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Knitting for smart wearable clothing

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I. INTRODUCTION

Smart textiles derived from intelligent or smart materials. Smart textiles that are able to sense based on stimuli from the environment and it reacts and/or adapt to them by integration functionalities in the textile structures [1]. The application of smart textiles includes many fields such as medical, transportation, energy, protection, security communication and textile electronics[2]. The textile products fibers, filaments (yarn), fabrics such as woven, knitted and nonwoven structures etc., interact with the environment via smart textiles. Smart textiles is not limited to specific one which extend the functionality and usefulness of common fabrics. The integration of wearable technology (e-textiles) in social welfare is increasing due to the implementation of smart textiles. Wearable textiles can be divided as following categories.

- Passive smart textiles: These can be only able to sense the environment/user, based on sensors.
- Active smart textiles: Based on the environment, signals from actuator by integration and as sensing device which reactive sensing to stimuli.
- Very smart textiles: These can be sense, reactive based on sensing information and adapt their reactive to the given condition.

The polymeric materials can be made as sensors, actuators etc., called as electomechanical systems. Flexible and nonflexible are the two type of wearable sensors. All components developed using textiles are increasing the potential applications of smart system.

II. KNITTING TECHNOLOGY

Knitting defined as the intermeshing of loops of yarn in horizontal or vertical direction. Textile fabric manufacturing technologies followed for developing the wearable components in smart system. Various techniques involved in circular knitting and flat knitting fabric production adopted for the development of main components in wearable system due to their flexibility and principle of fabric manufacturing. The conductive or sensible raw materials in the form of yarn individually or combined with conventional yarn is knitted to make the whole fabric or certain courses in weft knitted fabrics.

The choice of fabric structure for the wearable elements is important; the basic fabrics plain jersey, rib and interlock selected with the fabric structure having the combination of knit stitch, tuck and float stitches. The tuck and float stitches consume less yarn by forming almost straight loop in the order of float and tuck stitches.

III. KNITTING FOR SMART COMPONENTS IN WEARABLE TEXTILE

Without affecting the comfort and aesthetic property of the clothing textile based triboelectric nanogenerator(TENG) is integrated in seamless knitwear using advanced knitting technology. For wearable power sources in smart electronic textiles-TENG is fabricated and knitted tubular fabric. Furthermore, the integration of TENG in knitted pant also done using intarsia knitting technique[3]. The development of smart devices for health, sports and allied application textile sensors plays important role. Strain sensors are developed by the researchers[4] using weft knitting technology. These flexible fabric sensors involved directly for measuring the body parts. The knitted fabric having the thin conductive copper wire along with classic yarn is used to develop sensor integrating in a knitted garment to sense breathing of patients in daily basis. The conductive yarn combined with elastic yarn provides better results than PES base yarn[5]. The knitted flexible electro-active strain sensors are worked based on their resistance variation, it can be used for measuring the deformation in human body parts[8]. The figure 4 shows the flexible knitted strain sensor used for measurement or monitoring the deformation in the human body parts. A knitted 3D shaping and seamless technology with plaiting and intarsia stitch enables the scope for wearable electronics[6]. The google's -Project jacquard touch responsive textiles in the form of fabric, clothing and any other textile products forms[7].

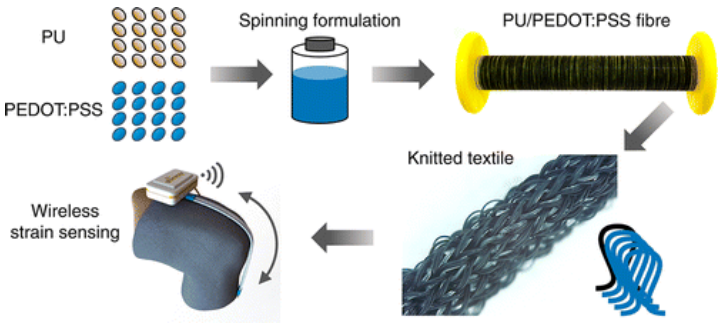

Figure 1: Knitted strain sensors

IV.CONCLUSION

The advances in textile technologies are the future scope to make the fabrics for future electronic textiles in all the fields. The knitted fabric contributes as electric path, sensing and interactive tool for smart wearable, so the wearable product designer should select the right choice of knitted fabric and technology for development of new product.

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