Robust, Electro-conductive, Self-healing Superamphiphobic Fabric Prepared by One-step Vapour-phase Polymerisation of Poly(3,4-ethylenedioxythiophene) in Presence of Fluorinated Decyl Polyhedral Oligomeric Silsesquioxane and Fluorinated Alkyl Silane

Hongxia Wang[1], Hua Zhou[1], Adrian Gestos[1], Jian Fang[1], Haitao Niu[1], Jie Ding[2], Tong Lin[1]*

1 Institute for Frontier Materials, Deakin University, Geelong, VIC 3216, Australia

2 Human Protection and Performance Division, Defence Science and Technology Organisation, Melbourne, Vic 3207, Australia

Electronic Supplementary Information

S1 SEM image of uncoated polyester fibres.

Fig. S1 SEM image of uncoated polyester fibres.

S2 XPS survey spectra of PEDOT, PEDOT/FAS and PEDOT/FD-POSS/FAS coated polyester fabrics.

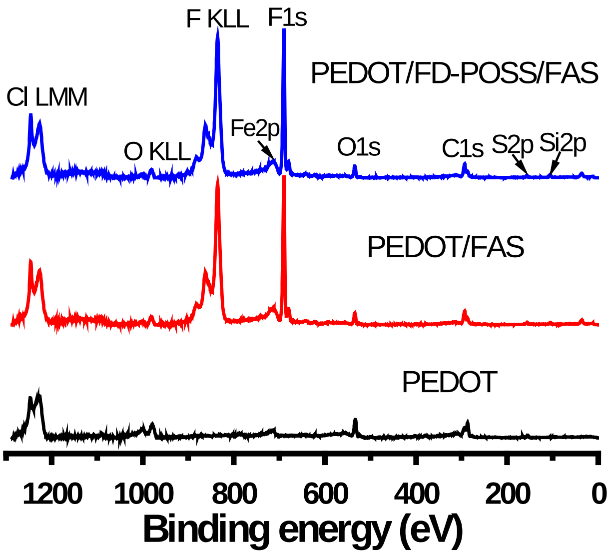

Fig. S2 XPS results for PEDOT, PEDOT/FAS and PEDOT/FD-POSS/FAS treated polyester fabrics.

Atomic contents calculated based on XPS spectra

	Atomic Content (%)				
	C	O	Si	F	S
PEDOT	78.3	20.88	-	-	0.82
PEDOT/FAS	40.02	7.29	2.38	49.67	0.64
PEDOT/FD-POSS/FAS	38.9	6.93	2.26	51.32	0.59

S3 High-resolution XPS C1s and Si 2p spectra of coated fabrics.

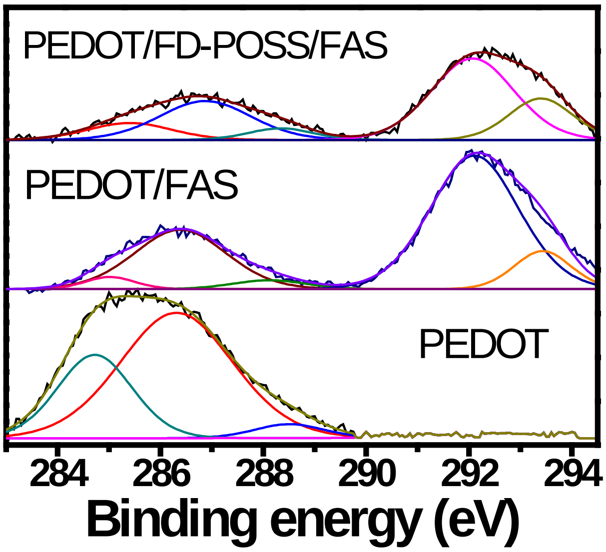

Fig. S3a High resolution XPS C1s showed binding energies. The peaks at 285 eV, 286.5 eV and 288-289 eV are derived from C–C, C-S/C-O and C=C bonds in PEDOT. The peaks at 292 eV and 294 eV for PEDOT/FAS and PEDOT/FD-POSS/FAS coated surface are typical characteristic of CF_2 and CF_3 moieties.

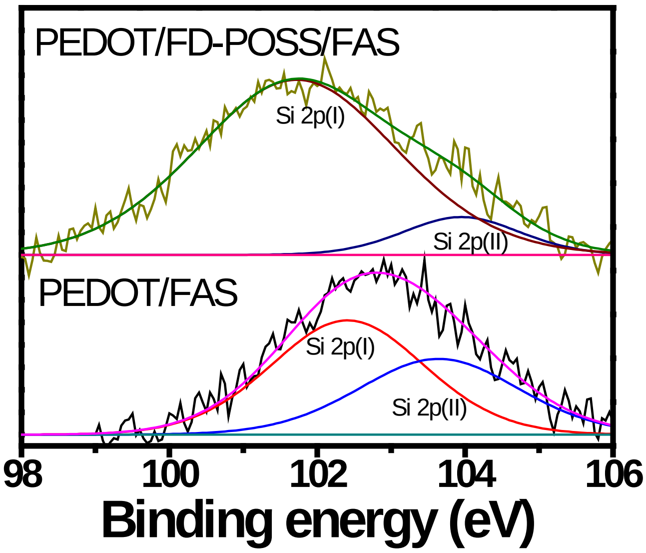

Fig. S3b High resolution XPS Si 2p showed binding energies. The peaks at around 102 eV and 104 eV correspond to Si 2p (I) and Si 2p (II) respectively derived from Si-C and Si-O on the coating surface [S Yochelis, E Katzir, Y Kalcheim, V G OdedMillo, and Y Paltiel, *Journal of Nanotechnology*, **2012**, Article ID 903761].

S4 FTIR spectra of uncoated and coated polyester fabrics.

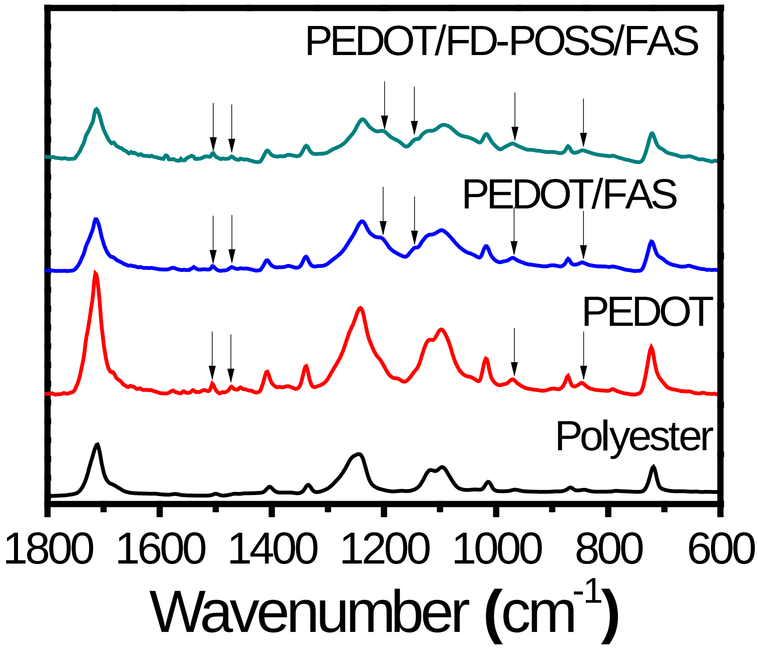

Fig. S4 FTIR spectra of uncoated and coated polyester fabrics.

For PEDOT coated fabric, the appearance of vibration peaks at 1506 and 1473 cm^{-1} was attributed to the stretching modes of C=C and C–C in the thiophene ring. The vibration of the C–S bond in the thiophene ring can be observed at 848 cm^{-1}. The peak at 970 cm^{-1} was due to the ethylenedioxy ring deformation [S. V. Selvaganesh, J. Mathiyarasu, K. L. N. Phani, V. Yegnaraman, *Nanoscale Research Letter*, **2007**, 2, 546-549]. For the PEDOT coating containing FD-POSS/FAS or FAS in the coating layer, peaks at 1200 cm^{-1} and 1147 cm^{-1} occurred in the spectra, which were the typical characteristics of C–F and Si–O–Si vibrations, respectively.

S5 AFM images of the polyester fibre before and after coating treatments.

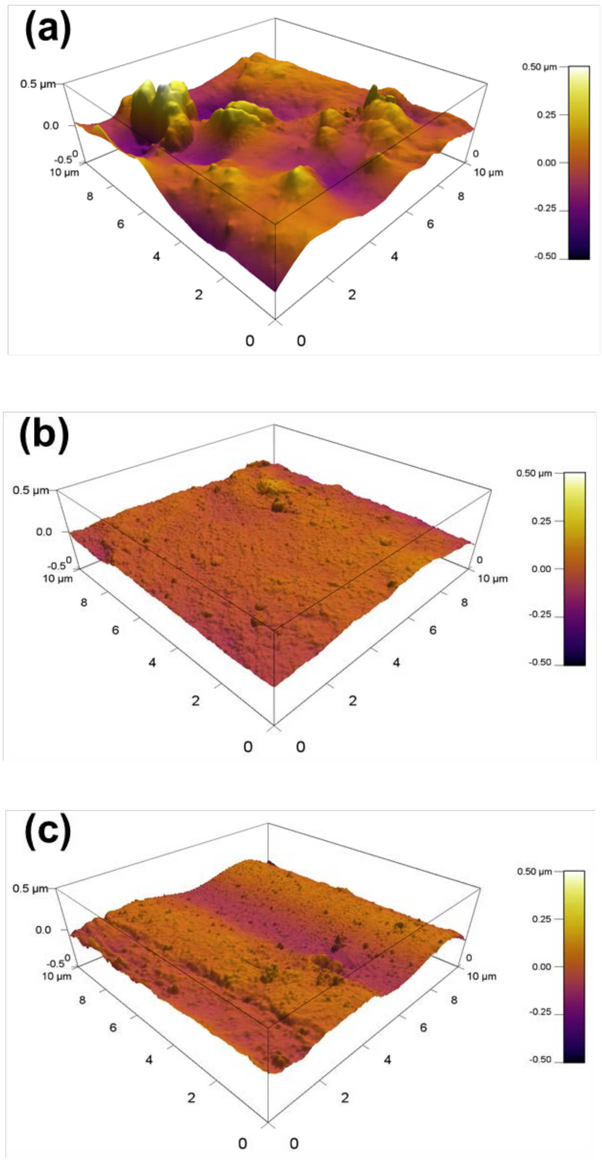

Fig. S5 AFM images of a) PEDOT/FD-POSS/FAS, b) PEDOT/FAS, and c) PEDOT coated polyester fibres. The roughness (RMS) of the surfaces is 110 nm, 43 nm and 60 nm, respectively.

S6 Photo of PEDOT/FAS and PEDOT/FD-POSS/FAS coated polyester fabrics after 10,000 cycles of abrasion.

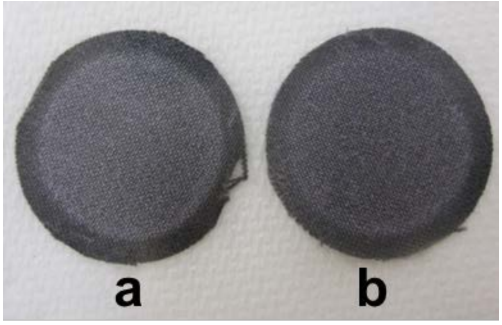

Fig. S6 Photo of a) PEDOT/FAS and b) PEDOT/FD-POSS/FAS coated polyester fabrics after 10,000 cycles of abrasion.

S7 Effect of abrasion cycles on the surface resistance of PEDOT and PEDOT/FAS coated fabrics.

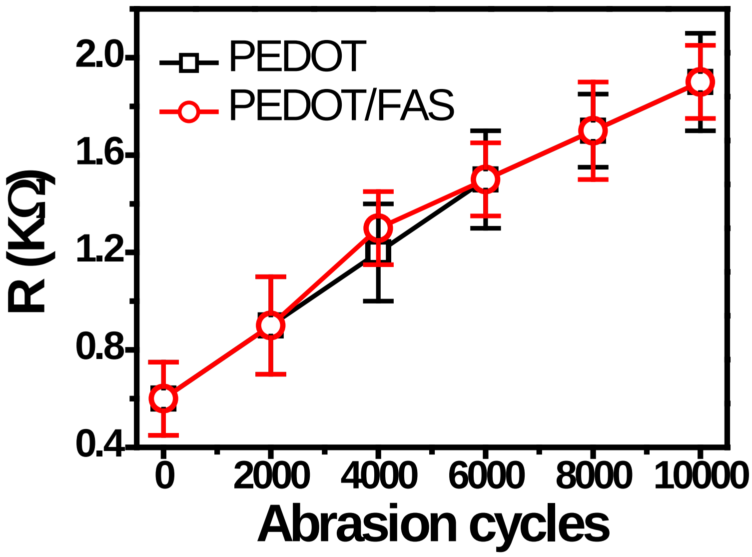

Fig. S7 Effect of abrasion cycles on the surface resistance of PEDOT and PEDOT/FAS coated fabrics.

S8 SEM images for PEDOT/FAS and PEDOT treated polyester fabrics after 10,000 cycles of abrasion.

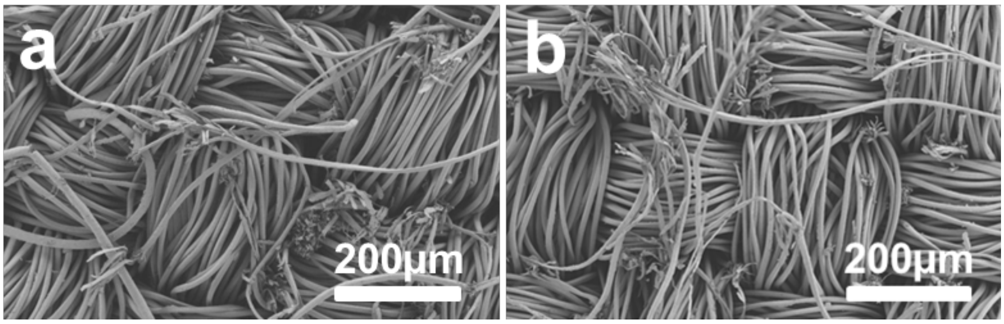

Fig. S8 SEM images of a) PEDOT/FAS and b) PEDOT treated polyester fabrics after 10,000 cycle abrasion test.

S9 SEM images of PEDOT/FAS and PEDOT/FD-POSS/FAS treated polyester fabrics after 500 cycles of laundries.

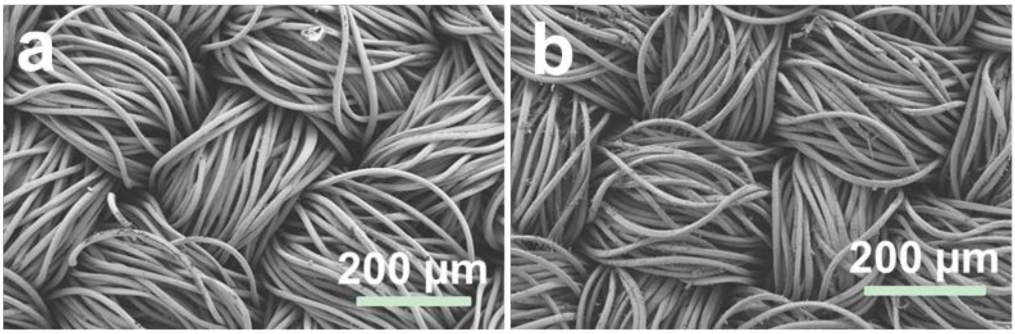

Fig. S9 SEM images of a) PEDOT/FAS and b) PEDOT/FD-POSS/FAS treated polyester fabrics after 500 washing cycles.

S10 Effect of washing cycles on surface resistance of PEDOT and PEDOT/FAS coated fabrics.

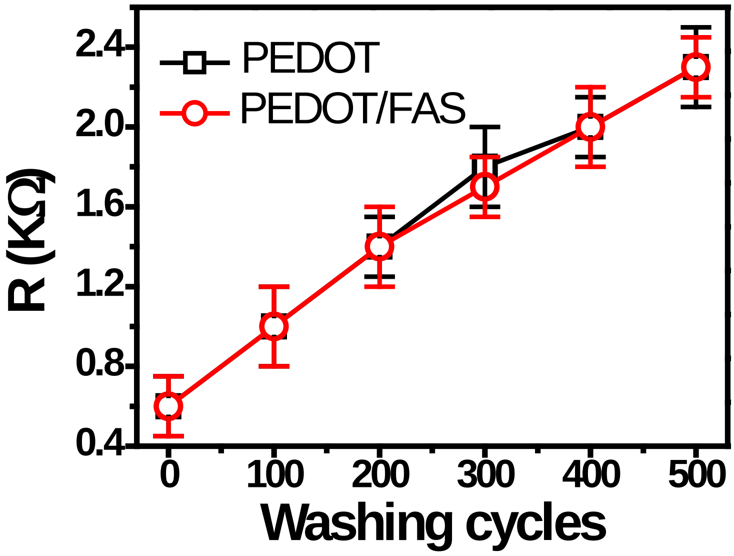

Fig. S10 Effect of washing cycles on surface resistance of PEDOT and PEDOT/FAS coated fabrics.

S11 Water contact angle change with ageing time.

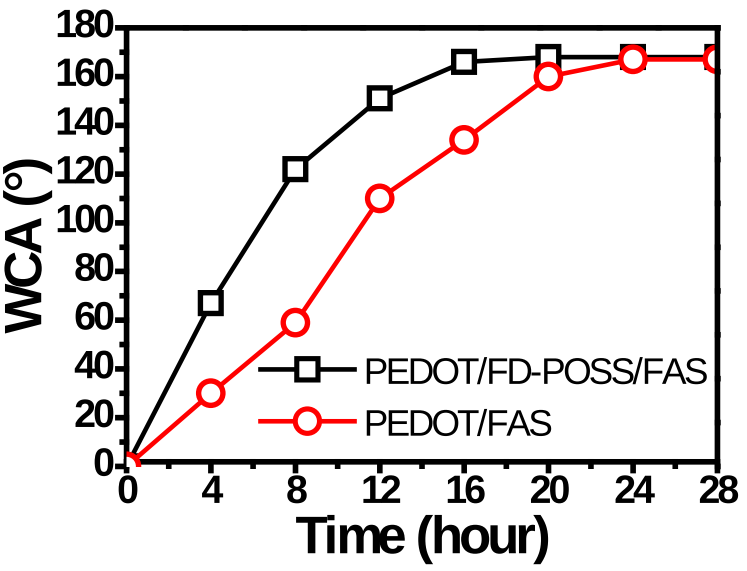

Fig. S11 Water contact angle of the plasma treated PEDOT/FAS and PEDOT/FD-POSS/FAS fabric samples changes with ageing time at room temperature.