

On the Characteristics of Silk Crape

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Abstract

In order to make the characteristics of crape clear, at first the hearing investigations related to the characteristics of crape at wholesale drapers and *Kimono* speciality stores, which deal in crape, in Tokushima city were carried out. And next stage, some basic mechanical properties, the luster and the wet-shrinkage were measured, and the detailed imports on the hearing investigation were tried to throw light on the characteristics of crape mechanically.

As the results, the characteristics of crape were summerized as follows.

① Strong and substantial durable, ② Soft and flexible, ③ *Kimono* made of crape is secure and gives warmness to wearer, ④ Craping gives *Kimono* agreeable and soft touch, ⑤ Crape is not easy to become creased, and it is useful for the ceremonial dress and the visiting dress, ⑥ At the parts such as hips and knees on *Kimono*, where workes the elongation force, the deforms of crape *Kimono* in parallel to warp direction of cloths are large and crease easily but they fade away by and by, ⑦ The crape *Kimono* shrink largely when they suck up water, and in a rainy day it's better not to wear them, ⑧ The density of fibers of crape is large, and the dyed color of crape is deep and fine, ⑨ The luster of crape is sober and restful.

Key words: *Kimono*, hearing investigation, mechanical property, luster

1. INTRODUCTION

The crape has been one of Japan's most distinctive textiles since ancient time and has gained a reputation worldwide as the supreme example of japanese costume. It is because of its distinctive quality and features, transcending the history, location and local customs of the people who wear this from of clothing, that crape has continued to be highly valued over a long historical period.

There is a wide range of literature on the subject of crape written from the standpoints of introducing the various types of material, discussing its history, and looking at the origins of the textile unions. However, most such writings are little more than fragmentary attempts to describe these matters from an empirical and publicity-oriented position. Very little serious research has ever been published in this area.

In the present study I examine the features of crape. I began by directly interviewing kimono wholesalers, kimono stores and Western-style clothing stores on the subject of crape in order to establish a clear image of this fabric. I then went on to examine the subject experimentally in terms of the physical properties of the fabric in connection with the features of this image.

In the study of the physical properties of the material, I selected habutae as a silk fabric to offer comparisons with crape. Habutae is used frequently together with crape in garments such as semi-formal visiting kimono (homongi), kimono in non-color fabric (iromuji), mourning kimono (mofuku), broad-sleeved kimono (tomesode and furisode), and undergarments such as juban.

2. TESTING METHODS

In order to gather how retail stores themselves see the features of crape, I began by presenting a series of questions to 30 kimono wholesalers, kimono stores and Western-style clothing stores that handle crape fabric and have been in business for at least 30 years (Table 1, Table 2, Table 3). The questions covered the following specific matters:

Table 1 Quantitative percent of crape vs all the fabric holdings at wholesale drapers and *Kimono* speciality stores in Tokushima

| Quantitative percent of crape* (%) | Numbers of shops | Percent of shops (%) |
|------------------------------------|------------------|----------------------|
| more than 70~80 | 8 | 40 |
| about 50 | 5 | 25 |
| less than 10 | 3 | 15 |
| not clear | 4 | 20 |
| Total | 20 | 100 |

* Result of hearing investigation.

(1990. Nov.)

- 1) Types of crape.
- 2) Features of crape (strong points and weak points).
- 3) Uses for crape.
- 4) Proportional extent of use of crape in each store.
- 5) Other matters (e.g. opinions and impression of crape).

Table 2 Details of samples

| Sample* | | Thickness (mm) | Weight (g/m ²) | Density (1/cm) | | Shrinkage (%) | |
|-----------------|----------------|-------------------|-------------------------------|----------------|---------|---------------|---------|
| Mark | Fabric | | | warp | filling | warp | filling |
| A ₁ | Habutae | 0.29 | 132.0 | 53.0 | 24.4 | 6.19 | -0.12 |
| A ₂ | Habutae | 0.23 | 107.1 | 54.4 | 27.4 | 6.24 | -0.04 |
| A ₃ | Habutae | 0.28 | 119.8 | 53.0 | 24.0 | 7.06 | 0 |
| A ₄ | Habutae | 0.25 | 107.9 | 51.2 | 24.2 | 4.61 | -0.02 |
| A ₅ | Habutae | 0.21 | 94.0 | 53.0 | 29.4 | 3.89 | -0.33 |
| A ₆ | Habutae | 0.27 | 106.7 | 53.6 | 25.0 | 4.12 | 0.04 |
| A ₇ | Habutae | 0.13 | 49.7 | 54.2 | 30.4 | 2.50 | 0.45 |
| A ₈ | Habutae | 0.17 | 73.9 | 52.2 | 31.6 | 2.42 | 0.42 |
| B ₁ | Kawari-muji** | 0.30 | 121.2 | 60.0 | 22.9 | 5.67 | 1.38 |
| B ₂ | Kawari-muji** | 0.30 | 122.8 | 59.3 | 23.7 | 7.80 | 2.50 |
| B ₃ | Kawari-muji** | 0.31 | 133.2 | 56.4 | 21.7 | 4.40 | 2.13 |
| B ₄ | Kawari-muji** | 0.30 | 131.9 | 59.8 | 23.9 | 6.30 | 0.50 |
| B ₅ | Kawari-muji*** | 0.30 | 125.5 | 52.3 | 20.3 | 4.40 | 0.88 |
| B ₆ | Kawari-muji*** | 0.31 | 128.5 | 52.1 | 20.4 | 7.20 | 1.25 |
| B ₇ | Kawari-muji** | 0.28 | 132.7 | 54.0 | 23.5 | 5.40 | 0.25 |
| B ₈ | Kawari-muji** | 0.29 | 131.0 | 54.0 | 23.9 | 7.47 | 0.50 |
| B ₉ | Kawari-muji** | 0.27 | 134.5 | 51.5 | 22.2 | 3.87 | 1.13 |
| B ₁₀ | Kawari-muji** | 0.29 | 138.7 | 51.6 | 22.8 | 2.70 | 0.13 |
| B ₁₁ | Kawari-muji*** | 0.25 | 101.0 | 49.4 | 25.9 | 8.00 | 1.75 |
| C ₁ | Hitokoshi** | 0.39 | 140.9 | 65.8 | 21.5 | 13.27 | 19.75 |
| C ₂ | Hitokoshi** | 0.39 | 147.0 | 66.4 | 21.6 | 15.03 | 14.50 |
| C ₃ | Hitokoshi** | 0.34 | 134.6 | 92.6 | 23.2 | 7.13 | 10.25 |
| C ₄ | Hitokoshi*** | 0.37 | 128.9 | 61.3 | 20.2 | 13.73 | 19.50 |
| C ₅ | Hitokoshi*** | 0.38 | 130.1 | 61.1 | 19.9 | 14.03 | 20.75 |
| C ₆ | Hitokoshi*** | 0.38 | 134.0 | 61.6 | 20.2 | 14.20 | 22.25 |
| C ₇ | Hitokoshi*** | 0.38 | 132.4 | 63.0 | 20.2 | 15.80 | 22.50 |

* Samples A₁~A₈, B₅, B₆, B₁₁, C₄~C₇ were bought at *Kimono* speciality stores in Tokushima in Nov.1990, and the others were come in hand from TANGO ORIMONO KOGYO KUMIAI in Kyoto Prefecture in Nov.~Dec. 1990.

** Tango crapes.

*** Hama crapes.

(B₇~B₁₁ are commonly colled Seika sometimes in Tango district but these are formally colled Kawari-muji as technical terms).

(Habutae (A₁~A₈) were woven in Hokuriku districts (such as Ishikawa, Fukui and Fukushima Prefectures etc)).

Table 3 Marks and their details of mechanical properties

| | Mark | Detail | Unit | Note |
|--------------|----------------------|-----------------------------------|-----------------------|---|
| Shear* | <i>G</i> | Shear stiffness | g/(cm·degree) | Pre-tension:10g/cm |
| | <i>2HG</i> | Hysteresis at $\phi = 0.5$ degree | g/cm | Maximum shear angle: $\pm 8^\circ$ |
| Bending* | <i>B</i> | Bending rigidity | g·cm ² /cm | Maximum curvature: $\pm 2.5\text{cm}^{-1}$ |
| | <i>2HB</i> | Hysteresis of bending moment | g·cm/cm | Rate of bending deformation: $0.5\text{cm}^{-1}/\text{sec}$ |
| Tensile** | <i>E</i> | Young's modulus | g/(cm·%) | Maximum tensile strain 15 % |
| | <i>R_E</i> | Resilience (tensile) | % | |
| Compression* | <i>WC</i> | Compressive energy | g·cm/cm ² | Compression plate: circle of 2 cm ² |
| | <i>RC</i> | Resilience (compression) | % | Compression rate: 0.02mm/sec |
| | <i>EMC</i> | Compressibility | % | Maximum compression load: 50g/cm ² |
| Surface* | <i>MIU</i> | Coefficient of friction | none | Friction: 50g |
| | <i>MMD</i> | Mean deviation of <i>MIU</i> | none | Roughness: 10g |
| | <i>SMD</i> | Geometrical roughness | μm | |

* Measured with KES-system (KATO TECH), ** measured with TENSILON UTM-II (TOYO BALDWIN).

3. RESULTS OF STUDY OF THE FEATURES OF CRAPE

The results of the study based on interviews concerning the features of crape with kimono wholesalers, kimono stores and Western-style clothing stores can be summarized in the following nine items:

- 1) The material is robust and durable.
- 2) It is a fabric with a soft and smooth texture.
- 3) Clothing made from crape is strong and also warm.
- 4) The presence of natural crimpling gives the fabric a pleasantly relaxing and refined feel.
- 5) Since the material does not easily become creased, it is well suited to use for formal kimono (reiso), semi-formal visiting kimono (houmongi), and stylishly designed kimono.
- 6) The fabric tends to lose shape in areas subject to tensile strength such as around the hips.
- 7) The material contracts through absorption of moisture, meaning that care is needed when wearing on a rainy day.
- 8) The fabric takes well to dyeing because of the high yarn density.
- 9) The material has a restrained and subdued luster.

I then conducted various experiments in connection with the results of the interviews on the features of crape aimed at studying and clarifying the details on the basis of the physical properties of this fabric.

4. DYNAMIC PROPERTIES OF THE FABRIC

Despite the fact that crape is a relatively thick fabric, it bends easily, is soft, and recovers well from deformation through bending. The occurrence of fabric creasing is linked to recovery from deformation of the fabric through bending, meaning that crape is a fabric that is not easily subject to creasing²⁾.

Since crape is a fabric created by degumming relatively thin strongly twisted yarn and then untwining the yarn, the fibers themselves possess winding constriction and gaps are present between the fibers constituting the yarn. This means that there is

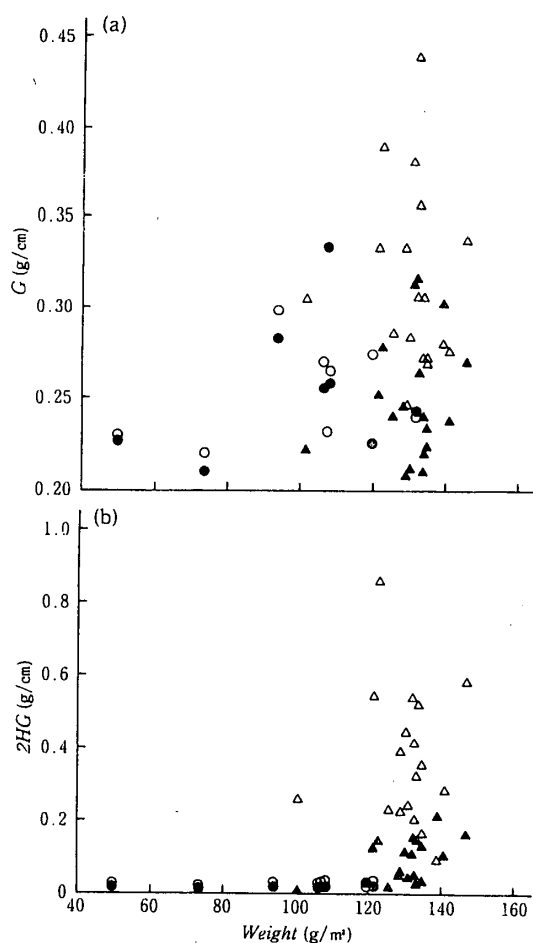


Fig.1 Variations of shear stiffness G and hysteresis $2HG$ at hysteresis angle 0.5° of cloths vs their weight
 ○ Warp direction of Habutae
 ● Filling direction of Habutae
 △ Warp direction of Crape
 ▲ Filling direction of Crape

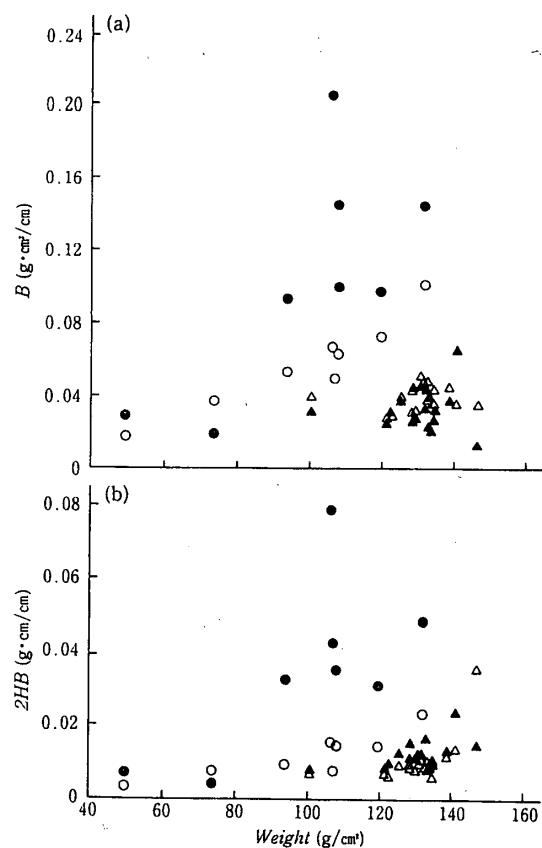


Fig.2 Variations of bending rigidity B and hysteresis $2HB$ of cloths vs their weight
 ○ Warp direction of Habutae
 ● Filling direction of Habutae
 △ Warp direction of Crape
 ▲ Filling direction of Crape

considerable freedom with respect to movement of the fibers inside the yarn, which are not subject to a significant degree of deformation in respect to deformation of the fabric through bending, and this is likely to be a factor in the fabric's strong recovery capacity. Another factor is that the presence of natural crimpling on the surface of the fabric, which prevents deformation through bending. Since the fabric is not subject to extensive deformation in this manner, this has a beneficial effect on enhancing the capacity of the material to regain its form.

The gaps between the fibers constituting crape fabric hold the air in the fabric, meaning that clothing made from such silk crape material gives a sensation of warmth. Furthermore, it would appear to be the air content of the silk crape material together with its natural softness that gives rise to the light sensation of the material on the skin (Fig.1, Fig.2).

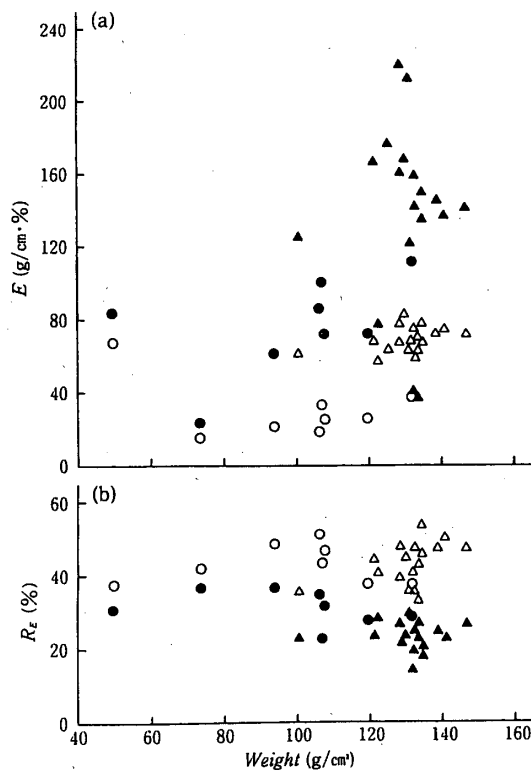


Fig.3 Variations of Young's modulus E and tensile resilience R_E of cloths vs their weight
 ○ Warp direction of Habutae
 ● Filling direction of Habutae
 △ Warp direction of Crape
 ▲ Filling direction of Crape

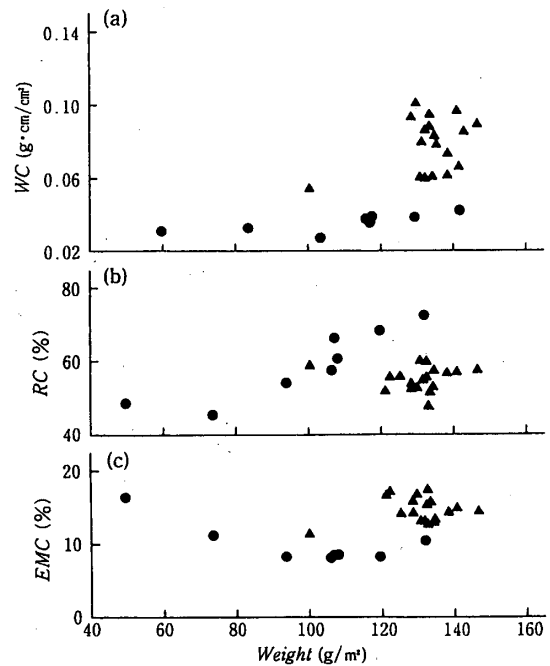


Fig.4 Variations of compressive energy WC and compressive resilience RC of cloths vs their weight
 ● Habutae, ▲ Crape

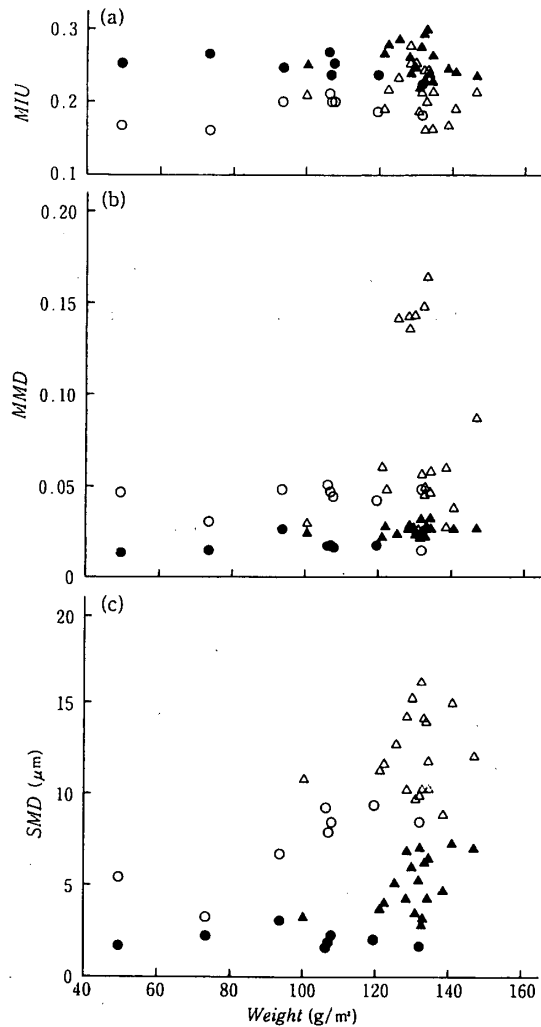


Fig.5 Variations of mean coefficient *MIU* of friction, deviation *MMD* of *MIU*, and surface roughness *SMD* of cloths vs their weight
 ○ Warp direction of Habutae
 ● Filling direction of Habutae
 △ Warp direction of Crape
 ▲ Filling direction of Crape

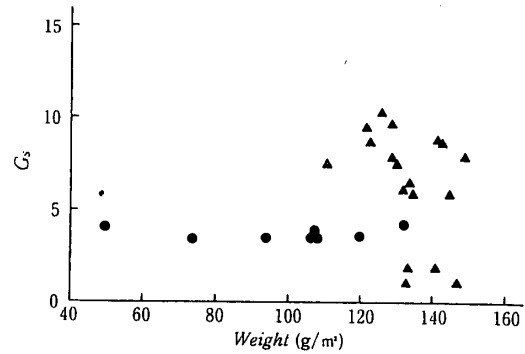


Fig.6 Variations of regular reflexion *Gs* of cloths vs their weight
 ● Habutae, ▲ Crape

In comparison with habutae silk, crape tends to be less affected by deformation through expansion and contraction in respect to tensile strength, but the warp direction of the fabric is stronger than the weft in respect to extent of deformation and recovery capacity. Since the warp direction of fabric generally tends to be constituted so as to conform with the length direction of clothing, when a person sits in the formal position on their knees wearing a costume made from crape, tensile

strength works in the warp direction of the clothing around the bottom and the knees. This means that the material easily loses its shape as a consequence of expansion deformation being applied in this direction. However, because of the strong capacity for tensile recovery, or flexibility, in the warp direction in the case of crape, loss of shape caused by wearing can be easily lost (Fig.3, Fig.4, Fig.5). Accordingly, adding to Item 3 in the results of the survey concerning the features of crape referred

to earlier, it may be assumed that "(6) The material is liable to lose shape in the warp direction of the clothing in places subject to the application of tensile strength on the material such as around the hips and the knees, but the original shape is easily regained."

5. THICKNESS OF THE FABRIC, YARN DENSITY AND WEIGHT

The values for the thickness and weight of the yarn are both higher in the case of crape than in the case of habutae silk, indicating that crape is a very strong material. The yarn density of crape is greater than that of habutae in the warp direction, although it is less in the weft direction. Seen in terms of the average density in both the warp and weft directions, there is no significant differences between the two materials³⁾. However, owing to the natural crimpling of crape, values for both the thickness and the weight of the fabric are higher for crape than for habutae, indicating that crape has the higher fiber density.

6. CONCLUSION

In order to make the characteristics of crape clear, at first the hearing investigations related to the characteristics of crape at wholesale drapers and *Kimono* speciality stores, which deal in crape, in Tokushima city were carried out. And next stage, some basic mechanical properties, the luster and the wet-shrinkage were measured, and the detailed imports on the hearing investigation were tried to throw light on the characteristics of crape mechanically.

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- ⑤ Crape is not easy to become creased, and it is useful for the ceremonial dress and the visiting dress.
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- ⑦ The crape *Kimono* shrink largely when they suck up water, and in a rainy day it's better not to wear them.

- ⑧ The density of fibers of crape is large, and the dyed color of crape is deep and fine.
- ⑨ The luster of crape is sober and restful.

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