Connection points of woven moisture sensor electrodes and its durability

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INTRODUCTION

In order to improve the system comfort properties, modular humidity sensor should be replaced with a textile sensor. One of solutions is use of textile conductive yarns in sensor design. In literature mentioned textile moisture sensors are designed as several layers sensors [1, 2], what increases thickness of material or one layer sensors were made where conductive textile yarn appears in both sides of fabric [3]. During this research textile moisture sensor solution was designed when conductive yarns aren't visible on left side of fabric and are partly insulated on fabric right side. In paper design process of sensor development is described as well as different connection ways of vertical and horizontal conductive yarn traces of sensor electrodes are realized and tested.

MATERIALS AND METHODS

Woven textile moisture sensor was design what consists of conductive and insulated (non-conductive) textile yarns. Samples were fabricated on industrial jacquard weaving machine, in warp and weft yarn system cotton yarns were used, in some part of sample for electrical contacts copper yarns (electrical resistance 2,3 ohms/m) were interwoven. After fabric was woven, vertical and horizontal electrical pathways of sensor's electrodes should be correctly connected. Tightness of contact was evaluated by electrical resistance between connected contact points. Washing was performed as durability test.

CONNECTION POINTS OF ELECTRODES

For sensor design copper/PA yarn was chosen with stabile conductivity so that change of electrical resistance would be related just to contact tightness, not to property and behavior of conductive yarn. Yarn is solderable as well so it is possible to realize different ways of yarns connection. Vertical and horizontal electrical pathways of sensor's electrodes were joined by knot or solder connection: double knot (A), single knot (B) and soldered connection (C). Joints are illustrated in Fig.1.

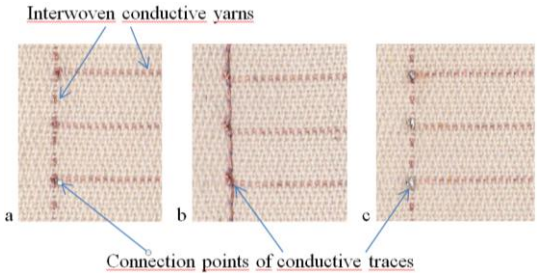

Figure 1. Connections of electrode contacts: knotted (a), double knotted (b), soldered (c)

DURABILITY OF CONNECTION POINTS

After washing some part of knot connection samples (A and B) formed less tight contact (higher electrical resistance) – probably knots became looser. Resistance change of soldered samples (C) is related with contact break, relevant change of resistance wasn't observed in soldered samples with unbroken contacts. Conductivity of samples with unbroken contacts is represented in Fig.2.

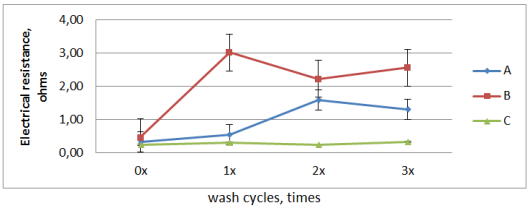

Figure 2. Electrical conductivity of contact points after washing

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