huan Zheng [b,*]

[a] *Key Laboratory of Advanced Textile Materials and Preparation Technology, Zhejiang Sci-Tech University, Hangzhou 310018*

[b] *Ministry of Education Engineering Research Center of Ecological Dyeing and Finishing Technology Zhejiang Sci-Tech University, Hangzhou 310018*

Abstract

In view of the many problems in the coating of the trademark, such as the poor stability of the filler, the poor adhesive resistance and ink absorption of the fabric, the high pH value and insufficient printing stability, etc. this paper focuses on the study of two kinds of common inorganic fillers, wollastonite and kaolin, on the structure of the polyamide 6 coating film and the properties of the wet coating trademark fabric. The mixture of these two kinds of filler is applied to the coating slurry, and the ratio and dosage are optimized. On this basis, combined with production practice, the wet coating process conditions were optimized. The results showed that the mass ratio of wollastonite and kaolin is 1:1 (the mass of the filler is 22% of anhydrous methanol), the compatibility of coating slurry is higher than that of the coating slurry prepared from single wollastonite, it is not easy to settle, but also the dispersion of coating slurry is better than that of only kaolin, and the microporous structure on the surface of coating film is more uniform. Moreover, the coated fabrics presented higher ink absorption performance. When the coating temperature is 35 °C, the viscosity of the coating is 2∼3 Pa·s, the baking temperature is 160 °C, and the baking time is 80 s. The color fastness to the soaping color of the coated fabric reaches to grade 4-5, the printing effect reaches to 3-4, the whiteness and the fabric style are better.

Keywords: Filler; Rheologic Properties; Mechanical Property; Polyamide Wet-coating; Process Optimization

1 Introduction

At present, the trademark coating processing methods are mainly dry [1, 2] (direct coating) and wet [3, 4] coating. Dry coating is a process in which a coating agent is directly coated on a fabric to form a continuous film, thereby changing the function of the coating surface. Wet coating is the main process for making artificial leather. It is also called wet artificial leather

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*Corresponding author.
Email addresses: 1148090884@qq.com (Qing Zhu), hzzjh1968@163.com (Jin-huan Zheng).

technology. After coating or impregnating different types of base cloth through polyurethane coating agent, it solidifies to form a continuous micro porous structure in solution, and then makes products after grinding or embossing, calming and other processing procedures. The polyamide wet coating is prepared by dissolving waste polyamide filament [4] with methanol and anhydrous calcium chloride solvent, and adding proper filler to get polyamide coating slurry, the coating slurry undergoes phase transformation in a coagulating bath to form a layer of polymer film on the surface of the fabrics, thereby giving the fabric excellent elasticity, wear resistance, air permeability and moisture permeability, etc [5-7].

In the fabric coating, fillers play extremely important roles in the coating slurry viscosity, coating fabric style, whiteness, ink absorption property and washable color fastness of the coated fabric. Inorganic fillers that are often used, calcium carbonate, hydrotalcite, kaolin and wollastonite etc [8-10], of which kaolin as filler coating slurry stability is high, but its hardness is larger, the wear of the cutter is more serious, and ink absorption property is poor; While the rheological property of the coating with wollastonite is excellent. The surface of the coating film has a large number of microporous structure, excellent ink absorption and high whiteness, but the stability of the coating slurry prepared by wollastonite is poor and easy to settle. When the filler is applied to the trademark fabric coating, it not only needs high compatibility and dispersibility, but also needs to meet the requirements of whiteness, stiffness, smoothness, low price and the environmental protection. In this paper, the best compounding ratio and dosage were obtained by the combination of kaolin and wollastonite of fillers, testing its sedimentation, rheology, coating film surface structure, and tensile properties. Based on this, the wet coating process conditions were optimized in combination with the actual production.

2 Experimental Methods

2.1 Materials

Calcined kaolin (5 μm, Yangzhou god chemical raw material co., Ltd), anhydrous calcium chloride, polyamide 6 waste silk (Huzhou Xinli trademark belt co., Ltd), polyether NJ-220 (Jurong Ningwu new material development co., Ltd), wollastonite (5 μm, Changxing Huayuan powder material co., Ltd).

2.2 Formulation and Preparation of Coating

In the coating slurry formula [11], there were 17 g of wast polyamide 6 filament, x g of fillers, 35 g of anhydrous calcium chloride, 2 g of polyether and 100 g of absolute methanol.

Absolute methanol and calcium chloride were added to the three-neck flask, and then placed in a water bath at 65 °C for dissolution. After the reaction completed, 17 g of polyamide 6 wasted silk was taken and cut into pieces, and slowly added to the mixed liquor to dissolve. Meanwhile, fillers were added with stirring when waste nylon was dissolved completely. After 45 minutes, when the temperature of the water bath decreased from 65 °C to room temperature, polyether was slowly added and stired until evenly dispersed.

According to the preparation method of coating film in the literature [4], the polyamide coating slurry was evenly coated on 10 cm×10 cm glass plate (on both sides with transparent adhesive