Embroidered Sensors – An Overview

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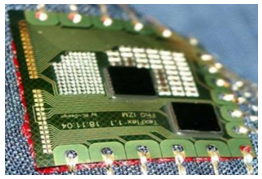
Background

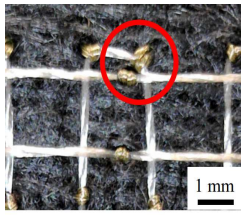
Embroidery has been around for almost 2000 years as a way of decorating materials, but using it to put sensors and electronic into a material has only come about in the last 20 to 30 years.

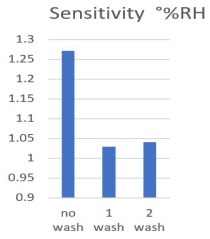


Embedding electronic sensors in the material instead of simply attaching conventional electronics to its surface, has many advantages including reduced mass and increased comfort.

Difficulties

The base material needs to be dense enough so the thread can be added with enough precision so sensors don't touch as that would cause a short circuit. It also needs to not stretch as that could tear the electrodes stopping the sensor from working.





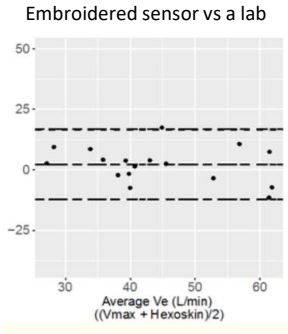
Washing has the potential to reduce the sensitivity of the sensors and even stop them working all together. After 1 wash in this test the sensitivity dropped dramatically but this doesn't occur after the 2nd wash. This is because the fabric is treated with an antibacterial spray after manufacture which is washed off after the first wash.

Protecting firefighters

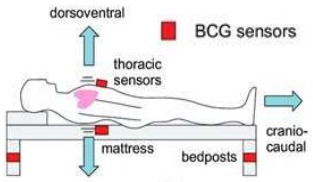
Firefighter's clothing has to store large amounts of energy and heat; if the firefighter is exposed to too much heat for too long then they could have serious burns. Embroidered sensors have the potential to provide an early warning system that says when the suit is too hot.

Medical modelling

Embroidered sensors can be used to take medical measurements in a far cheaper and easier way than conventional methods in a lab environment. The sensor can be embroidered into the fabric and worn normally. The graph shows that embroidered sensors produce results that are close enough for most uses to results from a lab.



Example



Sensors have the potential to measure a persons cardiac potential non-invasively. Measuring cardiac potential can diagnose heart related problems such as arrhythmias, which can be fatal. But it needs to be measured for fairly long periods of time to collect enough data. Embroidered sensors are ideally suited for this, as the patient doesn't have to stay in hospital and can go about their normal life.

The shape of sensors

The shape of a sensor has to be carefully considered so that it doesn't break. Sharp corners, such as in A, break more easily than rounded ones, as they increase the tension, but are faster to embroider.

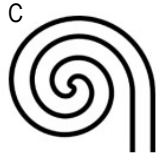
A

B

Rounded corners don't put as much tension on the embroidery, especially when it is stretched, but are more complicated. Example B can also be stretched side to side which is important for stretchy clothing.

The spiral shape, as in C, has the potential to be stretched both ways which has obvious advantages, it also reduces thread tension the most – which reduces the chance of breakages. However, it is the hardest and slowest to embroider.

C



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Thanks to Katie McConville

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