Supplementary Material

Improved thermoelectric properties and environmental stability of conducting PEDOT:PSS films post-treated with imidazolium ionic liquids

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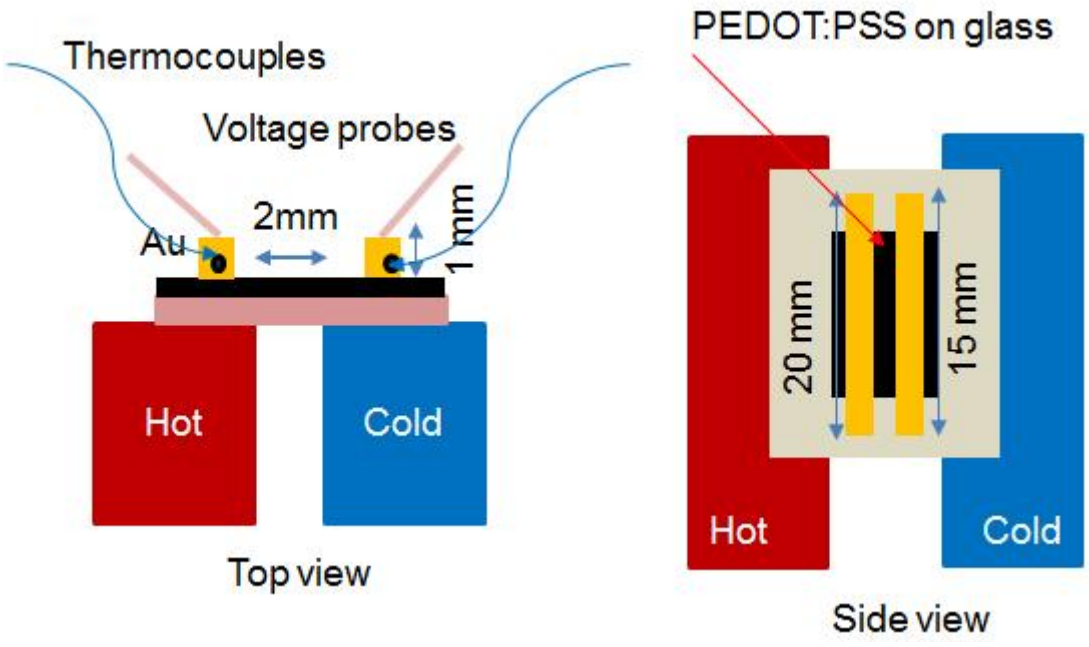

Figure S1. TE characterization of the PEDOT:PSS films. Schematic illustration of the *S* measurement setup and detailed electrode geometry.

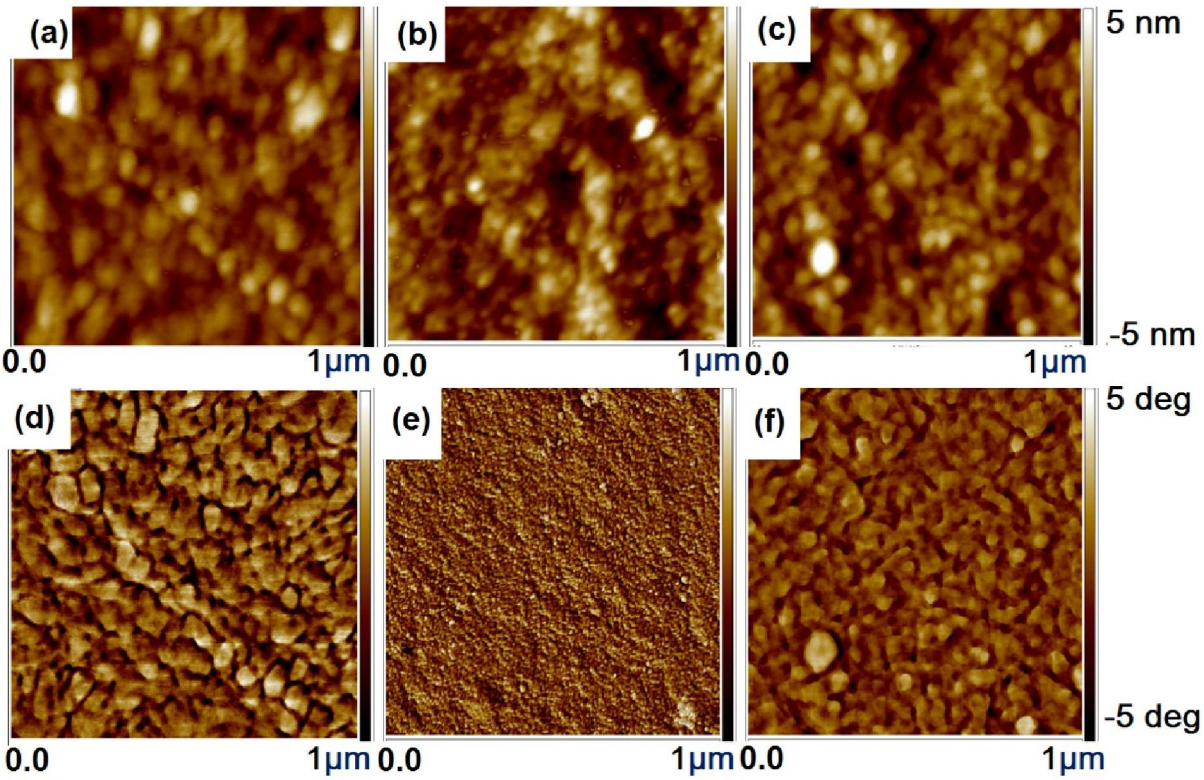

Figure S2. The AFM surface morphology of pristine and SFS-F-PEDOT:PSS films at various concentration SFS in water. Height images: (**a**) pristine, (**b**) 0, and (**c**) 100 mM SFS in water. Phase images: (**d**) pristine, (**e**) 0, and (**f**) 100 mM SFS in water. The area scanned is 1×1 μm^2 for each image.

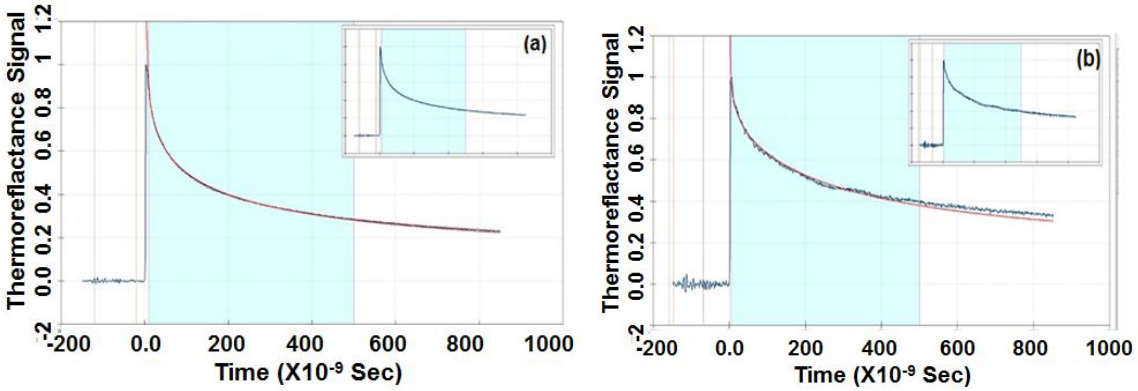

Figure S3. The normalized thermal reflectance signals of pristine and BMIM-TFSI-SFS-F-PEDOT:PSS films coated with 100 nm-thick-Al after the nanosecond-pulse heating. (**a**) Pristine and (**b**) 40 vol.% BMIM-TFSI-SFS-F-PEDOT:PSS films. The *b* of the PEDOT:PSS

films are extracted from the fitted temperature response curve which is represented with the solid red lines.

Table S1. Thermoelectric properties (σ, S and PF) of the sequential formamide (three times) and 100 mM SFS pre-treated films at various vol.% BMIM-TFSI in methanol.

Vol.% BMIM-TFSI-SFS-F-PEDOT:PSS	σ (S/cm)	S (μV/K)	PF (μW/mK^2)
0	693.01 ± 7	51.78 ± 0.8	185.77 ± 4.3
20	645.9±6	60.44±0.5	235.9±4.3
40	641±5	61.09±0.7	239.2±4.5
60	635.1±7	60.7±0.6	234±5.5
80	633.2±5	60.81±0.8	234.1±5.1
100	631.3±4	60.56±0.6	231.5±4.5

Table S2. Comparison of this work with previous reports in the literature on some typical sequential treated PEDOT based TE materials

Ref.	Dedoping Treatment	σ (S/cm)	S (μV/K)	PF (μW/K^{2}m)	k (W/mK)	ZT
(Bubnova et al., 2011)	PEDOT:TOS dedoping with TDAE ($C_{10}H_{24}N_4$)	67	220	324	-	-
(Park et al., 2014)	PEDOT:PSS treated with a mixture of DMSO and hydrazine	578	67	112	-	
(Yi et al., 2015)	Addition of DMSO in to PEDOT:PSS and then treated with Poly(ethylene oxide)	1061	38.4	157.35	-	-
(Lee et al., 2014b)	PEDOT:PSS treated with DMSO (C_2H_6OS), then DMSO and hydrazine (N_2H_4)	677	41	115.48	0.17	0.2
(Wang et al., 2015)	PEDOT:PSS treated with DMSO/$NaBH_4$	~580	~40	98.1	0.451	0.064
(Lee et al., 2014a)	PEDOT:PSS treated with p-toluenesulfonic acid monohydrate ($C_7H_8O_3S \cdot H_2O$)	~1300	~50	318.4	0.3	0.31

	, then hydrazine (N_2H_4) /DMSO solution					
(Fan et al., 2017)	PEDOT:PSS treated with H_2SO_4, then NaOH	2170	39.2	334	-	-
This work	PEDOT:PSS treated with formamide ($HCONH_2$), then SFS (CH_3NaO_3S) and then 40 Vol.% BMIM-TFSI	641	61.1	239.2	0.27	0.26

References

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