

Effects of Adhesive Agent on Shear Stiffness of Fabrics Bonded with Adhesive Interlining

Kyoung Ok Kim^a, Masayuki Takatera^{b,*}

^a*Interdisciplinary Graduate School of Science and Technology, Shinshu University
Nagano, Ueda, 386-0017, Japan*

^b*Faculty of Textile Science and Technology, Shinshu University, Nagano, Ueda, 386-0017, Japan*

Abstract

The effects of adhesive agent on shear stiffness of laminated fabrics bonded with adhesive interlining were investigated. The shear stiffness of face fabrics made of different weave density and adhesive interlinings made of different adhesive condition for mass, number and diameter were measured. As adhesive agent mass increases, shear stiffness values of adhesive interlining and laminated fabric is increased. Furthermore, as weave density of face fabric increases, shear stiffness of face fabrics is increased. The increasing rate (*I.R.*) of shear stiffness for face fabric by bonding adhesive interlining was obtained from the difference between shear stiffness of laminated fabric and pressed adhesive interlining. The relationship between fixed crossing points of warp and weft by adhesive agents per all crossing points of warp and weft (*F.C.* (%)), and adhesive agent mass and number was investigated. A prediction method was proposed using the increasing rate (*I.R.*) and *F.C.* (%). The predicted shear stiffness of laminated fabric showed good agreements with experimental ones.

Keywords: Shear Stiffness; Torque; Crossing Point; Adhesive Agent Mass; Laminated Fabric; Adhesive Interlining

1 Introduction

Nowadays, numerous subsidiary materials for clothing have appeared in the response to various necessities of fabrics. Among them, an interlining has been commonly used to give garments a suitable appearance and stability. The interlining is considered as the most important subsidiary material. An adhesive interlining which uses thermoplastic resin is a representative. Because the properties of a fabric were considerably changed by laminating adhesive interlining, and the changes of those properties have affected the garments' properties, studies about the effect of adhesive interlining on laminated fabric are necessary. Especially, prediction for mechanical properties of laminated fabric is needed for a garment design. Among many of the mechanical properties, bending and shear stiffness are the few of the most important factors for garments.

*Corresponding author.

Email address: takatera@shinshu-u.ac.jp (Masayuki Takatera).

There are some studies on prediction method of mechanical properties for laminated fabric with adhesive interlining. In regards to the prediction of bending rigidity for laminated fabric, Kanayama M. et al. [1] and [2] suggested a prediction method about the bending rigidity of a composite, based on mechanical theory for composite structure. In our previous study [3] and [4], we verified laminate theory and proposed a prediction method for the bending rigidity of laminated fabric with adhesive interlining, considering the tensile and compressive moduli of face fabric and adhesive interlining. Furthermore, we also proposed more precise prediction methods which consider the position of the neutral axis for face fabric [5]. However, studies on shear properties are insufficient.

In the case of uniform material, shear stiffness of laminated plate with plate 1 and plate 2 is the sum of shear stiffness for two plates. However, as shown in Fig. 1, the shear stiffness of laminated fabric is larger than the sum of the face fabric and adhesive interlining. Thus, it is clear that woven fabric and adhesive interlining show different properties than uniform material. Therefore, it is necessary to investigate related factors on shear stiffness of laminated fabric and a prediction method of shear stiffness for laminated fabric.

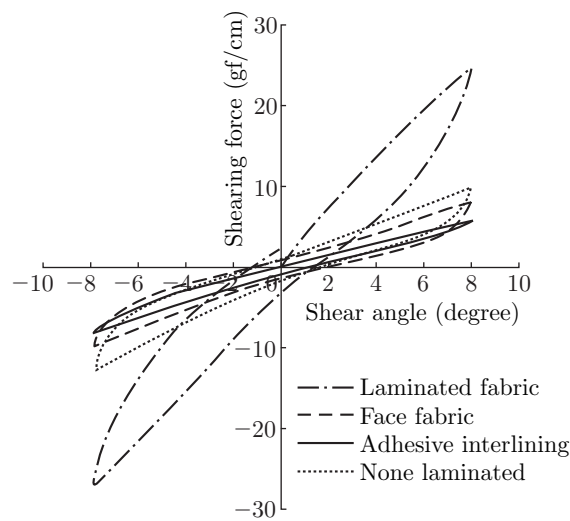


Fig. 1: Typical shear graph of face fabric, adhesive interlining, laminated fabric with face fabric and adhesive interlining, and none laminated fabric with face fabric and adhesive interlining

In relation to the prediction of shear stiffness for laminated fabric, Shishoo R. et al. [6] investigated the relationship of mechanical properties experimentally and statistically. They introduced regression equations for shear stiffness. Fan J. et al. [7] considered shear properties as important factors. They suggested a set of equations to predict the low stress mechanical properties of fused composites from those of composed and fusible interlining fabrics. The studies were focused on proposing prediction equations of mechanical properties for laminated fabric, with adhesive interlining based on statistical analysis. However, the errors between predicted and calculated results were still large. Kanayama M. et al. [2] also mentioned the possibility of using the prediction method concept for shear properties, considering the rate of hard segment with adhesive and soft segment without adhesive agent. However, the practical results did not show in their study. Those studies are still not enough for practical usage, therefore more precise prediction method of shear stiffness for laminated fabric is necessary.

In this study, the effect of torque at crossing point of warp and weft and adhesive agent were considered as the factors on shear stiffness of laminated fabric. The yarn torque properties of