



WEARPLEX Gamma Workshop: E-textile integration



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17th February 2022



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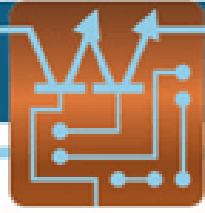


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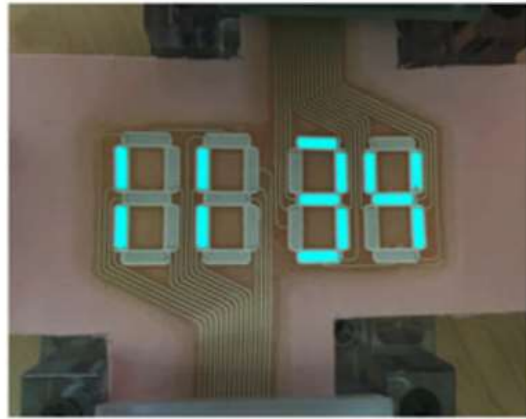
RISE



H2020-ICT-02-2018



Background: Related e-textile examples (UoS)



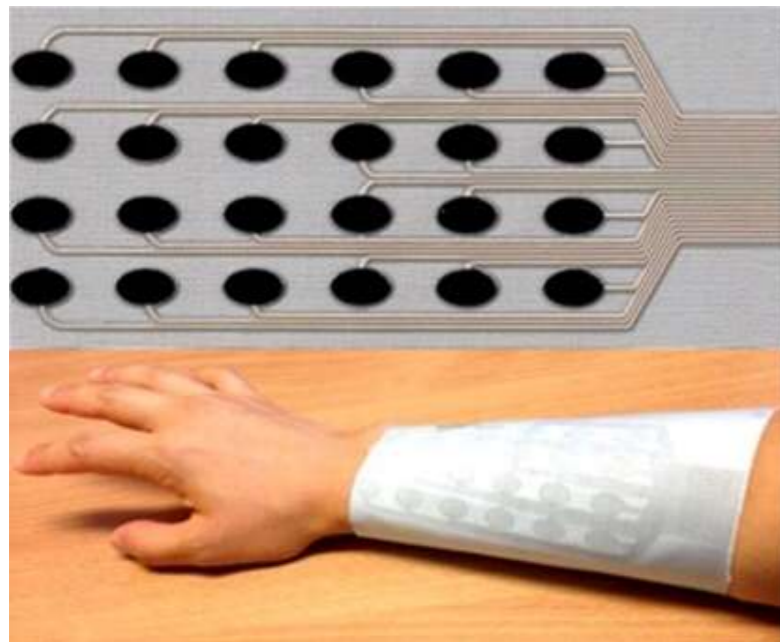
Printed Electroluminescent Watch Display on Fabric (UoS)
(M. de Vos et al (2016) *J. of Display Tech.* 12: 757-1763.)



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



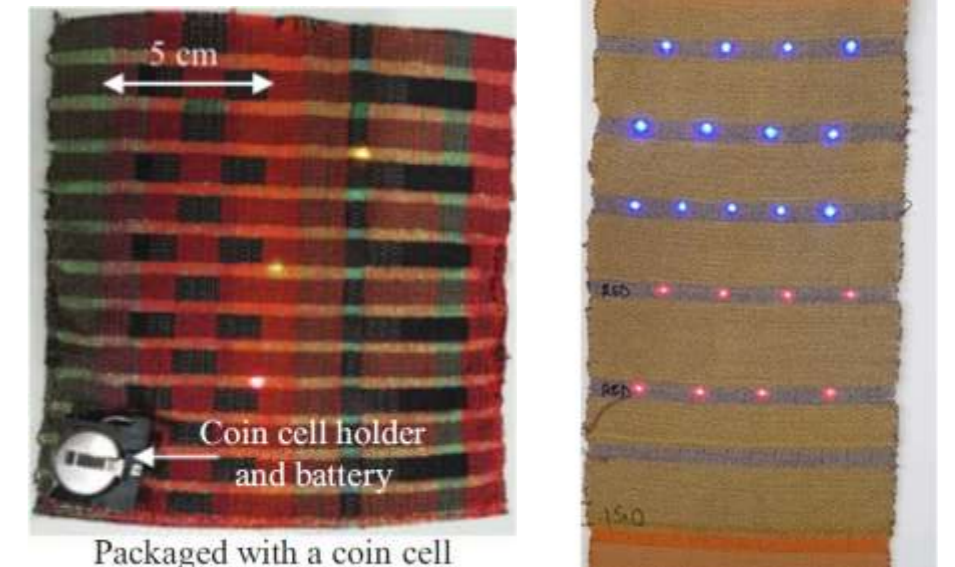
Motion sensing garments (UoS)
(Li et al - *Sensors* 2020, 20(18), 503310)



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)

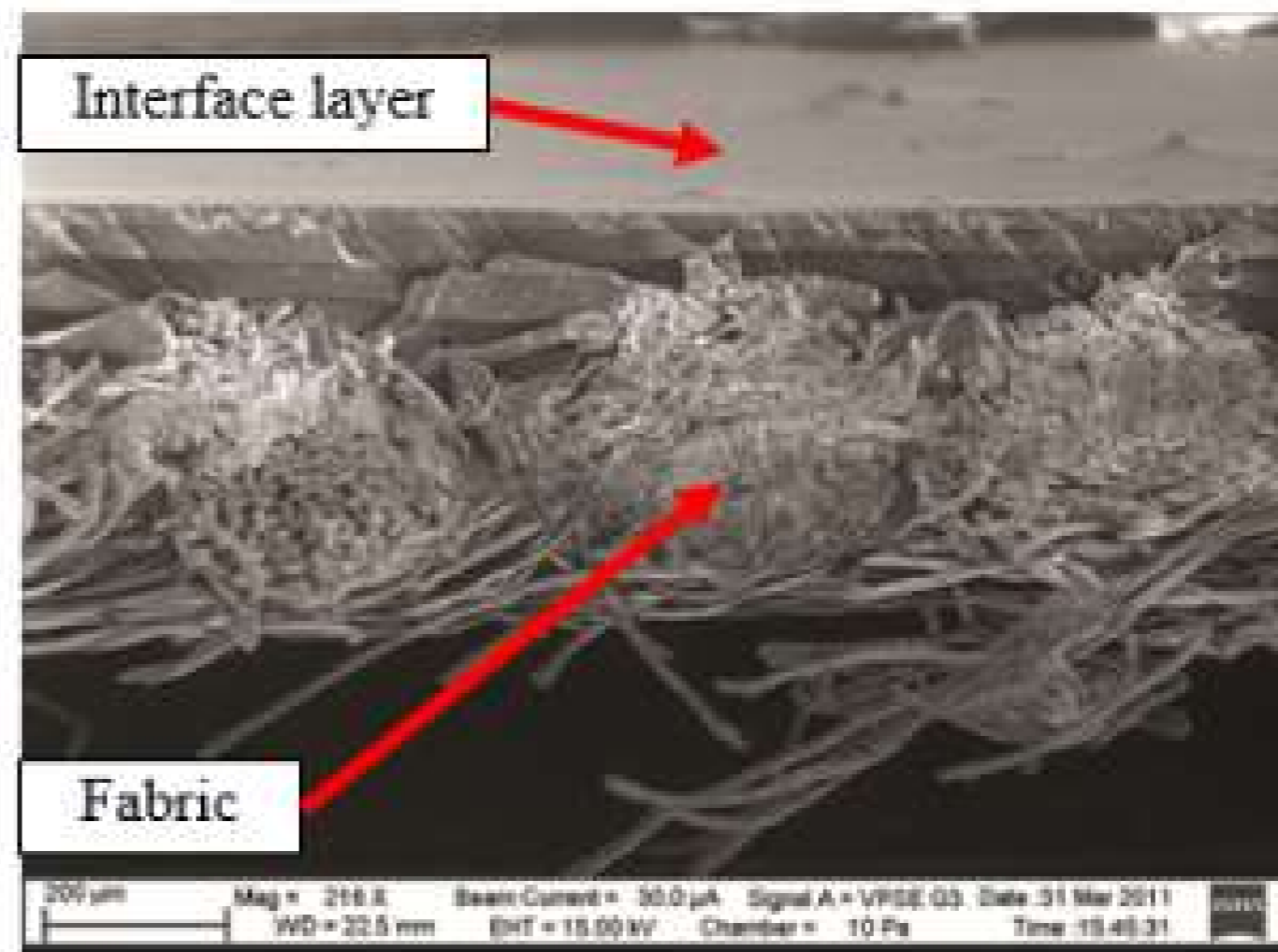
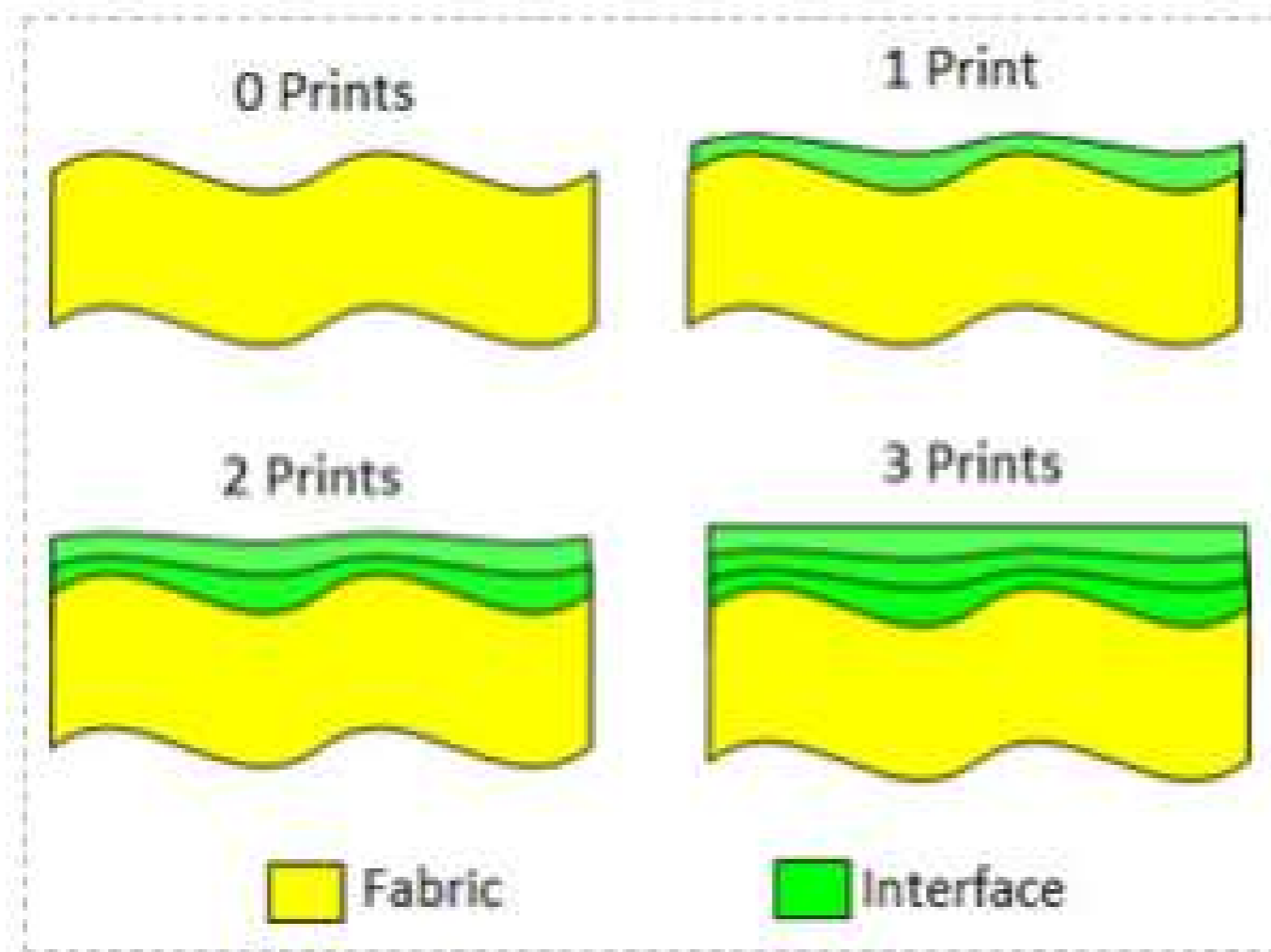


Woven LED filaments (UoS)
(Komolafe et al 2019 *Adv. Mat.Tech.* 4(7), p.1900176.)



Results - Primer layer

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

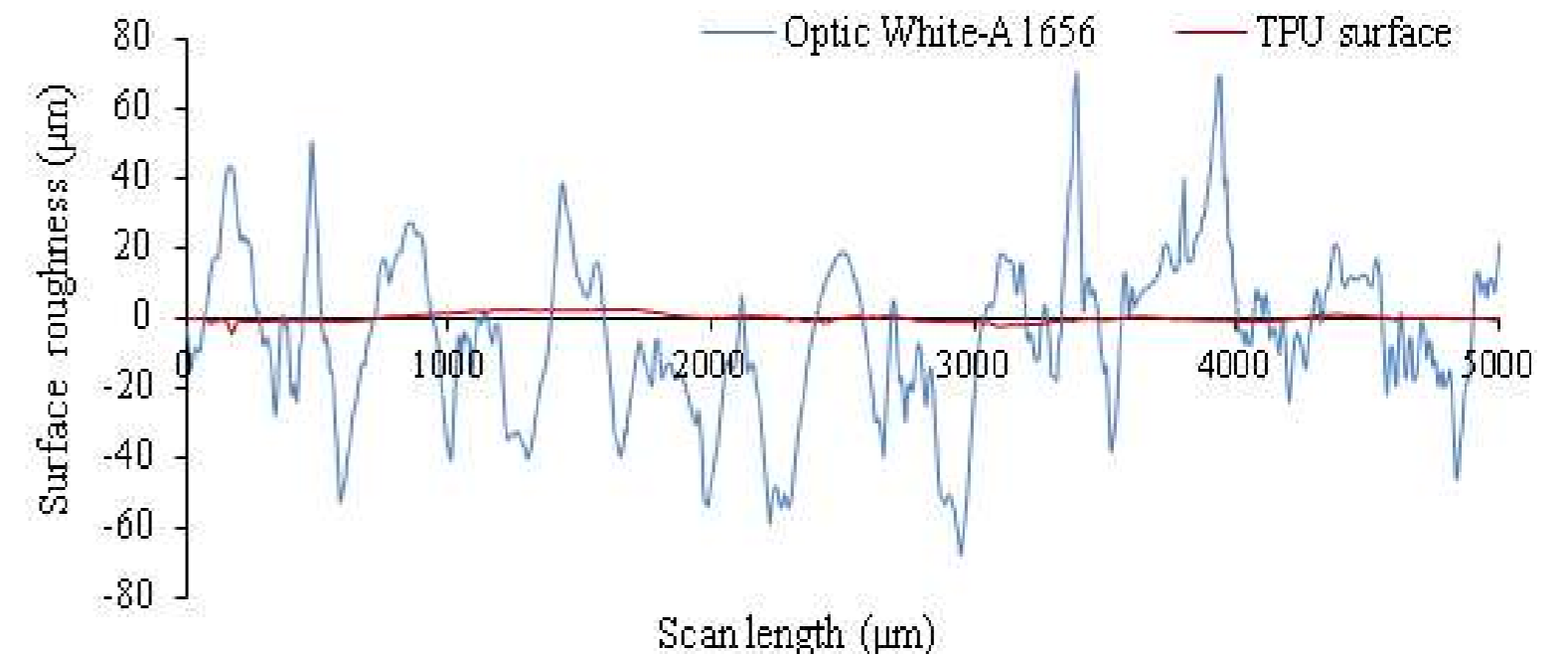
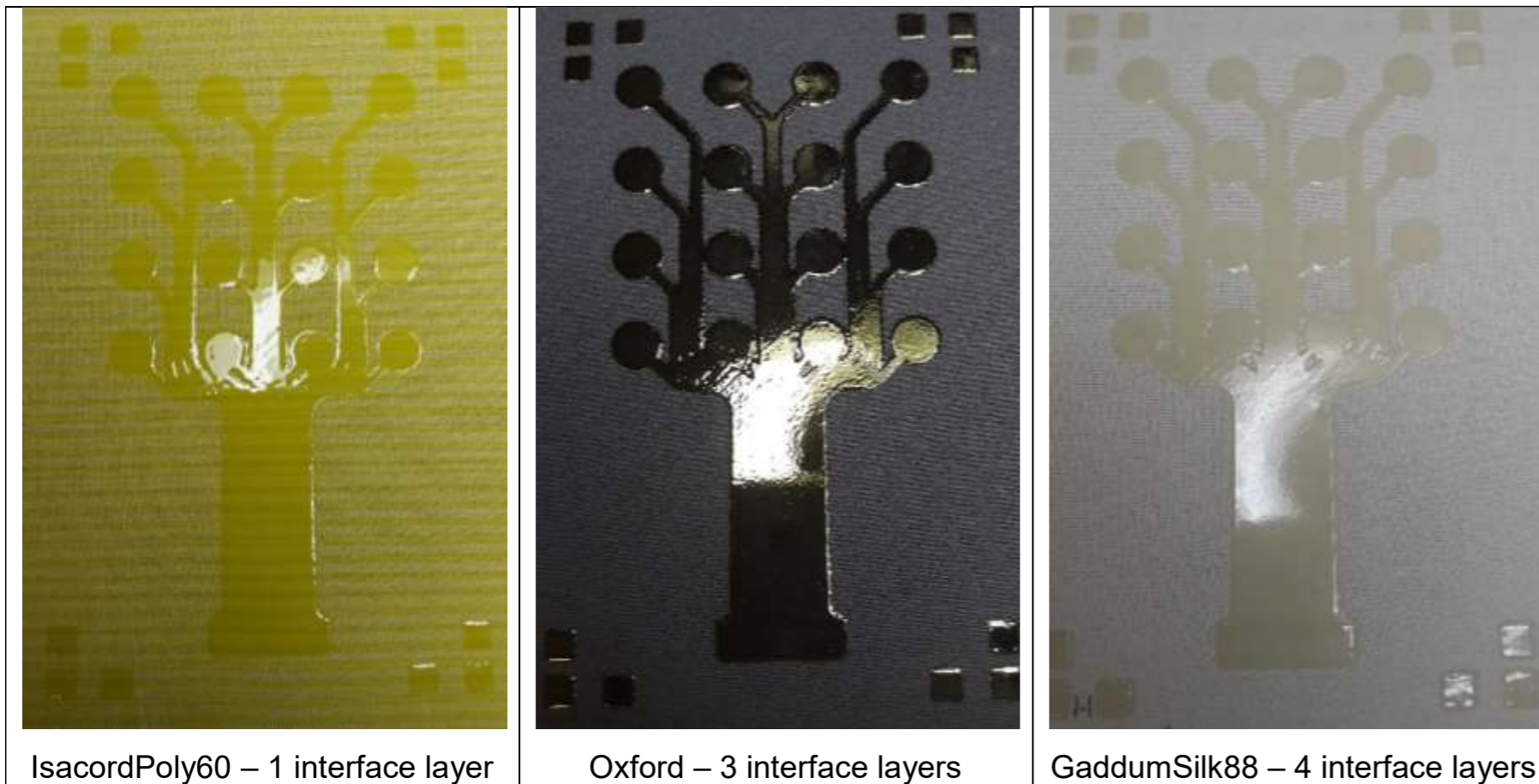


Multiple screen printed primer layer (~190 μm) on fabric (UoS)



Results - Fabric selection

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



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

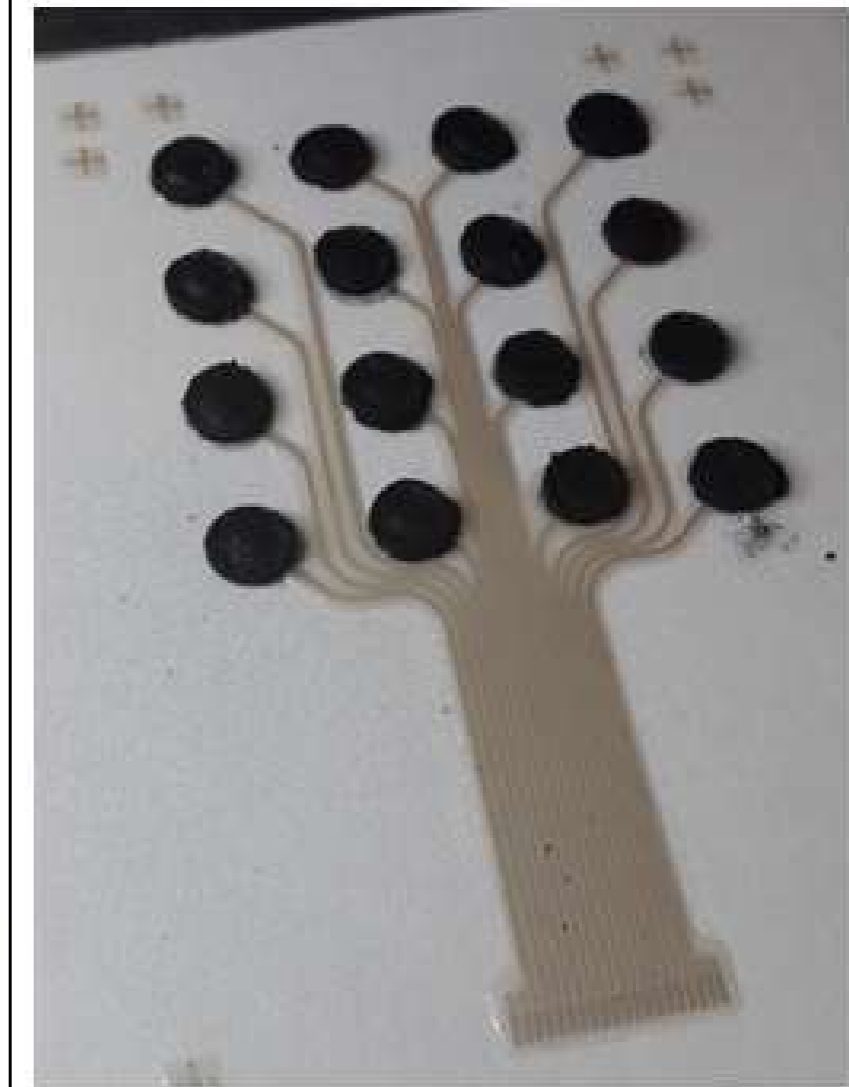
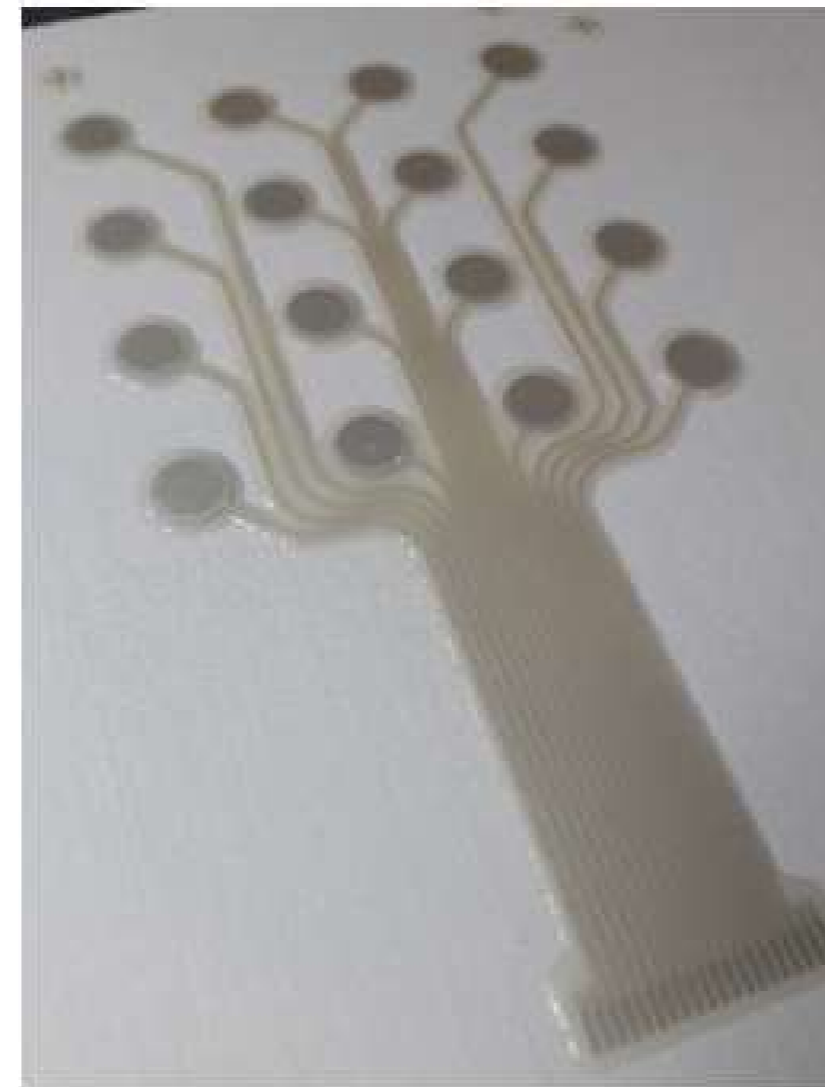
Komolafe et al. (2020) Influence of textile structure on the wearability of printed e-textiles. IEEE FLEPS 2020, <https://eprints.soton.ac.uk/442028/>



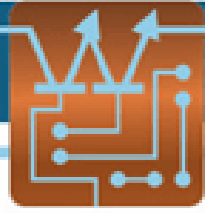
Results - Printed Electrodes

» 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

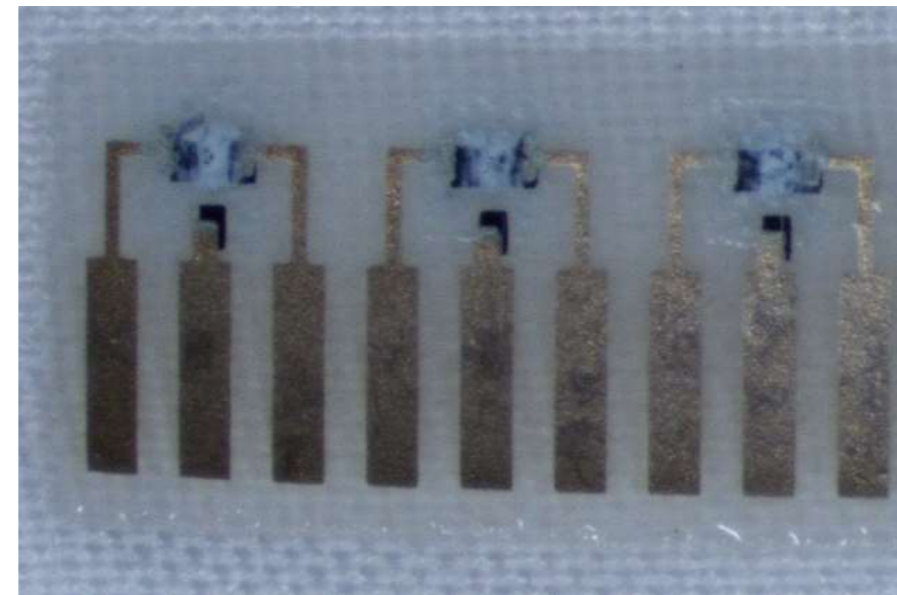
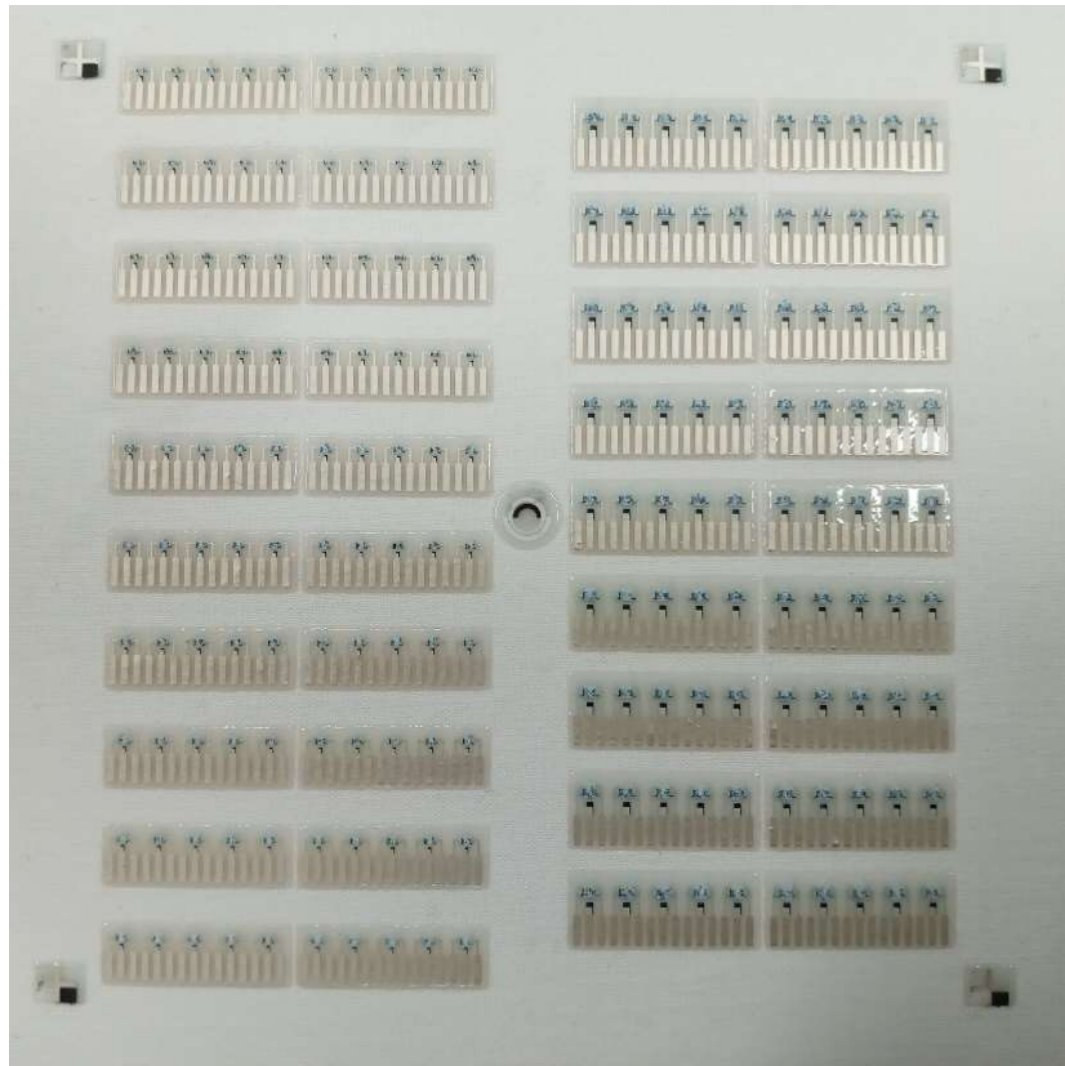


Example of screen printed recording electrode on fabric (UoS)

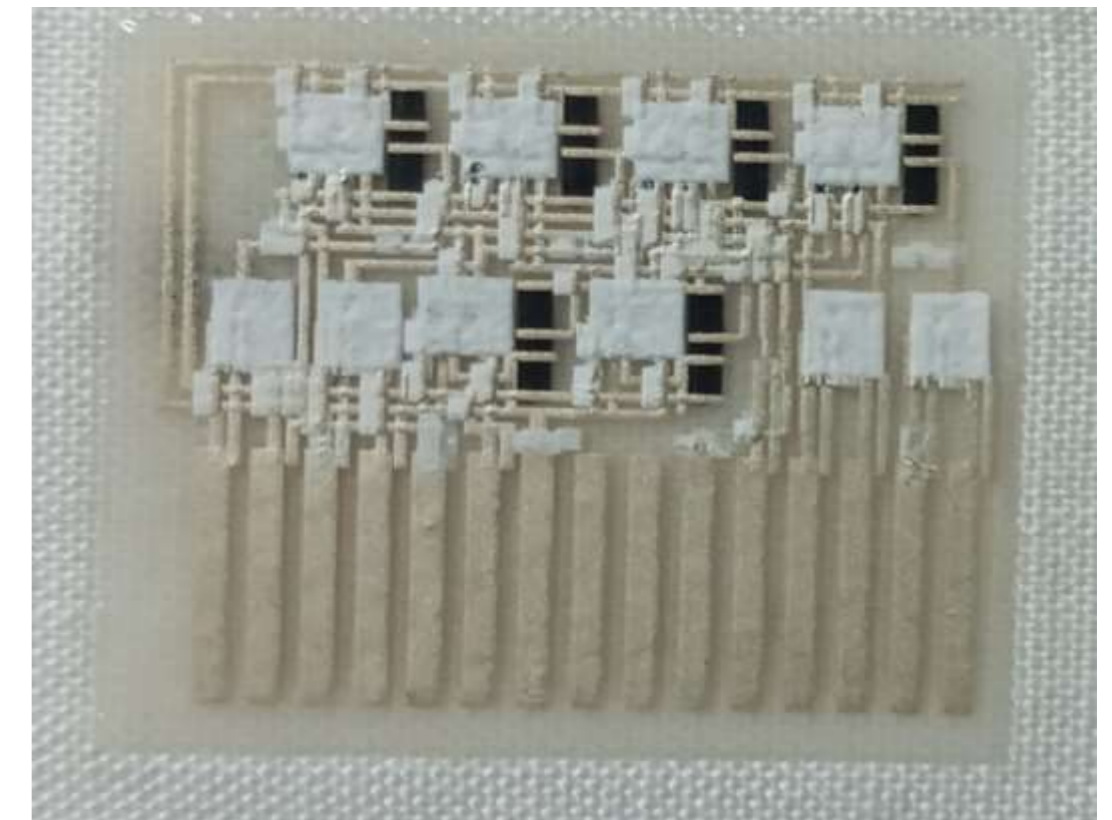


Results - Transistors on textile

» Printed OECT transistor structure on textiles.

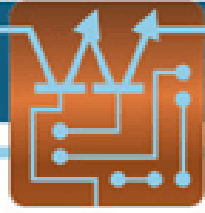


Magnified group of OECT transistors
(150x100 μm channel design)



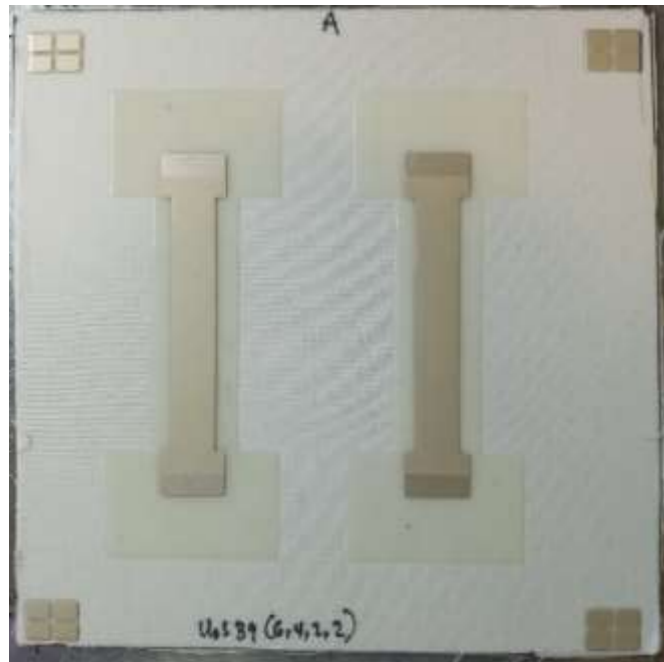
3-8 decoder circuit from RISE, printed on
textile by UoS

Array of single OECT transistors from RISE with different channel dimensions, modified and printed by UoS on textile

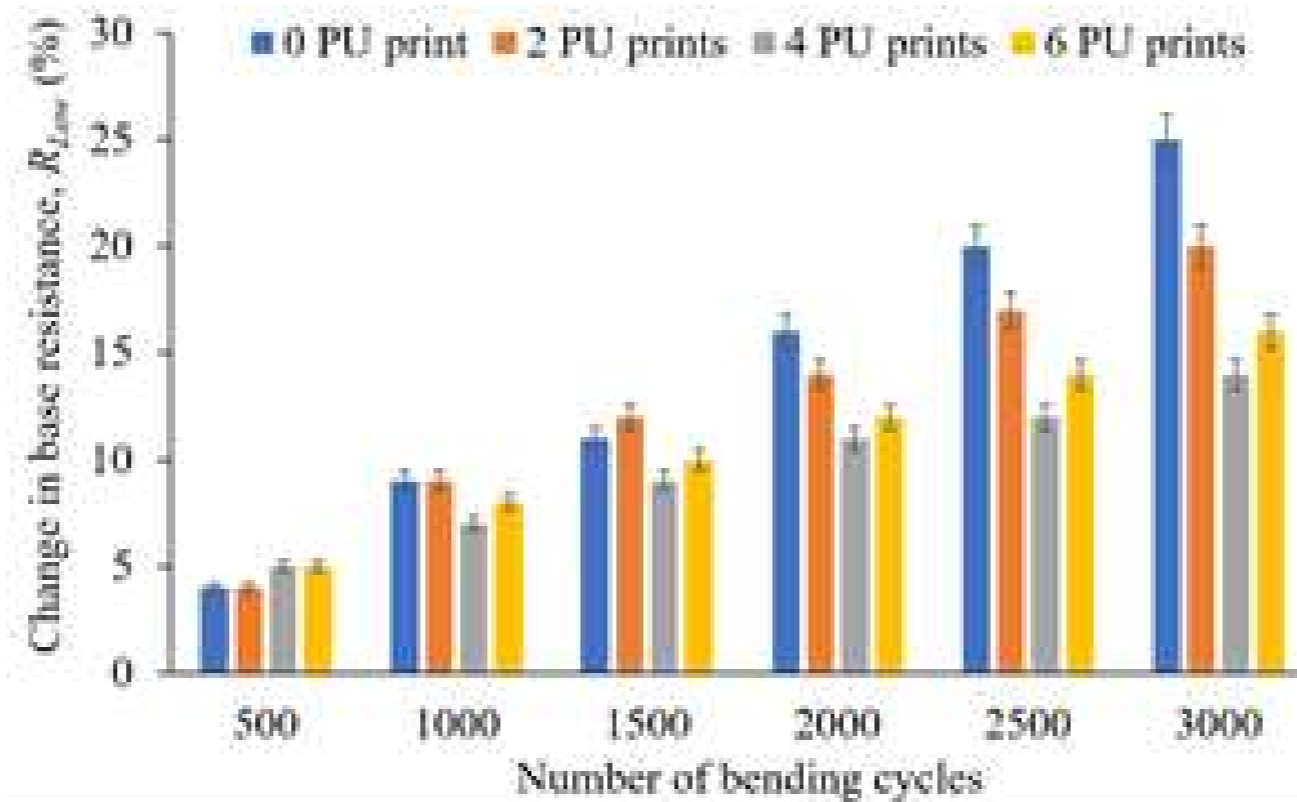


Results - Testing and reliability

» Reliability testing; including cyclic bending and washing trials.



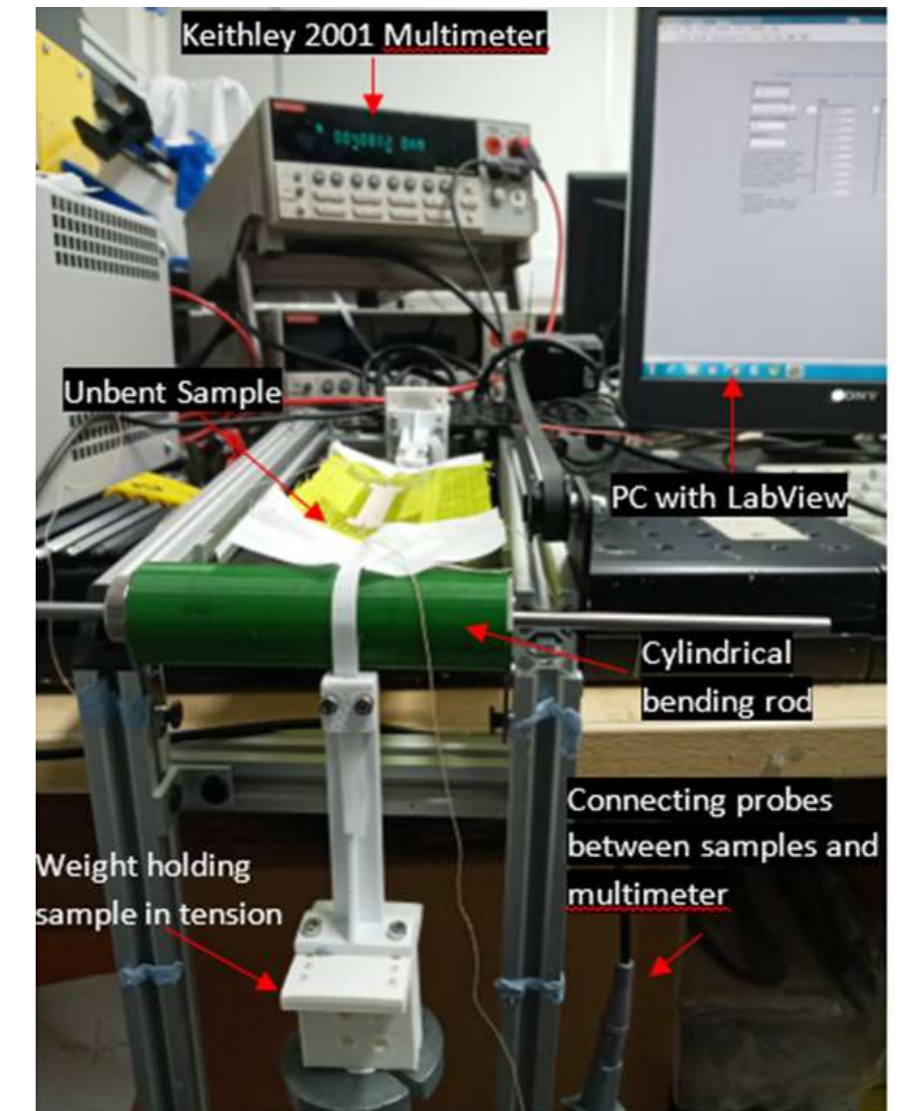
Dumbbell test patterns printed on fabric for bending and washing tests



Cyclic bending tests for different thickness of primer layer

Evaluating the effect of textile material and structure for printable and wearable e-textiles.
(Komolafe et al (2021) *IEEE Sensors Journal*, 21 (16), DOI: 10.1109/JSEN.2021.3086235)

Effect of textile primer layer on screen printed conductors for e-textiles
(Komolafe et al 2021 *FLEPS conference*, DOI: 10.1109/FLEPS51544.2021.9469732)



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