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Relation between Visual Impression of Slide Fastener with Different Color Technology Method and Its Reflection Properties

Hiroki Maru [a,*], Fumihito Shimizu [a], Hiroyuki Kanai [b,*], Toyonori Nishimatsu [b], Shigeki Matsunaga [c]

[a] *Graduate School of Science and Technology, Shinshu University, 3-15-1 Tokida Ueda, Nagano, 386-8567, Japan*

[b] *Faculty of Textile Science and Technology, Shinshu University, 3-15-1 Tokida Ueda, Nagano, 386-8567, Japan*

[c] *Machinery and Engineering Group, YKK Corporation, 200 Yoshida, Kurobe Toyama, 938-8601, Japan*

Abstract

A slide fastener (i.e., zipper) is widely used as a secondary material in apparel products. However, the texture of the slide fastener is totally different from the main fabric because the reflection properties change according to the structure or the material. Traditionally, the appearance of the slide fastener has been considered unimportant and so is often concealed. However, recently, novel color technologies such as structural color and mimetic metallic processing have been proposed for slide fasteners made from low-cost plastic. The aesthetics and modern appearance of these new slide fasteners have become attractive to end-users. In spite of the growth of slide fasteners with novel colors, no research has investigated or assessed the applicable photometric or colorimetric methodologies. The absence of a quantitative test method decreases the efficiency of the production of slide fasteners. This study proposes a quantitative methodology to assess the aesthetics of slide fasteners produced with either conventional or the novel color technologies, based on a data set of light reflection properties of slide fasteners. First, the structure of subjective attributes obtained from the human visual sense was analyzed by sensory evaluation and factor analysis. Then, the measurement of the light reflection properties of slide fasteners was conducted with an experimental goniophotometric system developed in this study. The parameters that highly correlated with the subjective scores of representative features were explored. As a result, three principal factors, "profoundness", "elegance" and "novelty" were identified as aesthetic factors for slide fasteners.

Keywords: Slide Fastener; Visual Impression; Reflection Properties; Quantification

*Corresponding author.
Email addresses: 14st107k@shinshu-u.ac.jp (Hiroki Maru), kanai@shinshu-u.ac.jp (Hiroyuki Kanai).

1 Introduction

The slide fastener (i.e., zipper) consists of three main parts: slider, tape and elements. Many elements are attached uniformly on the edges of the paired tape. The slider tightly joins the elements of each paired tape. Slide fasteners are widely used not only for apparel products but also for industrial products because of their convenience. The main requirements of slide fasteners are toughness, durability, and usability. In the previous study, the fastener was evaluated by the sense of touch when opening and closing from the view point of the usability [1-2]. Traditionally, the appearance of the slide fastener has been considered unimportant and so it is often concealed. However, the texture of the slide fastener is totally different from that of the main fabric because the reflection properties change according to the structure or the material. Recently, an excellent design property has been developed [3] and novel color technologies such as structural color and mimetic metallic processing have been proposed for slide fasteners made from low-cost plastic. The aesthetics of these slide fasteners is expected to satisfy the diverse demands of end users. Despite the production and circulation of slide fasteners with novel colors in apparel products especially, no research has investigated or assessed the applicable photometric or colorimetric methodologies.

This study proposes a quantitative methodology to assess the aesthetics of slide fasteners produced with either conventional or novel color technologies, based on the data set of the light reflection properties of slide fasteners. Furthermore, no research has reported a systematic investigation of the aesthetics, which is the reaction obtained from a human's visual sense when he or she is observing a slide fastener.

Hence, this study proposes a quantitative methodology to assess the aesthetics of slide fasteners produced with either conventional or novel color technologies. The methodology is based on a data set of the light reflection properties of the slide fastener. First, a structure of subjective attributes obtained from a sensory evaluation was analyzed by factor analysis. Second, measurement of the light reflection properties on the slide fasteners was conducted with an experimental goniophotometric system developed in this study. Third, the parameters that highly correlated with the subjective scores of representative features were explored. Finally, an assessment model based on the relation between the aesthetics of slide fasteners and their reflection properties was constructed mathematically.

2 Specimens

The components of the slide fasteners used in this study are a slider, a tape and elements, which are shown in Fig. 1. The elements were the determinants of the aesthetics because these parts are the most exposed on the surface of the slide fastener. In this study, the parameter of the specimens was the type of color technology used in the production of the elements. The material of the elements of all specimens was a polyester resin molded into a coil shape. With a coil shape, the color technologies of the slide fasteners (hereinafter referred to as coil fasteners) could be applied to plastic. As shown in Fig. 2, five different color technologies were used for the elements: (a) Dyeing [D], (b) Spun-dyeing [SD], (c) lamination of Metallic Layers [ML], (d) lamination of Thin Layers [TL] (structural color) and (e) Nondyeing [ND] (material is transparent). Of these methods, D and SD are regarded as conventional color technologies, and ML and TL are regarded as novel color technologies. A luster specific to the metallic surface was observed on the surface of