WEARPLEX Beta Workshop: E-textile integration

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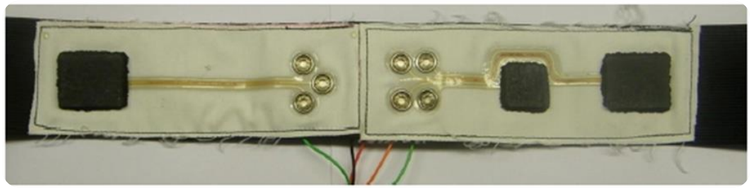
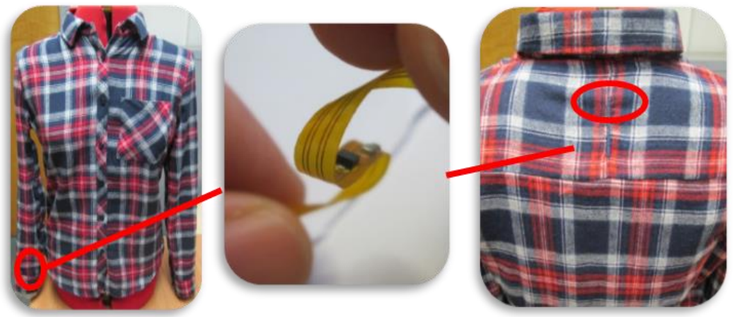
Background: Related e-textile examples (UoS)

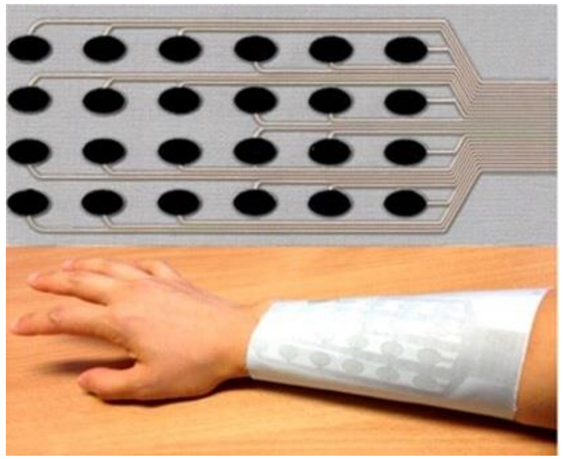
Printed Electroluminescent Watch Display on Fabric (UoS)
(M. de Vos et al (2016) *J. of Display Tech.* 12: 757-1763.)



Printed Active electrodes on fabric (UoS)
(Paul et al 2015 Sens. & Act. A. 221, p60-66410)

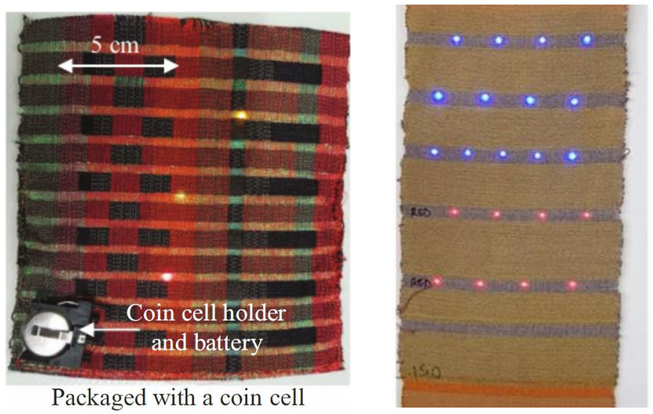


Motion sensing garments (UoS)
(Li et al - Sensors 2020, 20(18), 503310)



Printed FES electrode array on fabric (UoS)
(Yang et al - Sensors (2018)- 18(8), 2410)

Printed frank configuration vest (UoS)
(Paul et al 2017 Smart Mater. Struct. 26 025029)

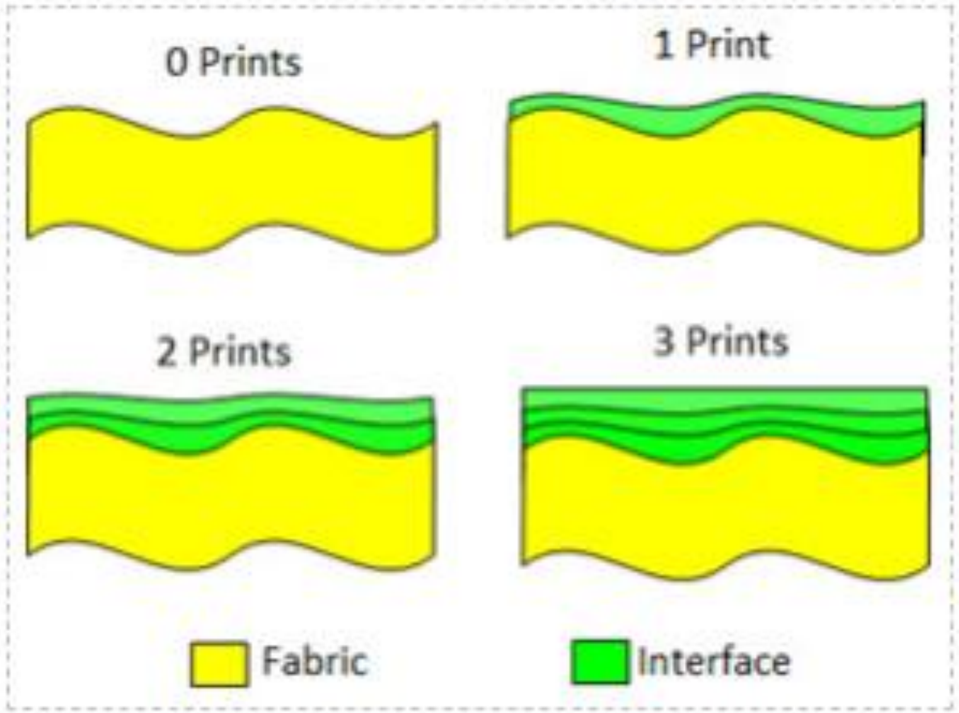


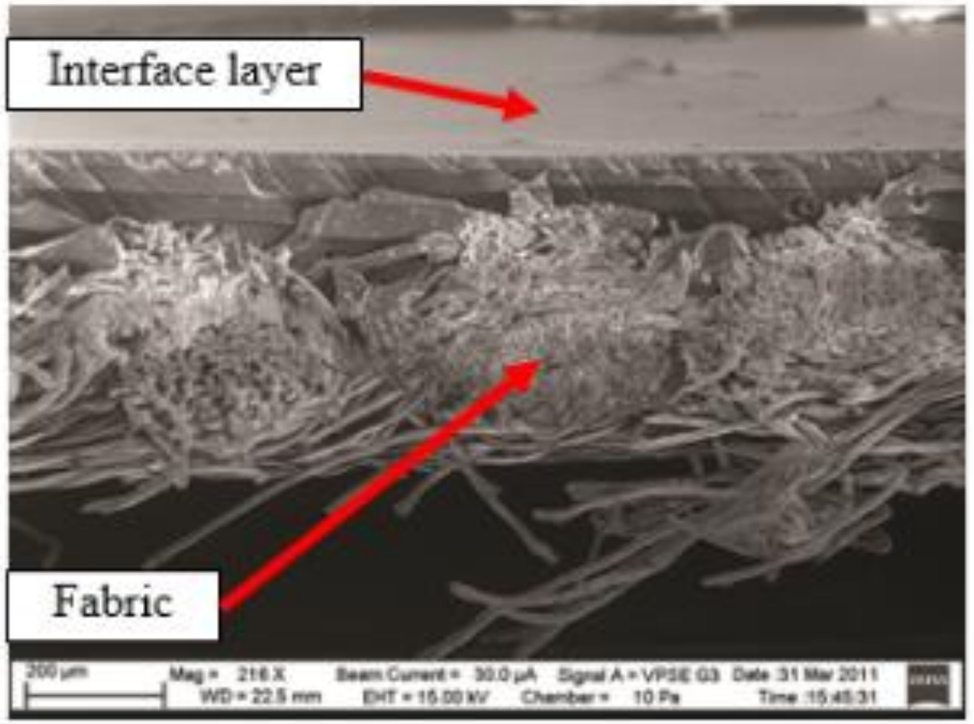
Packaged with a coin cell

Woven LED filaments (UoS)
(Komolafe et al 2019 *Adv. Mat.Tech. 4*(7), p.1900176.

Latest Results

» Screen printing electronics directly on to textile (UoS) – Fabric roughness (Ra) needs to be less than 10 µm to be suitable for OECT's.

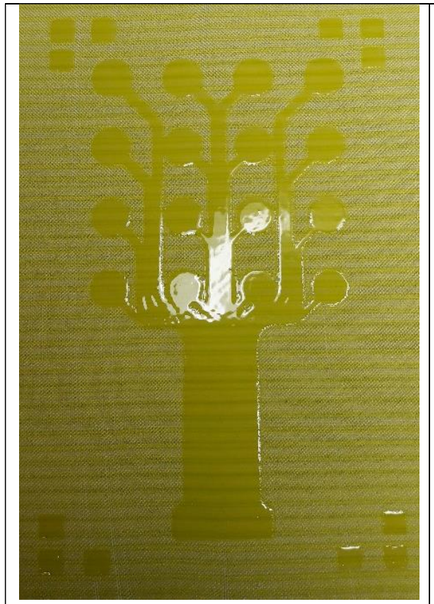




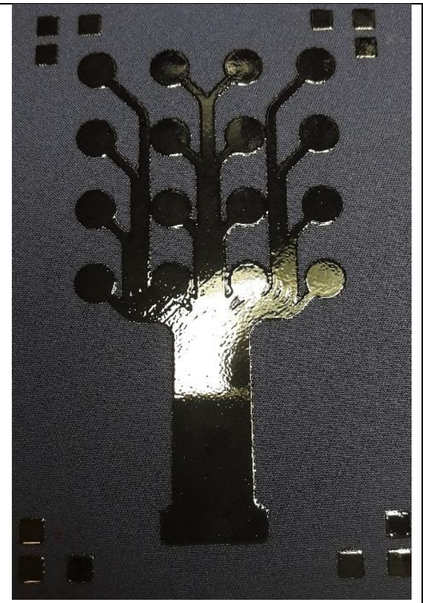
Multiple screen printed primer layer (~190 µm) on fabric (UoS)

Latest Results

» Key fabrics were printed with complex pattern (recording electrode) interface pattern to determine optimum surface roughness and thickness of PU layer.

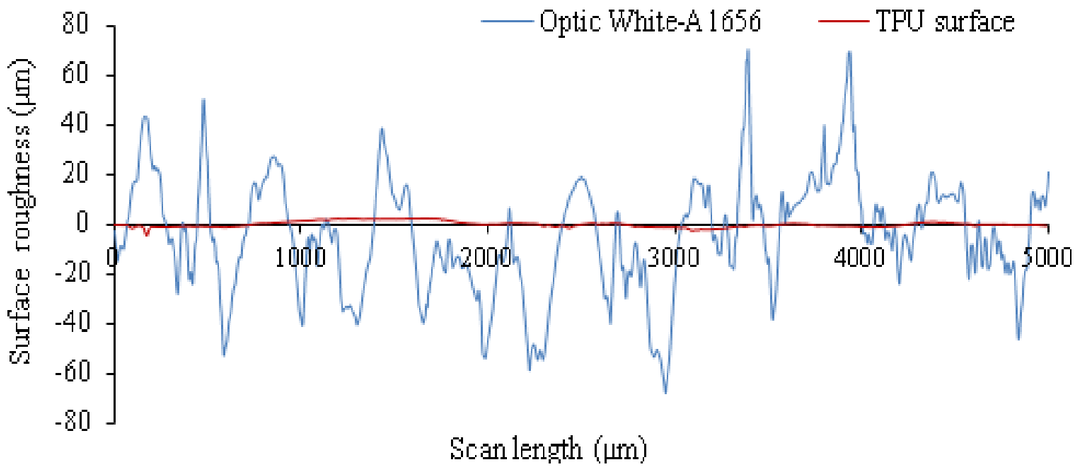


IsacordPoly60 – 1 interface layer



Oxford – 3 interface layers

GaddumSilk88 – 4 interface layers



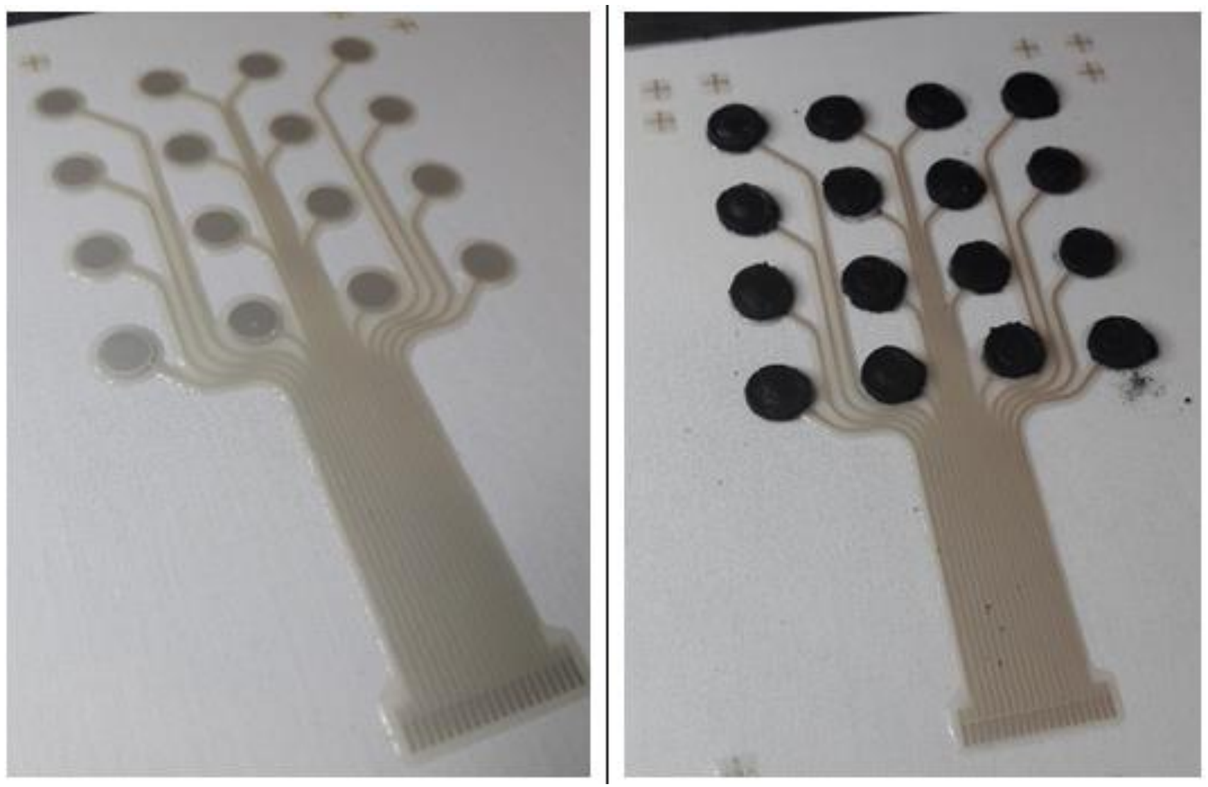
Surface roughness (Ra) measured using Tencor P-11 surface profilometer.

Komolafe et al. (2020) Influence of textile structure on the wearability of printed e-textiles. IEEE FLEPS 2020, https://eprints.soton.ac.uk/442028/

Latest Results

» WEARPLEX stimulation and recording electrodes have been printed on to fabric and tested by AAU and TECSR.

Pastes	Functionality	Curing Conditions
Fabink UV-IF-1004	Standard interface to create smooth surface on various fabrics	UV light, 30 s
Fabink UV-IF-1039	Waterproof interface and encapsulation suitable for various fabrics	UV light, 60 s
Fabink TC-C4007	Silver ink for printing flexible conductor layer on top of the interface layer	120–130 °C, 10–25 min
Fabink TC-E0002	Silicone rubber carbon paste for printing dry electrode on top of the conductive layer	80 °C, 30 min



Example of screen printed recording electrode on fabric (UoS)

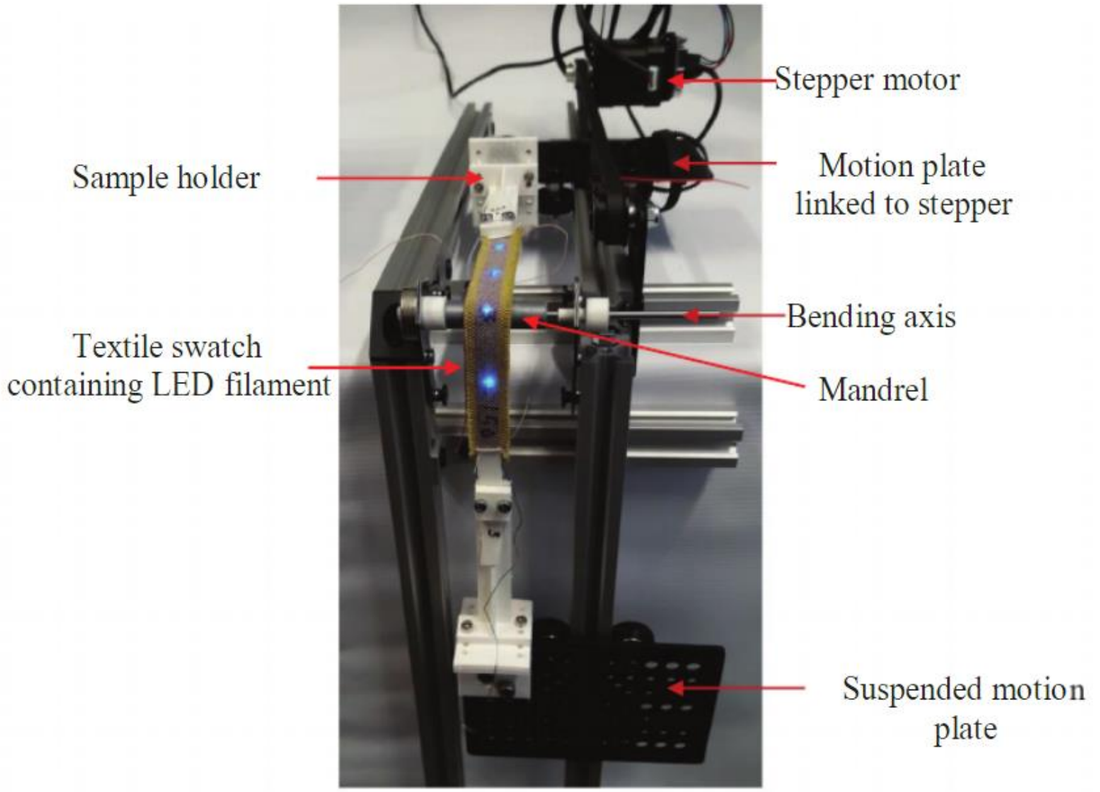
Future developments for WEARPLEX

» Printing the OECT directly onto textile – interface compatibility already confirmed.

» Integrating parts of the WEARPLEX electronics into the textile.

» Creating complete printed garments for EMG and stimulation applications.

» Reliability testing; including cyclic bending and washing trials.



Cyclic reliability of woven filaments (UoS)
(Komolafe et al 2019 *Adv. Mat.Tech. 4*(7), p.1900176.