A Study of Textile-based Sensor for IT convergence Textile Products (Ⅱ)
- Electrical Properties with Dyeing Conditions -

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INTRODUCTION

Recently IT fusion textile has been developed more friendly and human centered technology. As the diversified studies on physical factors such as comfort, usability, ergonomics and technology for user have been examined, the IT fusion textile has been progressed in diverse aspects. There are many hundreds of different electronic sensor that have been developed for use in a wide variety of industrial, medical, consumer, communication and other fields since the discovery of electricity and development of electronic device during the 1800s. This paper focuses primarily upon sensors and computing systems used within wearable application[1]. Specially, fiber and IT combine product by development of electric conductive yarn and fibers which were endowed electric functions was one of the representative case in industry amalgamation[2].

These fiber based sensors have many advantages such as space, body assessment and comfort compare with IT sensors and it will expect substantially increase of market demands in a few years. Fiber based sensor has some different detecting factors such as pressure, voltage, current and capacitance to operate sensing performance. Capacitance detecting method is most simple and useful method for sensor platforms like fiber based solutions but recently research of sensor that capacitance used sensor product was at an early stage and insufficient. [3]

In our precedence research, we investigate physical and electric properties of fiber based sensor. But we must consider that final product need dyeing and finishing process to be satisfied with demands of consumers. Therefore, we investigate an influence of various dyeing and finishing conditions to produce a fiber based sensor fabric and deduct their relationship. And we also derivate an optimum dyeing and finishing conditions using signal detecting circuit from the viewpoint of electrical properties.

EXPERIMENTAL

The sample has sheath/core type structure where metal fiber(conductor) located in its core and cotton/Nylon(dielectric substance) located in sheath part and size of sample was constantly produced 100mm×100mm. Since then sample was dyed and measured voltages using signal detecting circuit.

We were verified optimum conditions on dye process to easily detect of output voltage through observe structures of fiber based sensor fabric by SEM. Detailed dyeing conditions were shown in table 1.

Table 1. Sample conditions with dyeing and finishing conditions.

Sample No.	Dyeing method	Condition	Finishing
A	Pot	40℃ / 90min Procion Red MX	-
B		60℃ / 90min Remazol Brilliant Blue BB gran 133	-
C		80℃ / 90min Procion Blue H-ERD	-
D	Jigger	60℃ / 90min Remazol Golden Yellow RNL gran 150%	-
E		60℃ / 90min Remazol Brilliant Blue RN	-
F		60℃ / 90min Remazol Red GWF	-
G	Jigger	60℃ / 90min Remazol Brilliant Blue RN	Water repellent
H			Antistatic

RESULTS AND DISCUSSION

Two kinds of dyeing methods were applied in this study one is pot process and the other is jigger process and two kinds of finishing processes were applied one is water repellent process and the other

is antistatic process. We used these processes to investigate output voltages on fiber based sensor and verified their relationship. Using SEM images, we analyzed a reason of instability of output voltage and results were shown in Fig. 1.

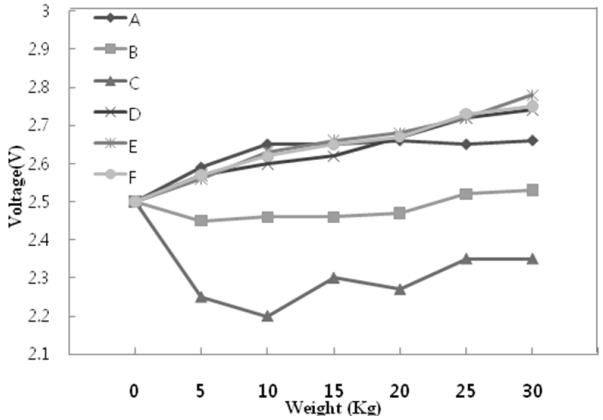

Fig. 1. Output voltage on dyeing process

The SEM images showed that inside fibers were changed with pH concentration increase. The fibers were more contact with nylon and cotton fibers. It caused by excessive tension of dyeing process.

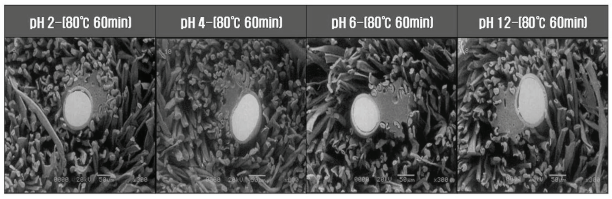

Fig. 2. Structure change with finishing conditions

Output voltages were showed relative stable values in different finishing conditions. Among these samples, sample A was showed higher resolution than other samples and finished samples were showed lower resolution. But stability of output data was most outstanding in sample F sample.

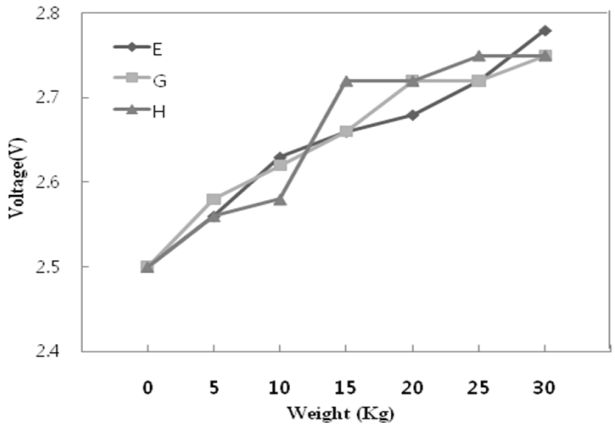

Fig. 3. Output voltage with finishing processes

CONCLUSIONS

The textile based sensor was affected various environmental factors such as temperature and tension in dyeing and finishing process. Specially, it can have unstable electronic characteristic(output voltage) in taking pressure since it is difficult that metal filaments which has instability of dimensional stability by shrinking material in dyeing process and composition of multi-structure conductor restored original form by affecting textile modification.

Thus, in order to production of textile sensor product, product must have the optimum processing conditions including minimum tension, lower temperature and neutral pH when the product was dyed. In this study, we suggest that jigger dyeing has a relative higher output voltages than pot dyeing process and there was no significant effect with finishing conditions.

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