Supplementary Information

Band edge modulated conjugated polymers for oxidation prevention

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Fluorescence Quenching Studies

Fluorescence emission spectra were recorded for polymers **P1**-**P4** with various PCBM quencher concentrations (1 x 10^{-5} M to 1 x 10^{-3} M). Polymers **P1**, **P2**, **P3** and **P4** were excited at the wavelength of 460 nm, 400 nm, 448 nm, and 547 nm, respectively. The decrease in the fluorescence emission intensity upon addition of PCBM reveals the efficient quenching of excitons by PCBM. These quenching results were analyzed by the following Stern-Volmer relationship.

$$M_0/M = 1 + K_{sv}\,[Q]$$

Wherein, M_0 and M are the fluorescence intensity of polymers with and without quencher respectively, [Q] is the quencher concentration in moles per litre, K_{sv} is the Stern-Volmer quenching constant. The plot between the ratio M_0/M of polymers (**P1**-**P4**) and the

concentration of quencher yields a straight line. From the slope, we obtained the Stern-Volmer quenching constant (K_{sv}). The K_{sv} values obtained from the Stern-Volmer plot was summarized in table. It can be found that the polymer 2 exhibits greater value than rest of other polymers, which may be due to relatively more appropriate distance and orientation of polymer 2 with PCBM.

Table S1. Summary of Polymers' Emission and Quenching Properties

Polymer	Excitation wavelength (nm)	Emission wavelength (nm)	Ksv
P1	460	570	1.9×10^4
P2	400	489	4.3×10^4
P3	448	588	2.7×10^4
P4	547	623	2.2×10^4

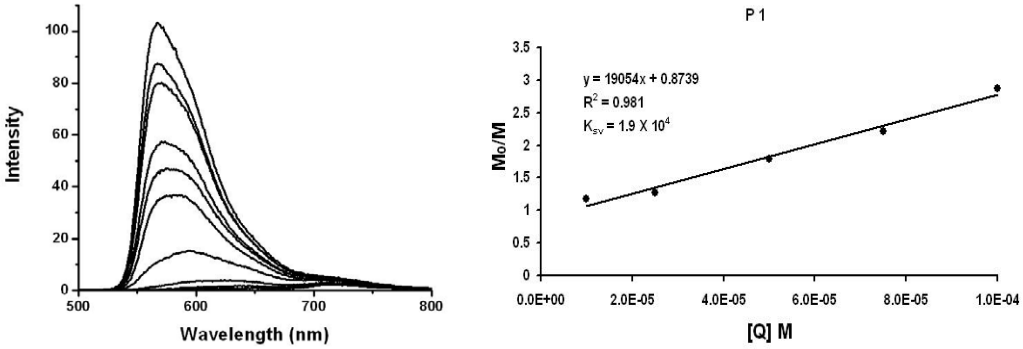

Figure S1. Emission spectra showing fluorescence quenching of **P1** in presence of PCBM (left) and corresponding stern-volmer plot (right).

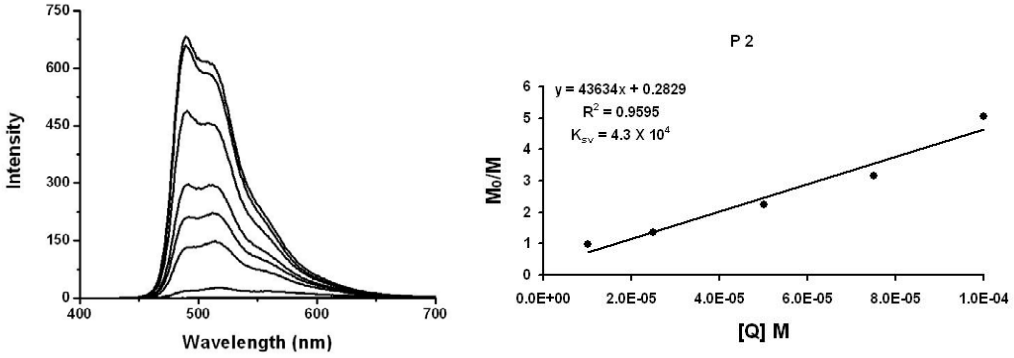

Figure S2. Emission spectra showing fluorescence quenching of **P2** in presence of PCBM (left) and corresponding stern-volmer plot (right).

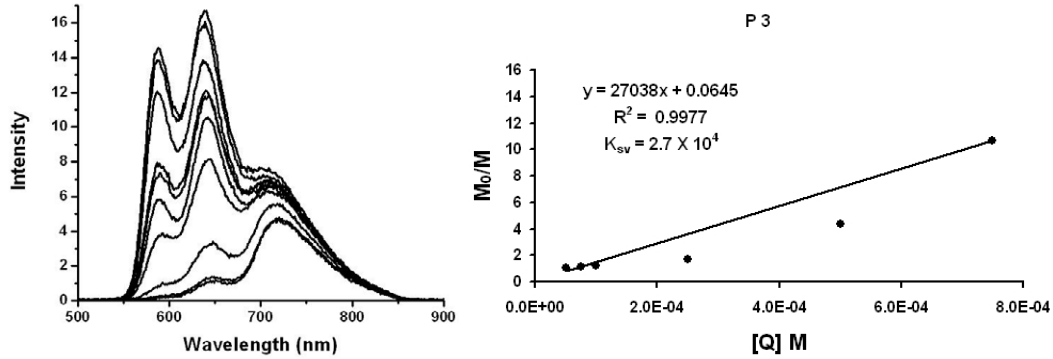

Figure S3. Emission spectra showing fluorescence quenching of **P3** in presence of PCBM (left) and corresponding stern-volmer plot (right).

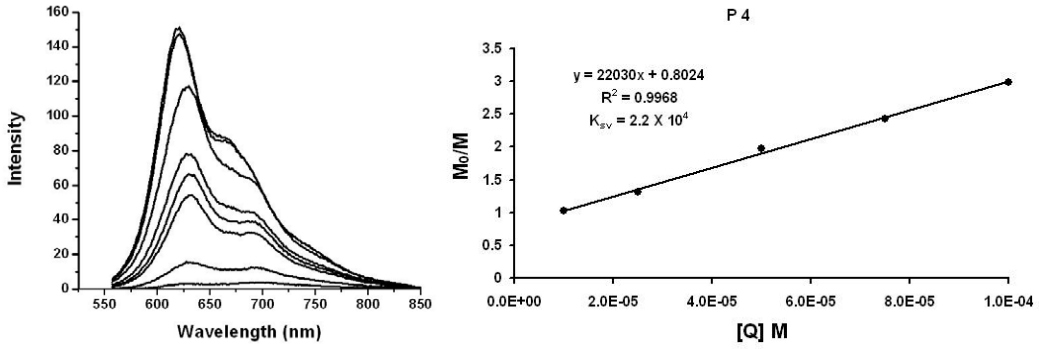

Figure S4. Emission spectra showing fluorescence quenching of **P4** in presence of PCBM (left) and corresponding stern-volmer plot (right).

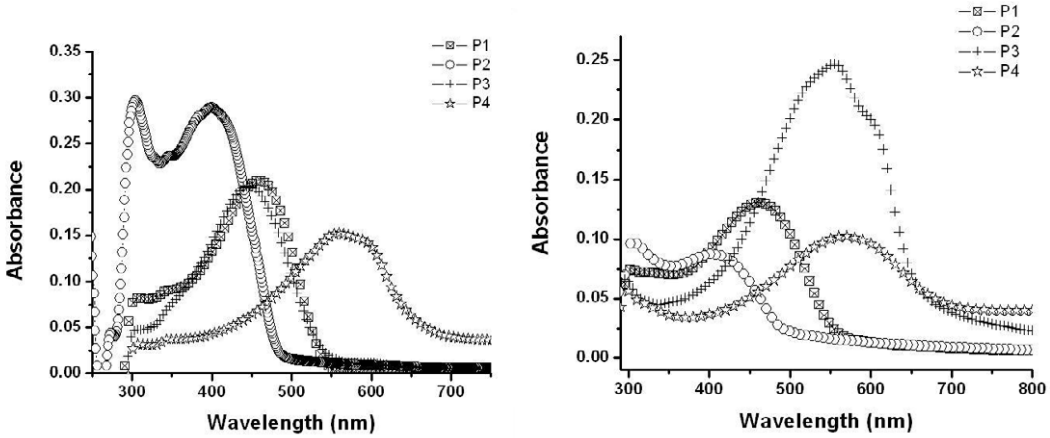

Figure S5. UV-vis absorption spectra of **P1**-**P4** recorded from chloroform solution (left) and thin film (right).

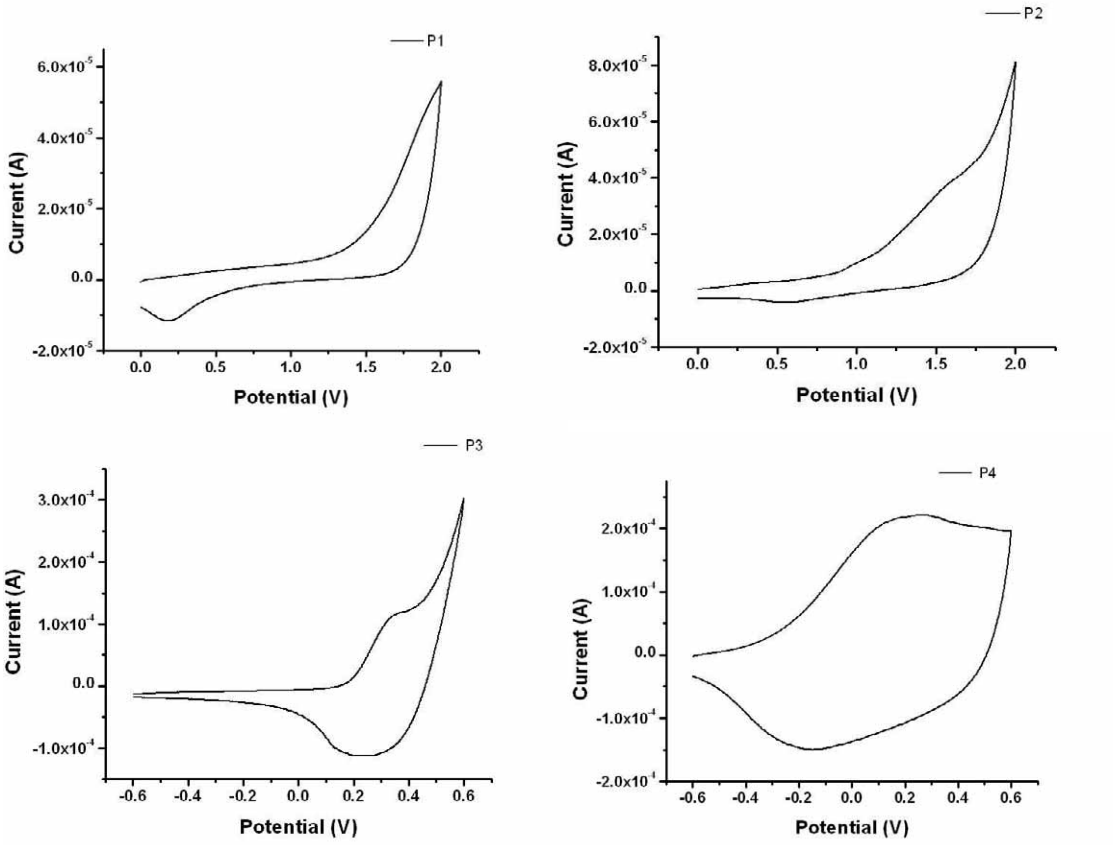

Figure S6. Cyclic voltammogram of thin films of polymers recorded in 0.1 M TBAP in acetonitrile with respect to Ag/Ag+ reference electrode.

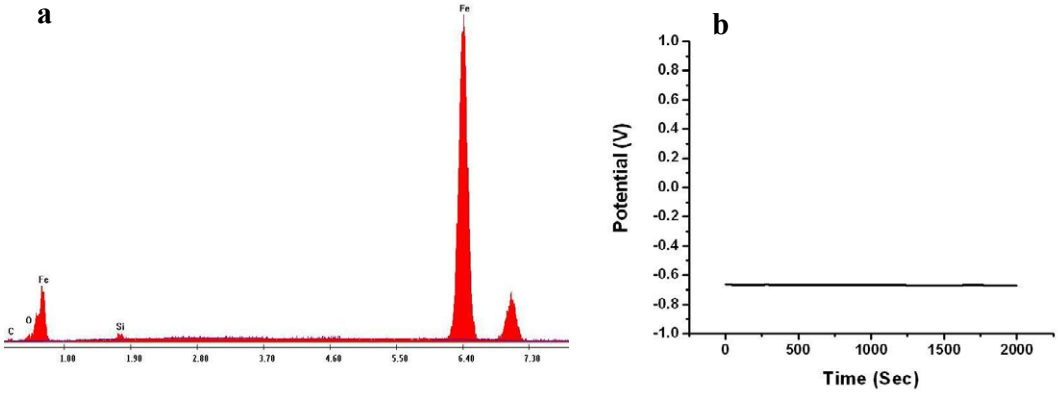

Figure S7. EDX spectra (**a**) and open circuit potential (**b**) of steel substrate.

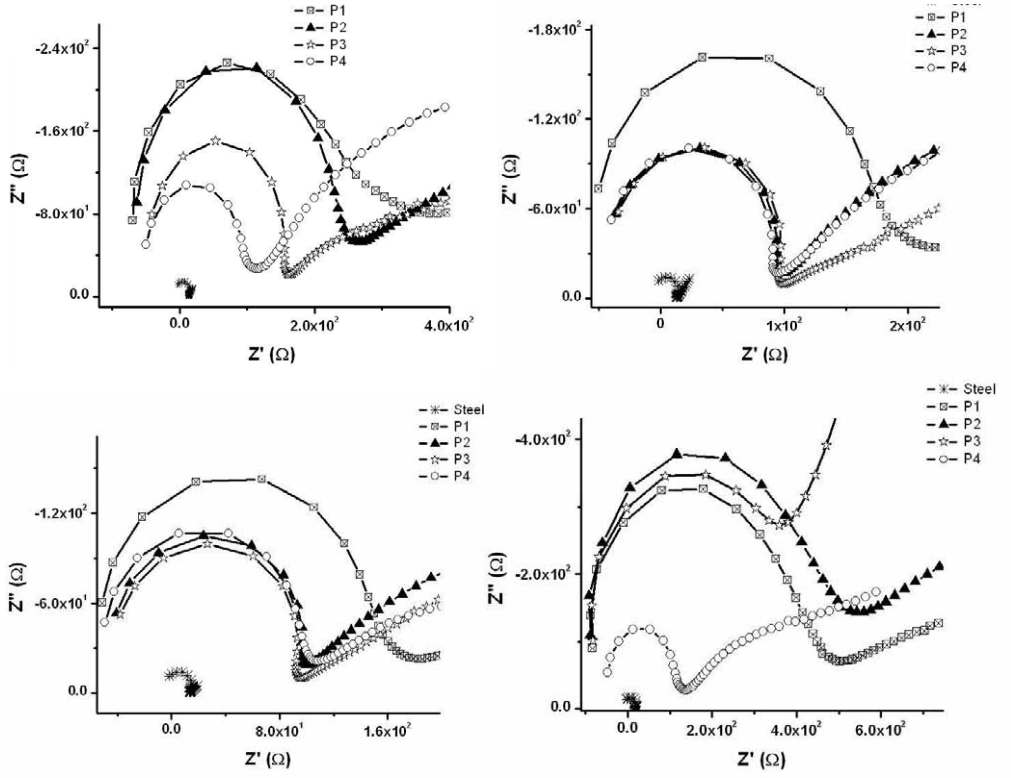

Figure S8. Impedance spectra showing variation in film resistance as a function of time of exposure to sodium chloride. **P1**-**P4** after 6 hours (top left), **P1**-**P4** after 12 hours (top right), **P1**-**P4** after 24 hours (bottom left) and **P1**-**P4** after solar light (bottom right) exposure.

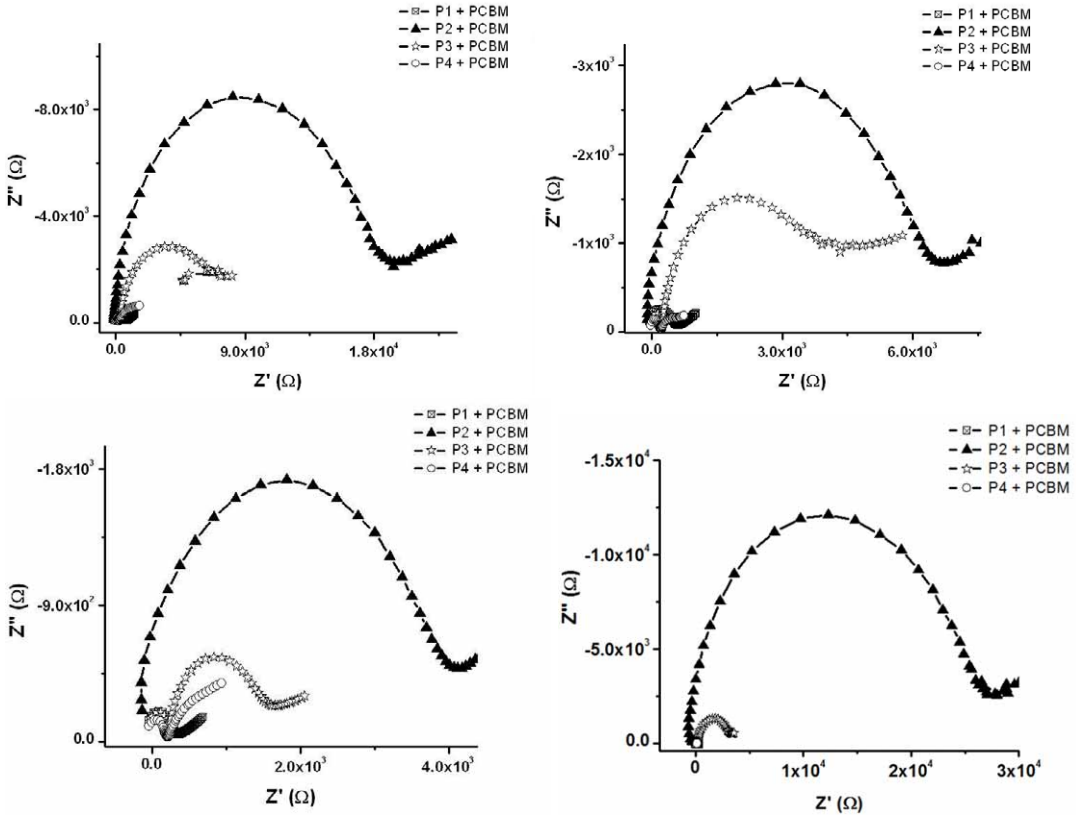

Figure S9. Impedance spectra showing variation in polymer-PCBM blend film resistance as a function of time of exposure to sodium chloride. **P1**-**P4**-PCBM after 6 hours (top left), **P1**-**P4**-PCBM after 12 hours (top right), **P1**-**P4**-PCBM after 24 hours (bottom left) and **P1**-**P4**-PCBM after solar light (bottom right) exposure.

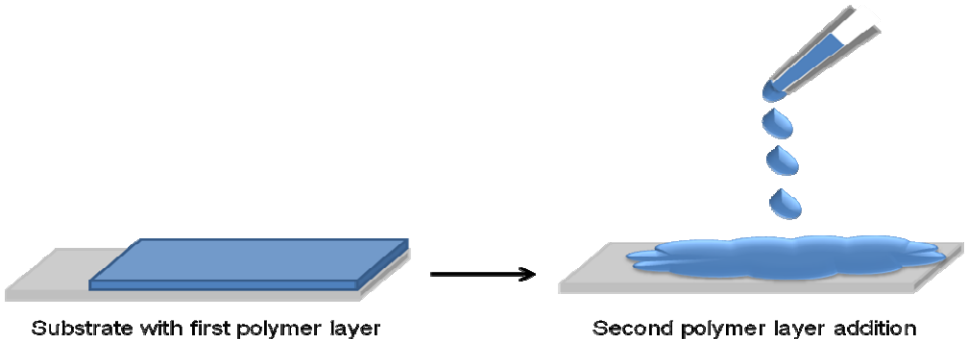

Figure S10. Substrate preparation by addition of polymer solution to an existing polymer film.

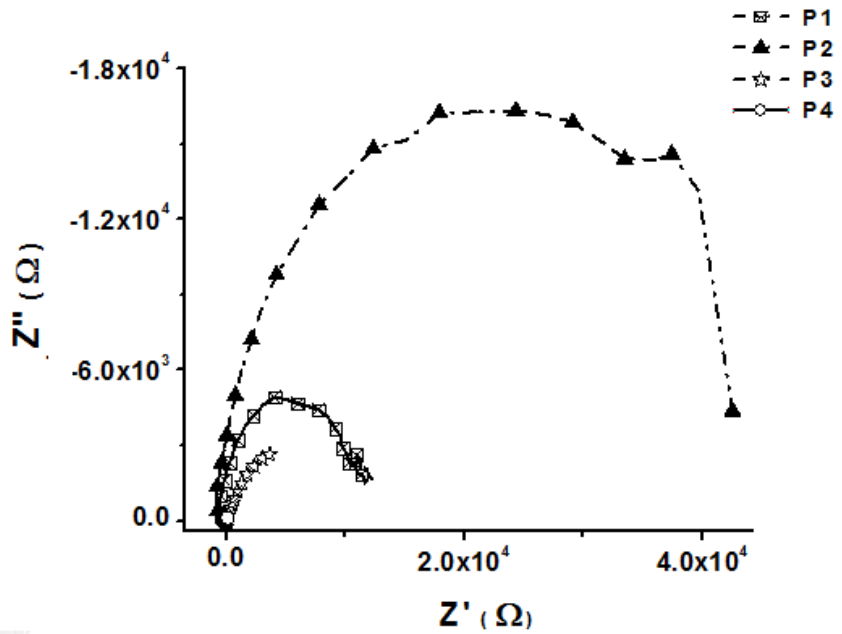

Figure S11. Electrochemical impedance spectra of two layers polymers (**P1**-**P4**) on steel substrates.

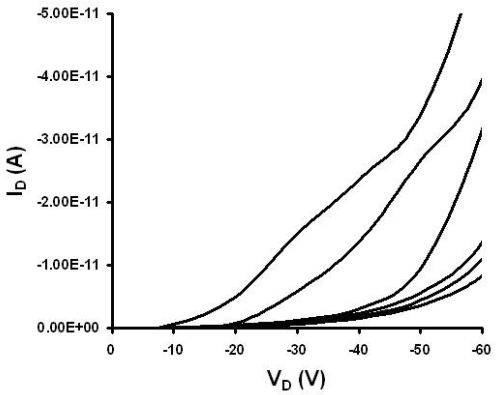

Figure S12. Output characteristics of **P1** measured as a function applied gate voltage using bottom gate, bottom contact FET.

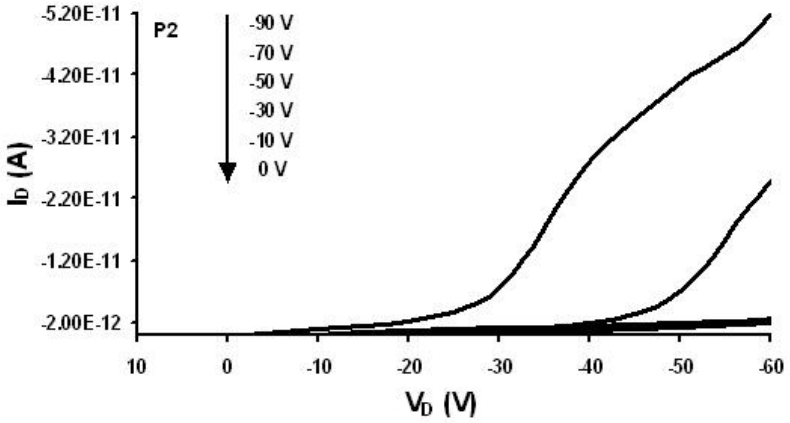

Figure S13. Output characteristics of **P2** measured as a function applied gate voltage using bottom gate, bottom contact FET.

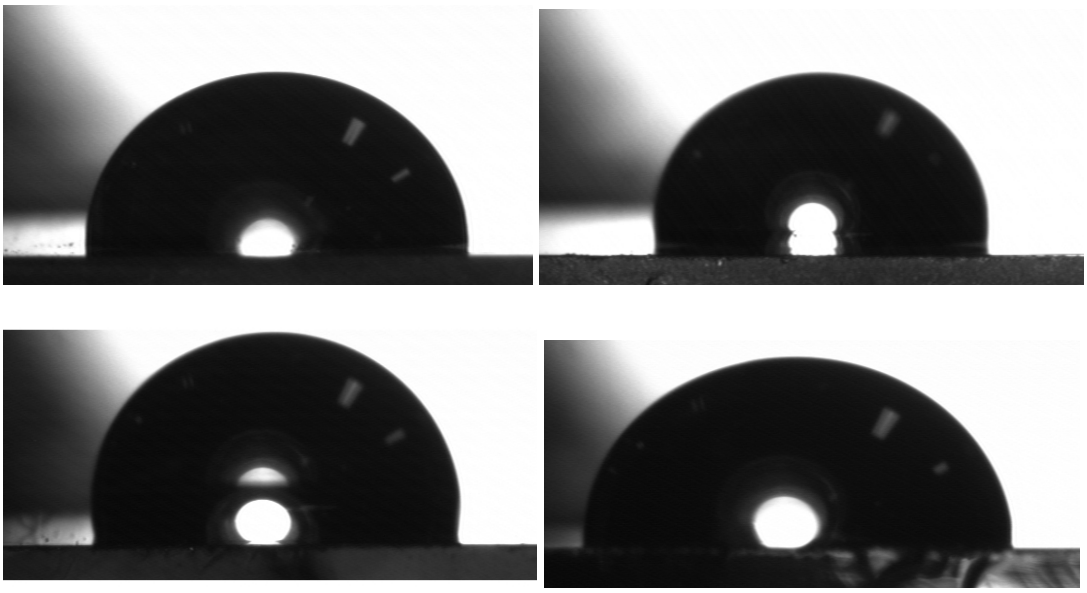

Figure S14. Water droplet contact angle measurement on top of **P1** (top left), **P2** (top right), **P3** (bottom left) and **P4** (bottom right).

Table S2. Summary of polymer resistance as a function of exposure to 0.5 M NaCl.

Sr. No	Polymer	0 hrs resistance (Ω/cm^2)	After 6 hrs resistance (Ω/cm^2)	After 12 hrs resistance (Ω/cm^2)	After 24 hrs resistance (Ω/cm^2)
1	**P1**	1.9×10^4	1.6×10^3	1.1×10^3	1.0×10^3
2	**P2**	1.4×10^4	1.5×10^3	6.5×10^2	6.8×10^2
3	**P3**	7.3×10^3	1.0×10^3	6.2×10^2	5.6×10^2
4	**P4**	4.9×10^2	7.4×10^2	6.4×10^2	7.9×10^2
5	**P1** + PCBM	3.9×10^4	3.8×10^3	2.9×10^3	1.5×10^3
6	**P2** + PCBM	2.1×10^6	9.0×10^4	3.3×10^4	2.0×10^4
7	**P3** + PCBM	1.2×10^3	1.3×10^3	1.2×10^3	1.2×10^3
8	**P4** + PCBM	8.3×10^2	1.1×10^3	9.8×10^2	1.0×10^3