

## Effect of Far-Infrared Finishing on Brassiere Pad

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### Abstract

*This study focused on the change of skin temperature by the emissivity and emission power of far-infrared for conformant far infrared effect to naked eyes. The study method is to manufacture the bra pad by each concentration on far-infrared materials of illite powder ( $(K,H_3O)Al_2(Si,Al)_4O_{10}(H_2O,OH)_2$ ), liquid alumina ( $Al_2O_3$ ), the extracted liquid from 29 kind of medical plants, then, measured change of skin temperature. Result are as follows. Far-infrared were emitted each 90.2%, 90.1%, 89.7% from the illite powder, liquid alumina, extracted liquid from medical plants. When the testee wore the bra pad, the temperature of coated bra pad was 0.5°C higher than the non finished bra pad. Washing fastness on far-infrared finishing was better dope addition method than coating method.*

*Key words : far-infrared, emissivity, emission power, illite powder, liquid alumina, medical plants, skin temperature, dope addition method.*

### 1. Introduction

Even though the far-infrared has been used in the industry since 1930, the study and investigation devoted in 1970s when the world was running out of energy after two of petroleum fluctuations. Far-infrared is a kind of electronic wave, long ultrared from 0.76 to 1,000  $\mu\text{m}$ . It generates heat. Also, The important thing in the characteristics of far-infrared is a phenomenon of resonance absorbing the atom or molecule

when the number of vibration of far-infrared is emitted the same as atom or a molecule of the material. If this phenomenon is occurring, the energy within the molecule is generated and it makes molecule of activity. The effect of far-infrared appears differently according to each wave scope. Among far infrared, the wave in the region of 9.36  $\mu\text{m}$  makes transform of water molecule in body to active energy.<sup>1-3)</sup>

Research for far-infrared related textile goods were progressed evaluation of wear feeling for clothes with far-infrared emission materials<sup>4)</sup>,

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<sup>1</sup> Korea Far-Infrared Association, Far-infrared material series: Evaluation & application technology part, Korea Far-Infrared Association (2001).

<sup>2</sup> Korea Far-Infrared Association, Far-infrared material series: Application & application case. Korea Far-Infrared Association (2001).

<sup>3</sup> Korca Far-Infrared Association, Progress seminar on far-infrared technology. Korea Far-Infrared Association (2000).

<sup>4</sup> P. J. An, B. H. Jang and J. H. Cho, "Evaluation of wear feeling for clothing with far-infrared emission materials in the office of summer season," *Journal of Korean Society of Living Environmental System*, Vol. 4 No. 4 (1997).

evaluation of charcoal finished non woven fabric for disposable clothes<sup>5)</sup> etc.

Far-infrared finishing of textile goods makes 1) manufactured textiles by dope solution with far infrared materials, 2) coating method of the powder or the liquid of far-infrared material on the surface of textile by heat or binder. But, far infrared finished textile goods are some problems. The cost rises by the far-infrared finishing, however difficult to conformant far-infrared effect to naked eyes. Also, The effect decreases by laundry.

This study focused on the change of skin temperature by the emissivity and emission energy of far-infrared for conformant far-infrared effect to naked eyes. The study method is to manufacture bra pad by each concentration of far-infrared materials. Then, measured change of skin temperature. Aim of this research is to develop of far-infrared bra pad for maintain and promotion of the aesthetic aspect as well as healthy; in view of the fact that now days, people are more concern about their health.

## II. Experiment

### 1. Materials

Far-infrared materials using are 1) illite powder( $K_2H_3O)Al_2(Si,Al)_4O_{10}(H_2O,OH)_2$ ), 2) The extracted liquid from 29 type of medical plants (Palson Co.), 3) The ionized liquid alumina ( $Al_2O_3$ ) from diaminoxid (Intarsia Co.).

### 2. Experimental Method

#### 1) Measurement of emissivity & emission power for far-infrared materials

Far-infrared materials were measured emissivity and emission power by FT-IR Spectrophotometer with condition far-infrared emission rate 5~20  $\mu m$ , and 37°C. Also, It were measured against black body.

#### 2) Bra pad foam manufacture & far-infrared finishing by dope addition

Melt spun foam (size: 220cm × 380 cm, thickness: 1.75cm) was manufactured by adding 5%, 7%, 10%, 15% from powder type of far-infrared material in the dope solution of polysol and isocyanate by the 3,000~3,500 r.p.m. shaker.

#### 3) Far-infrared finishing by coating

Coated foam was manufactured by binding 15% far-infrared materials to the hand screen.

#### 4) Bra pad manufacture

Bra pad were manufactured by pull cup type after heat treatment during 65min. to the mold press (Namyang Engineering Co., Ltd.).

#### 5) Measurement of skin temperature

The skin temperature measured the subject wearing 1Clo clothes. After wearing bra pad by Thermotracer (NECSan-ei: Japan Instruments Co., Ltd.). Testee were wearing far-infrared shoulder pad and bra pad which are ionized liquid alumina 30% concentration in the right shoulder and left breast for 1 hour in the indoor temperature of 21.8°C.

#### 6) Washing fastness

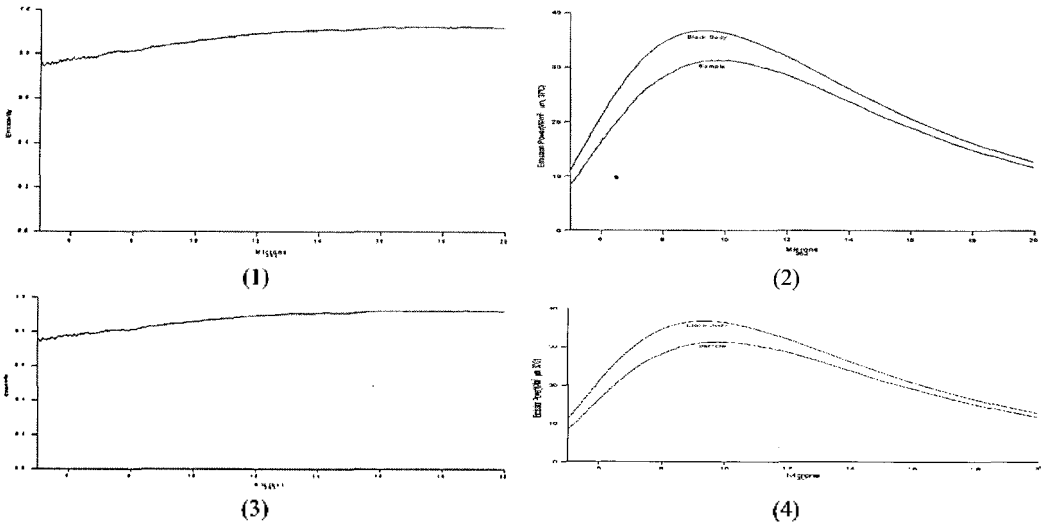
Far-infrared finished bra pad washed by washing method of KS K 0430, A-1. Then, Bra pad were measured surface temperature by Thermotracer (NECSan-ei: Japan Instruments Co., Ltd).

## III. Results and Discussion

### 1. Measurement of Emissivity & Emission Power for Far-Infrared Materials

Far-infrared materials using in this experiment were measured emissivity and emission power by FT-IR Spectrophotometer with condition far-infrared emission rate 5~20  $\mu m$  and 37°C. The result were as <Fig. 1>. Far-infrared is a kind of electric waves in 0.76~1,000  $\mu m$  area. One of

<sup>5)</sup> J. S. Shin, "Characteristic changes of disposable clothes fabric on printing using natural dyeing," *The Research Journal of the Costume Culture* Vol. 12 No. 6 (2004): 1010-1020.



- (1) Emissivity of the extracted liquid from 29 kind of medical plants.
- (2) Emission power the extracted liquid from 29 kind of medical plants.
- (3) Emissivity of the illite powder
- (4) Emission power the illite powder

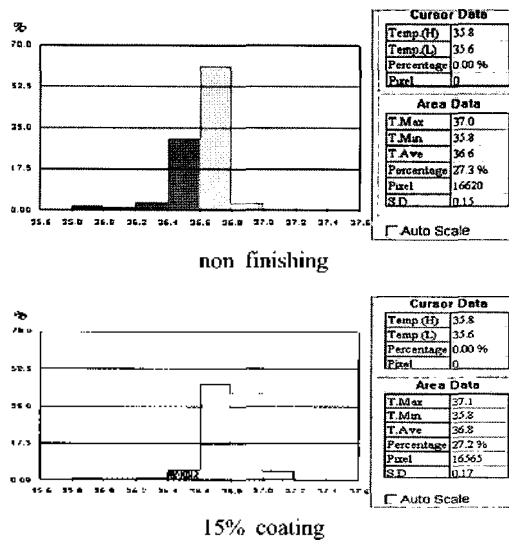
〈Fig. 1〉 Emissivity and emission power of far-infrared materials on 15% concentration.

important characteristic of far-infrared increase energy activity of body in  $9.36 \mu m$  similar with body waves<sup>6)</sup>.

Far-infrared were emitted each 90.2%, 90.1%, 89.7% from the illite powder  $(K,H_3O)Al_2(Si,Al)_4O_{10}(H_2O,OH)_2$ , and the ionized liquid alumina  $(Al_2O_3)$  from diaminoxid, the extracted liquid from 29 kinds of medical plants.

**2. Change of Surface Temperature by Coating**

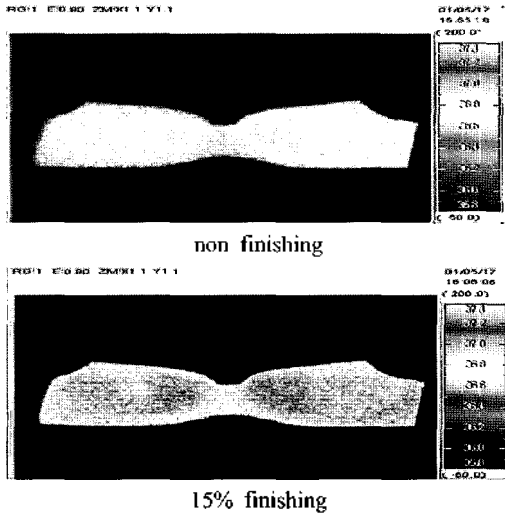
〈Fig. 2〉 is to investigate the change of surface temperature on coated bra pad with powdered far infrared material. In case of the bra pad with 15% far infrared coating and the non finished bra pad, the non-finished bra pad appeared 35.8~37°C and the average was 36.4°C. The coated bra pad appeared 36.4~37.4°C and the average was 36.9°C. The coated bra pad appeared 0.5°C the higher temperature distribution than the non-processed bra pad. 〈Fig. 3〉 is infrared thermal photographs of the coated bra pad with powdered far-infrared material and the non finished



〈Fig. 2〉 Change of surfacc temperature on bra pad coating by powdered far-infrared material.

bra pad.

<sup>6)</sup> Korea Far-Infrared Association, *Op. cit.* (2001).

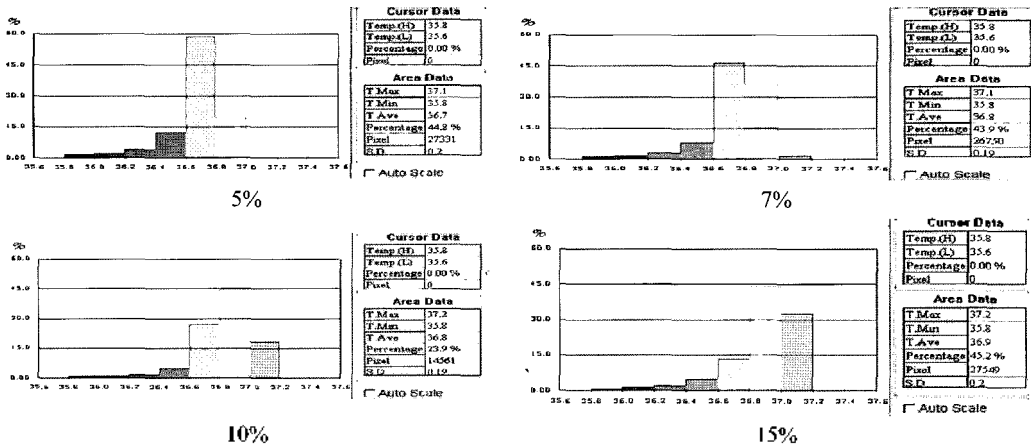


〈Fig. 3〉 Infrared thermal photographs of coated bra pad with powdered far-infrared material.

### 3. Change of Surface Temperature by Dope Addition

#### 1) Change of pad foam surface temperature by concentration

〈Fig. 4〉 is to investigate the change of foam surface temperature. The foam was manufactured to the dope solution with far infrared materials of powder type from high concentration



〈Fig. 4〉 Change of pad foam surface temperature by concentration in dope addition with powdered far-infrared material.

to low concentration. The temperature distribution were appeared 35.8~37.2℃, and by the concentration increase 5%, 7%, 10%, and 15%, the distribution of 37.2℃ is the highest.

When compare the coating method and the dope addition method about far-infrared materials finishing, dope addition method could get higher surface temperature then coating method.

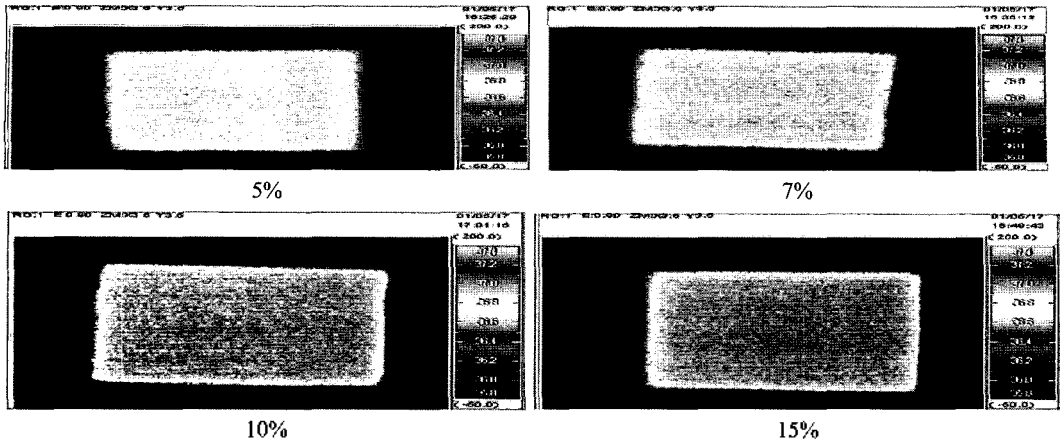
〈Fig. 5〉 are infrared thermal photographs of pad foam with powdered far-infrared material by dope addition.

#### 2) Change of surface temperature bra pad by concentration

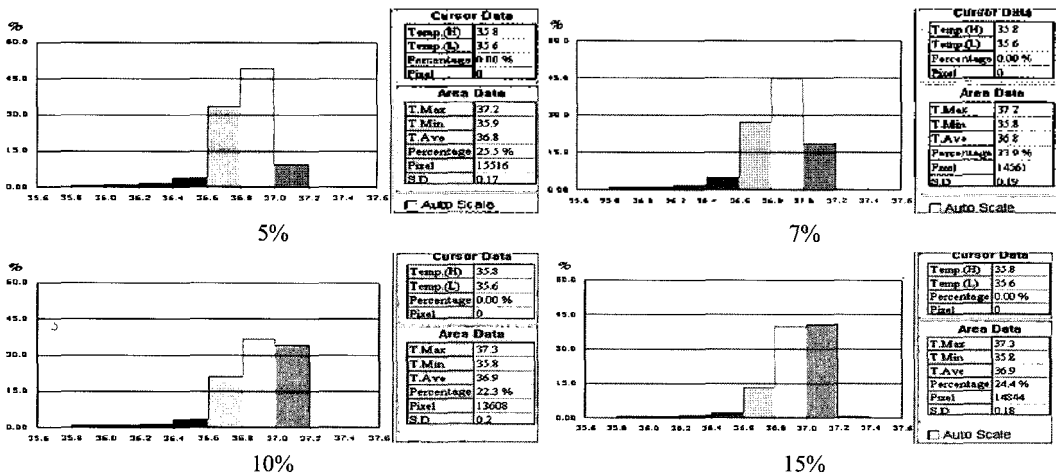
〈Fig. 6〉 is to investigate the change of the bra pad temperature. The bra pad was manufactured by melt spun foam with powdered far-infrared material. The temperature distribution appeared 36.4~37.2℃, and when the concentration goes on high, the distribution of 37.2℃ was high also. However, the distribution of 37.2℃ is higher on the bra pad than the foam. The cause of this result guessed the bra pad is circular, therefore the heat moves in the center. 〈Fig. 7〉 are manufactured the bra pad by melt spun foam with powdered far-infrared material.

#### 4. Change of Body Skin Temperature

Skin temperature was investigated how the developed far-infrared pad was influence on the



<Fig. 5> Infrared thermal photographs on pad foam by concentration in dope addition with powdered far-infrared material.



<Fig. 6> Change of surface temperature of bra pad by concentration.

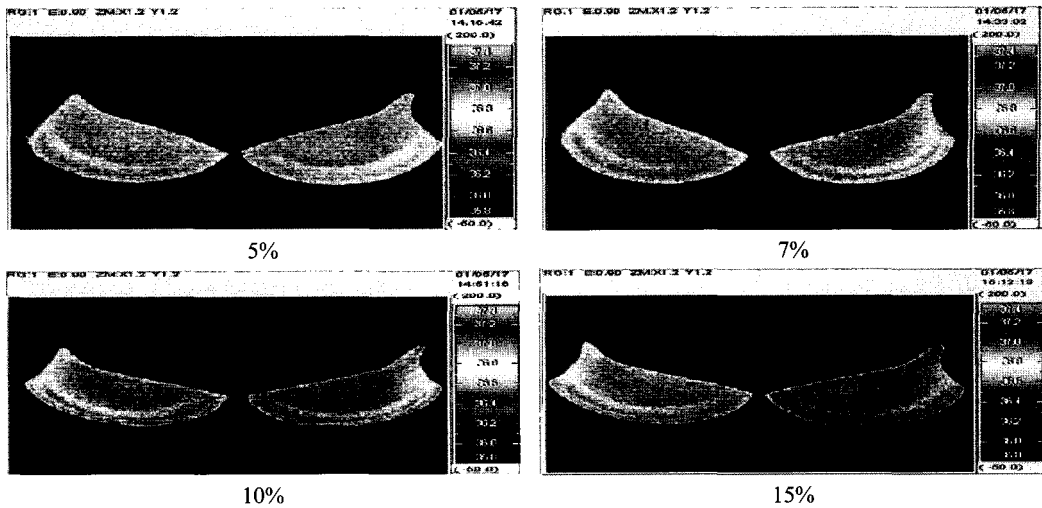
body of testee wearing 1Clo clothes. The testee was wearing far-infrared bra pad and shoulder pad and were measured the change of skin temperature by wearing time and taking off time of bra & should pad.

<Fig. 8> is showing 36~37°C in both shoulders of testee when measuring the change of skin temperature. The left breast of pad wearing showed 35~36°C, while the right breast showed 35°C. The difference was about 0.5°C. After five minutes of emitting the heat by taking off the clothes, there was appeared 35~36°C in the shoulders, but the right shoulder wearing far- infrared

pad was higher than the left one in 36°C to show to be low in the skin temperature slowly. The left breast wearing pad shows 35~34°C, while the right breast not wearing pad showed mainly 34°C.

5. Washing Fastness

Far-infrared were measured bra pad after 1~30 time repeat washing using detergent 5g/l during 30 min. in the 40+ -2°C. Compare the washing resistance depends on the manufacturing process between dope addition method and coating method. Fig. 9 is showing far- in-



<Fig. 7> Infrared thermal photographs of manufactured the bra pad by melt spun foam with powdered far-infrared material.

frared after bra pad washing.

Coated bra pad all were lowed the surface temperature of bra pad after 10 time, 20 time, 30 time repeat washing as like photo. In case of coating method, surface temperature of bra pad measured each 32~33℃, 35~36℃, 35~37℃ according to 10%, 20%, 30% concentration after finishing.

But, It were measured each 32℃, 32~33.5℃ according to 10 time, 20 time, 30 time repeat washing. It were lowed each 0.5℃, 2.5℃, 3℃ after washing.

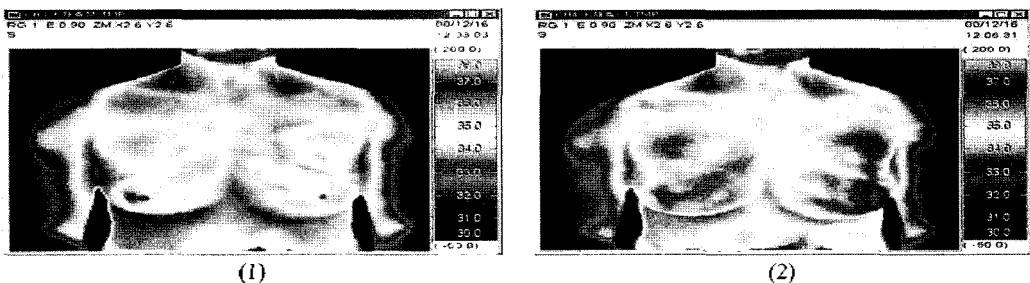
In case of dope addition method, surface tem-

perature of bra pad were measured 36.5~39℃. It was measured 36~36.5℃ after 30 time repeat washing. It was lowed 1.5℃ after washing. Washing fastness of far-infrared finishing was better the dope addition method than coating method.

#### IV. Conclusion

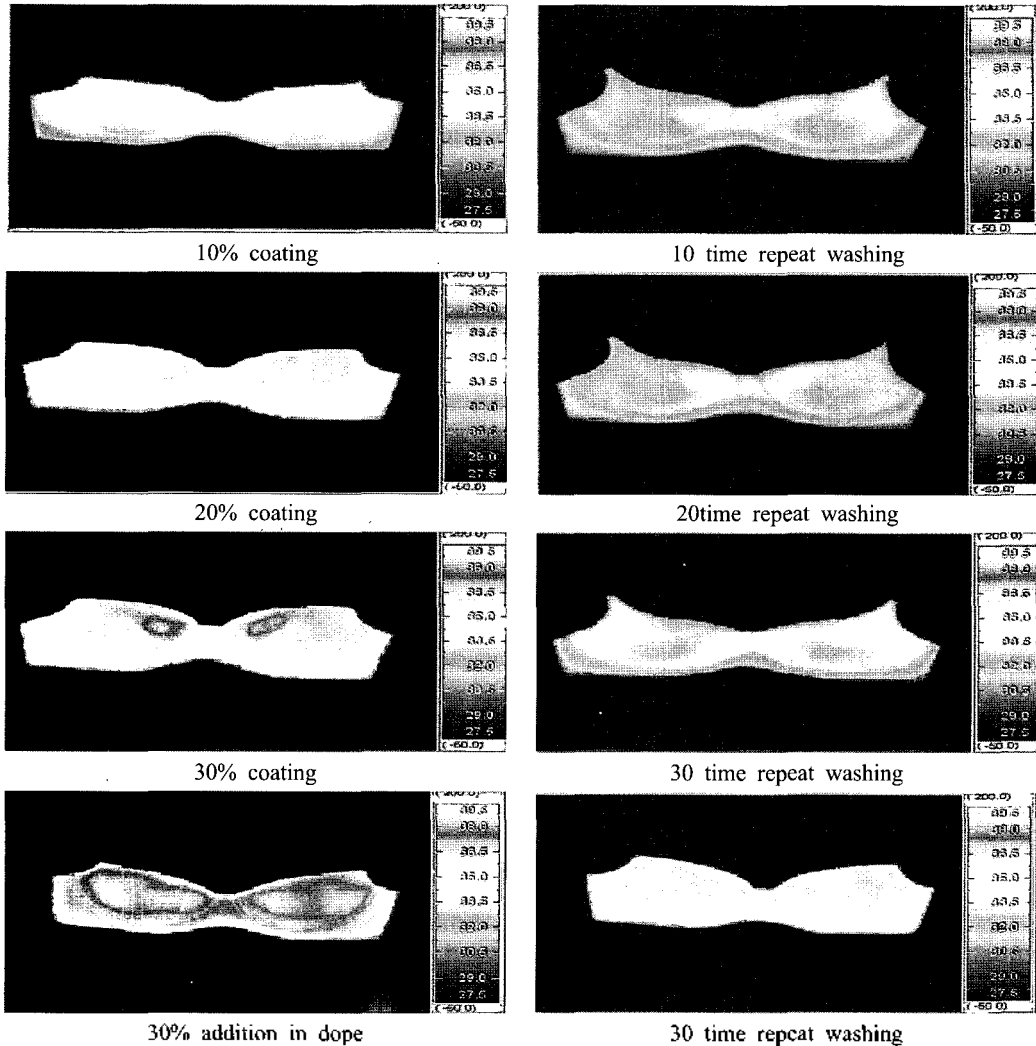
This study focused on the change of skin temperature by the emissivity and emission energy of far-infrared for conformant far-infrared effect to naked eyes. Results are as follows.

1. Far-infrared were emitted each 90.2%, 90.1



- (1) Change of skin temperature after wearing far-infrared shoulder & bra pad during 1 hrs. (part of pad wearing: right shoulder, left breast).
- (2) Change of skin after 5 min. separation of shoulder & bra pad from body.

<Fig. 8> Change of body skin. temperature



(Fig. 9) Washing fastness of far-infrared finishing on the coating method & dope addition method.

- %, 89.7% in the illite  $(K,H_3O)Al_2(Si,Al)_4O_{10}(H_2O,OH)_2$ , liquid alumina  $(Al_2O_3)$ , the extracted liquid from 29 kind of medical plants.
- The temperature distribution of the melt spun foam were appeared  $35.8\sim 37.2^\circ C$  by the concentration increase 5%, 7%, 10%, and 15%, the distribution of  $37.2^\circ C$  was the highest.
  - When compare the coating method and the dope addition method about far-infrared materials finishing, dope addition method

could get higher surface temperature then coating method.

- When bra pad were wearing, the temperature of powder type far-infrared material coated bra pad was  $0.5^\circ C$  higher than the non finished bra pad.
- The left breast showed  $35\sim 36^\circ C$  for bra pad wearing, while the right breast showed  $35^\circ C$ . The difference is about  $0.5^\circ C$ .
- Washing fastness on far infrared finishing was better dope addition method than coating method.

Among far infrared, the wave in the region of  $9.36\ \mu\text{m}$  makes transform of water molecule in body to active energy. If we can use the wave in the region of  $9.36\ \mu\text{m}$  in our life, our body can be more healthy.

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