Supporting Information

Thermoelectric Energy from Flexible P3HT Films Doped by a Ferric Salt of Triflimide Anions

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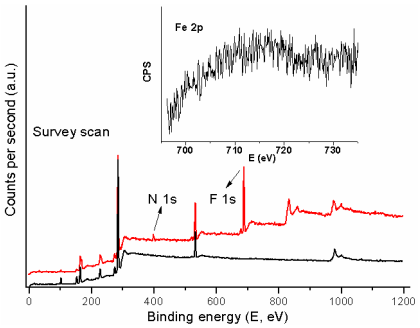

Fig. S1 Survey scan of XPS characterization for P3HT films before (black) and after doping (red).The inset shows detail of Fe(2p).

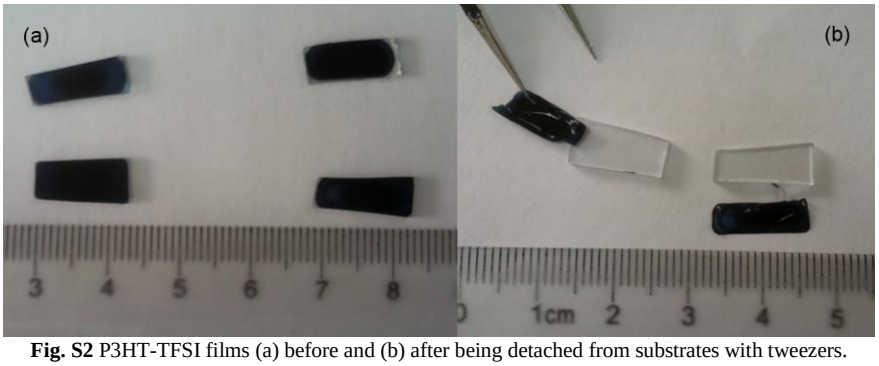

Fig. S2 P3HT-TFSI films (a) before and (b) after being detached from substrates with tweezers.

Table S1. Summary of thermoelectric property of P3HT at room temperature ever reported and obtained in this work.

Matrix	Dopant (solvent)	Electrical conductivity [S cm^{-1}]	Seebeck coefficient [μV K^{-1}]	Power factor [μW $m^{-1}K^{-2}$]
P3HT[1] (film, 1.75 μm)	F4-TCNQ (chlorobenzene)	3.8×10^{-4}	400	0.006
P3HT[2] (film, 1 μm)	$NOPF_6$ (acetonitrile)	2.2	25	0.14
P3HT[3] (film, 15 μm)	$FeCl_3$ (chloroform)	7	74	3.9
P3HT[4] (film, 5 μm)	$FeCl_3$ (chloroform)	8.9×10^{-3}	5400	26
P3HT[a] (film, 0.7 μm)	$FeCl_3$ (nitromethane)	21	30	1.9
P3HT[b] (film, 0.7 μm)	$NOPF_6$ (acetonitrile)	10	36	1.3

[ab] Samples doped by dopants ever reported are prepared in this work for comparison. $FeCl_3$ solution (in nitromethane, 10 mg ml^{-1}) and $NOPF_6$ solution (in acetonitrile, 5 mM) are used and the immersing time was 1.5 and 0.2 hours respectively.

Table S2. Carrier density of doped P3HT films extracted from temperature dependence of Seebeck coefficient according to Mott relation or from XPS measurement.

Formula	$\frac{S}{T} = \frac{\pi^2 k_B^2 m^*}{(3\pi^2)^{2/3}\hbar^2 \lvert e \rvert n^{2/3}}$		n = N·ρ	
Available parameters	Effective mass[5] [m^*, kg]	1.7 m_e [a]	Oxidation ratio (ρ) [b] Density of states [N, cm^{-3}][6]	0.32 5.2×10^{21}
Extracted parameters	Carrier density [n, cm^{-3}]	1.62×10^{21}	Carrier density [n, cm^{-3}]	1.66×10^{21}
Electrical conductivity at supposed carrier mobility [c] (σ, S cm^{-1})	μ = 0.2 cm^2 $V^{-1}s^{-1}$	51.8	μ = 0.2 cm^2 $V^{-1}s^{-1}$	53.1
	μ = 0.3 cm^2 $V^{-1}s^{-1}$	77.7	μ = 0.3 cm^2 $V^{-1}s^{-1}$	79.7
	μ = 0.35 cm^2 $V^{-1}s^{-1}$	90.7	μ = 0.35 cm^2 $V^{-1}s^{-1}$	93.0

[a] m_e is the rest mass of electrons; [b] oxidation ratio is defined as unit positive charge per thiophene monomer, determined by XPS as the area ratio of S(2p) peak around 168 eV to that around 164 eV; [c] although the estimated carrier mobility is above most results extracted from measurement in field-effect transistors of P3HT,[7] it is in accord with the mobility range of heavily doped P3HT.[3, 8]

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