

Impressive radiation stability of organic solar cells based on fullerene derivatives and carbazole-containing conjugated polymers

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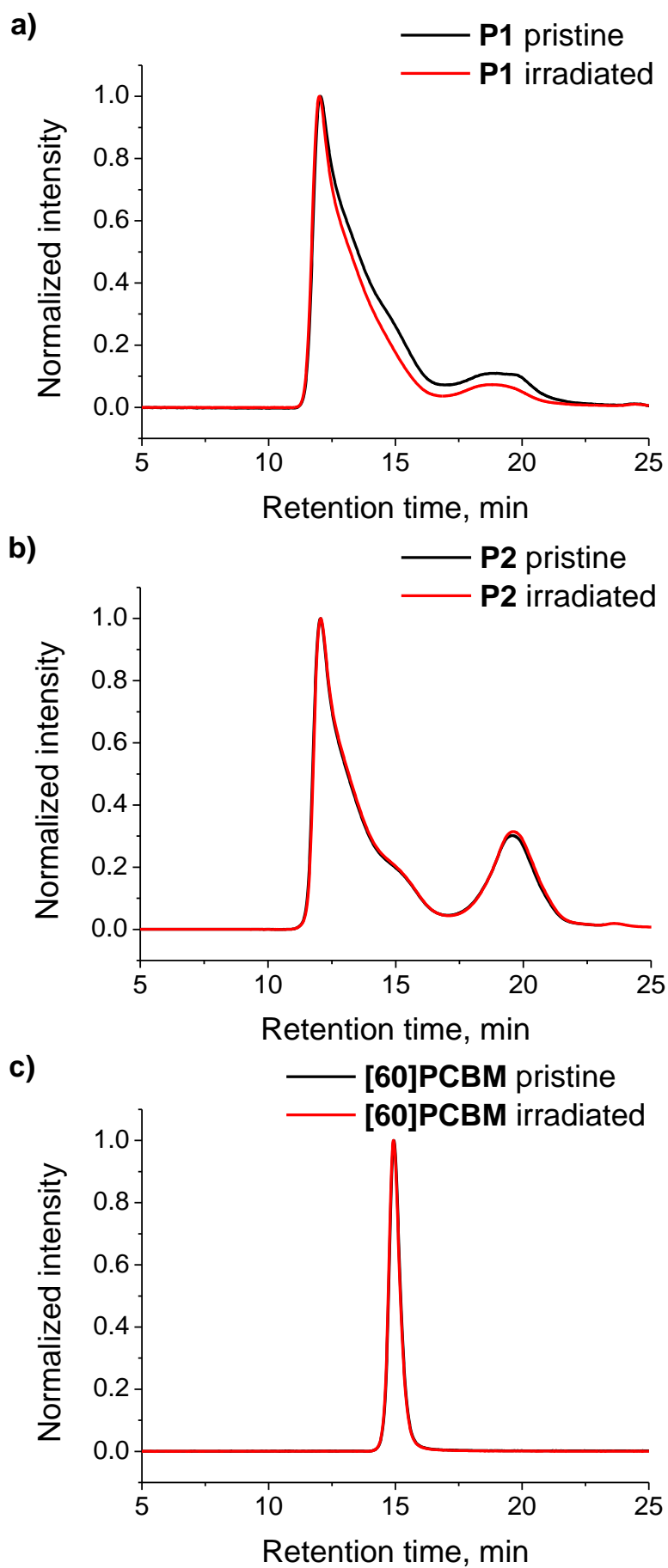


Figure S1. GPC profiles of the **P1** (a), **P2** (b) and **[60]PCBM** (c) before and after exposure to gamma rays with the absorbed radiation dose of 200 Gy.

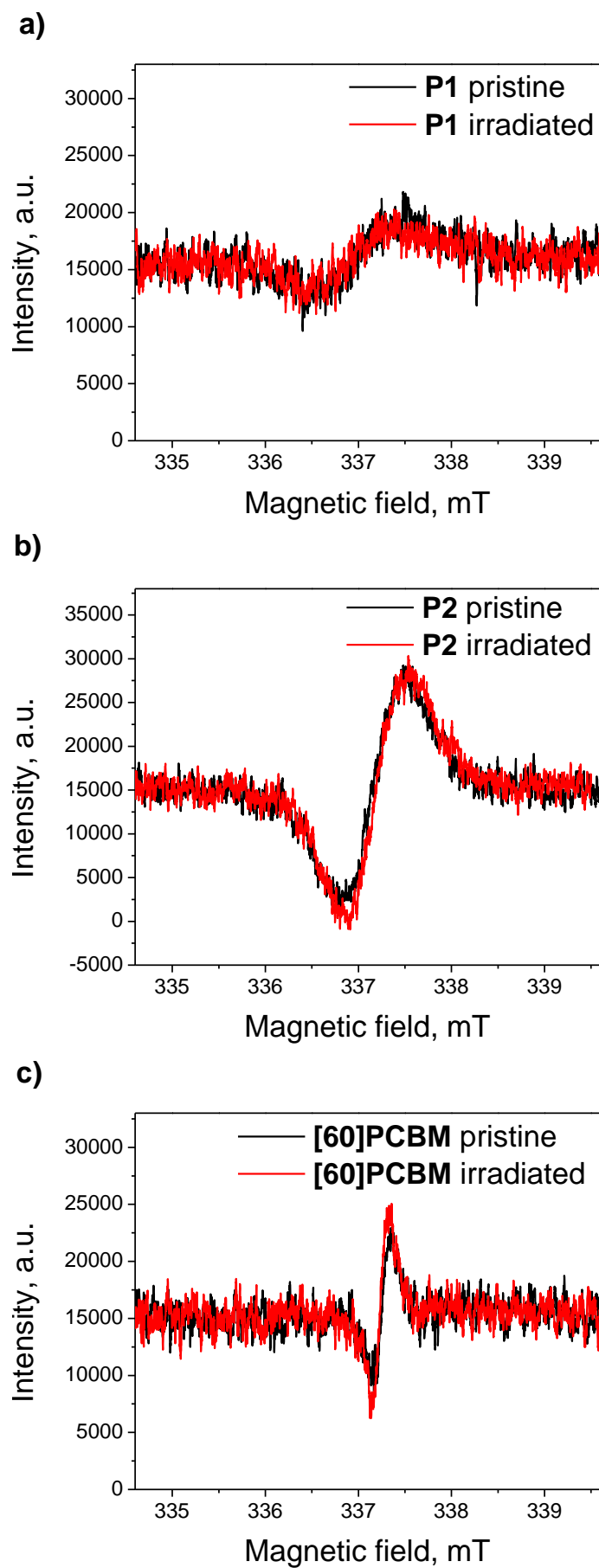
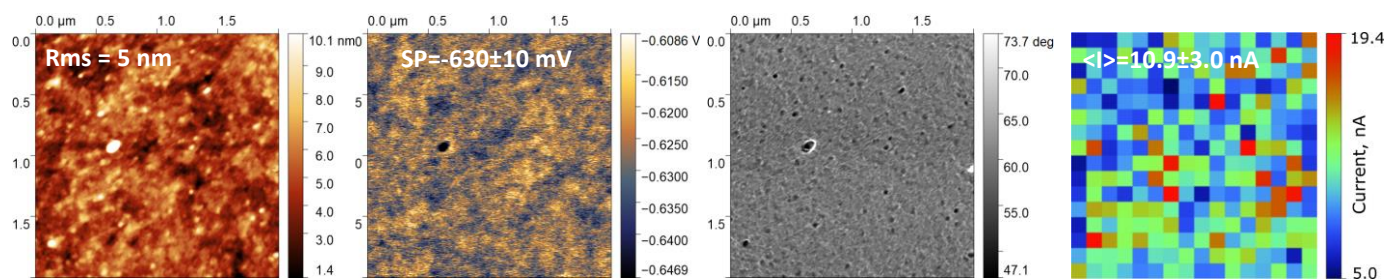


Figure S2. ESR spectra of the **P1** (a), **P2** (b) and [60]PCBM (c) before and after exposure to gamma rays with the absorbed radiation dose of 200 Gy.

Pristine films



Exposed films

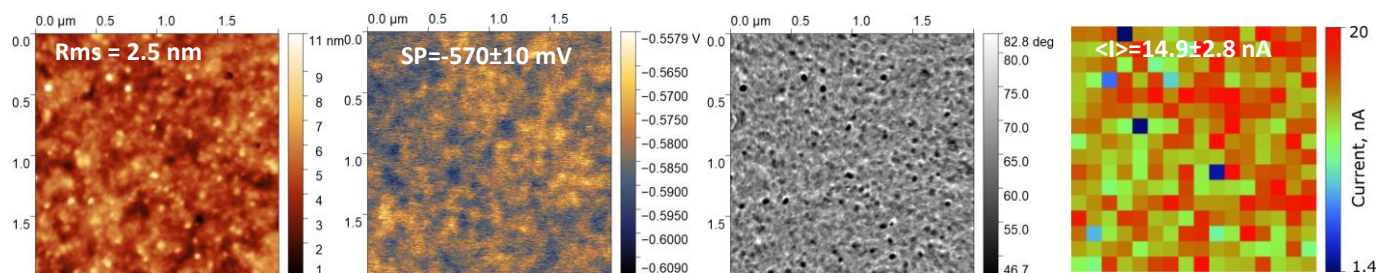
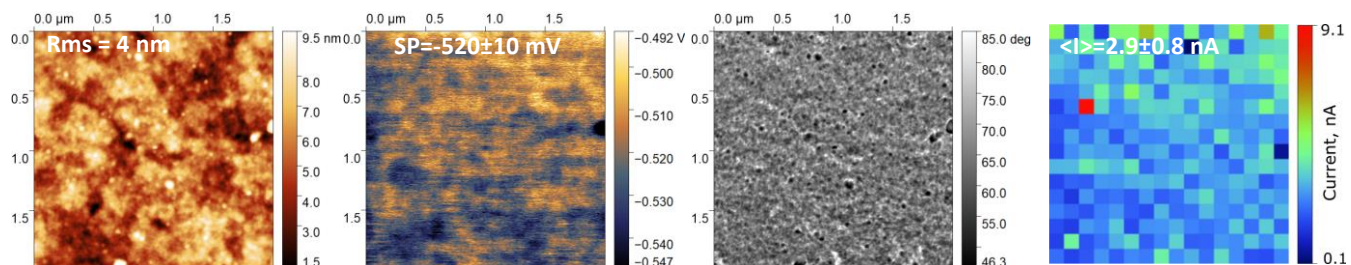


Figure S3. Left to right: AFM topography, surface potential, phase and current mapping images of **P1** films before (top) and after (bottom) exposure to gamma rays (6500 Gy).

Pristine films



Exposed films

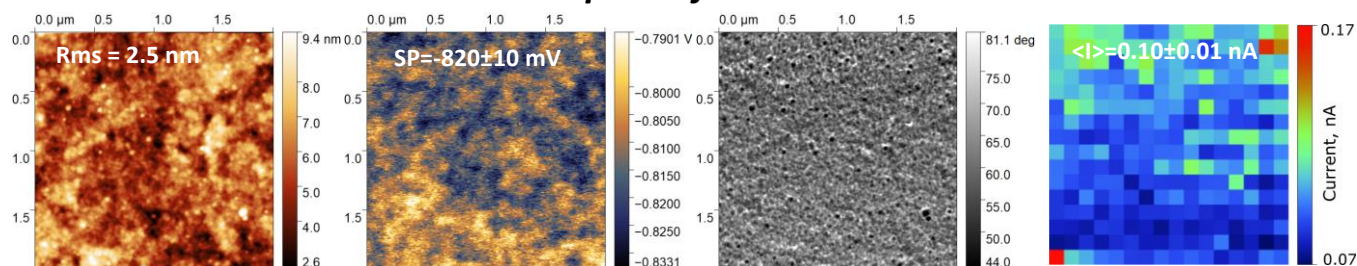


Figure S4. Left to right: AFM topography, surface potential, phase and current mapping images of **P2** films before (top) and after (bottom) exposure to gamma rays (500 Gy).

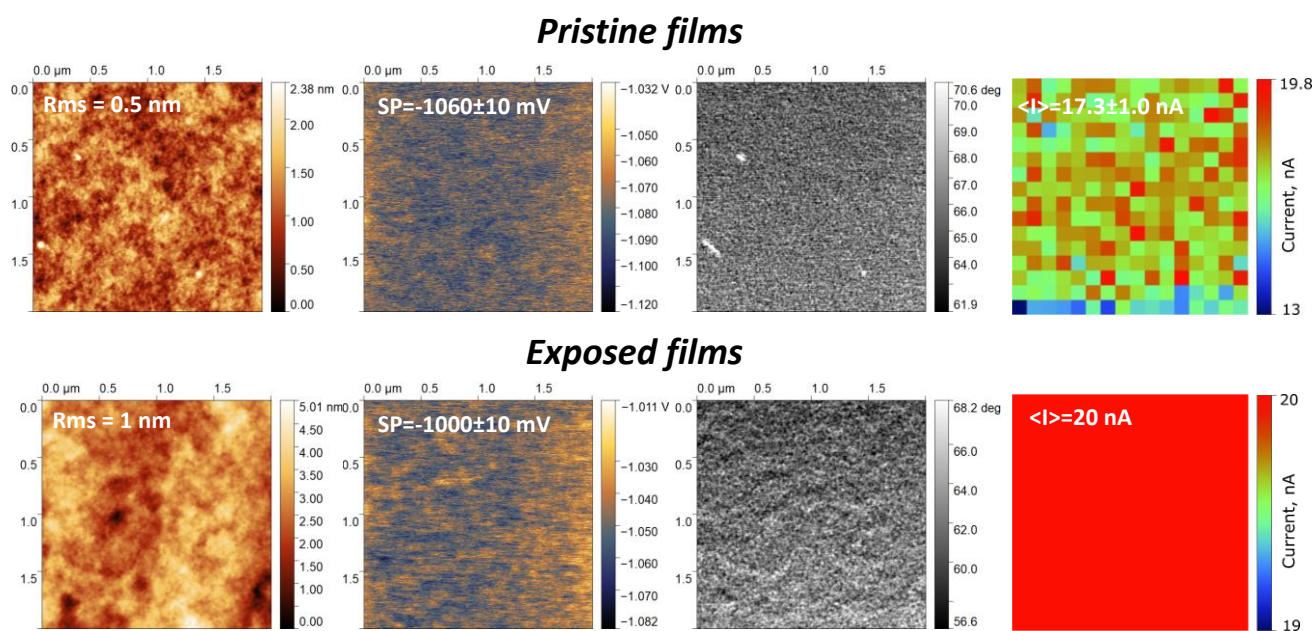


Figure S5. Left to right: AFM topography, surface potential, phase and current mapping images of [60]PCBM films before (top) and after (bottom) exposure to gamma rays (6500 Gy).

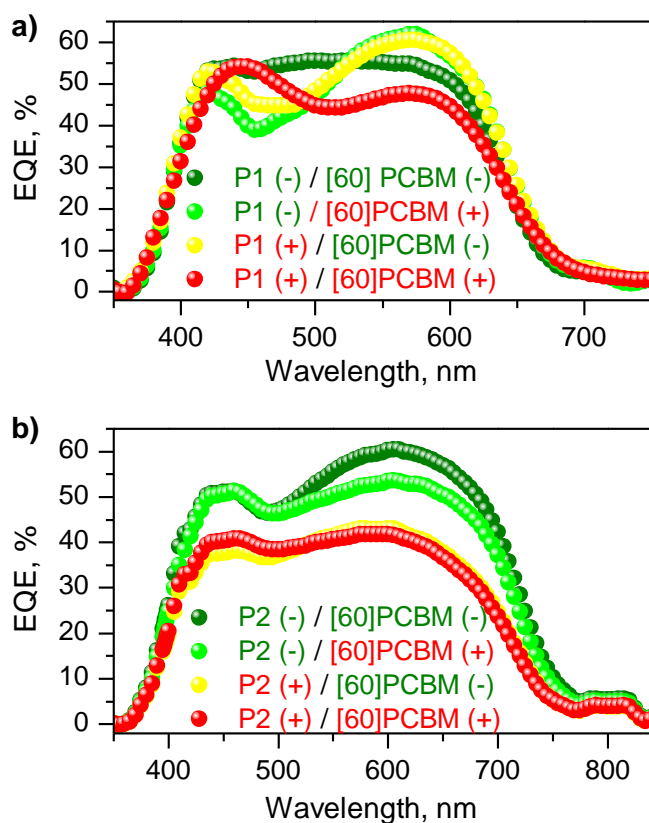


Figure S6. EQE spectra of organic solar cells based on the blends of non-exposed (-) and exposed to 200Gy (+) materials: **P1**/[60]PCBM (a) and **P2**/[60]PCBM (b).

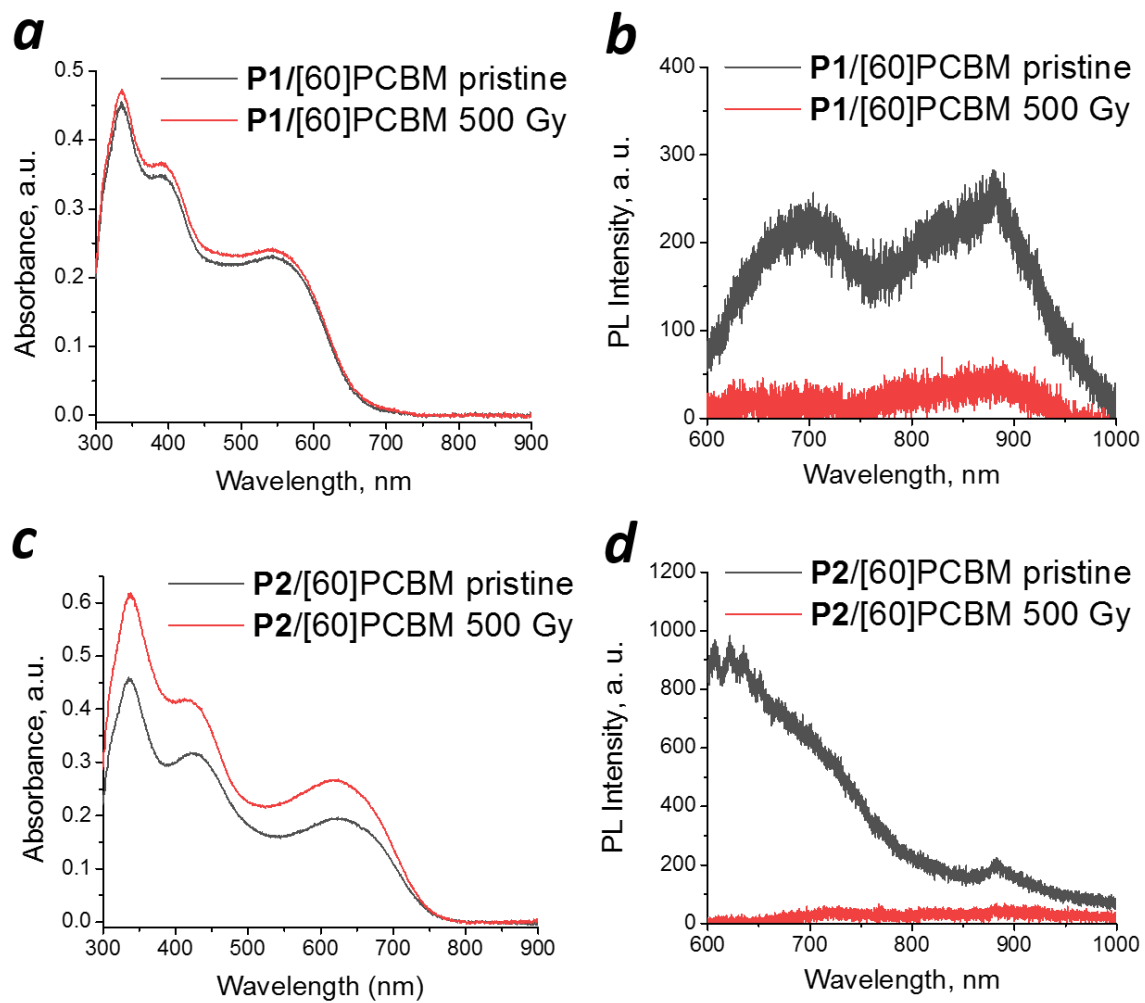


Figure S7 Evolution of the absorption (a, c) and PL (b, d) spectra of the **P1**/[60]PCBM (a-b) and **P2**/[60]PCBM (c-d) blend films

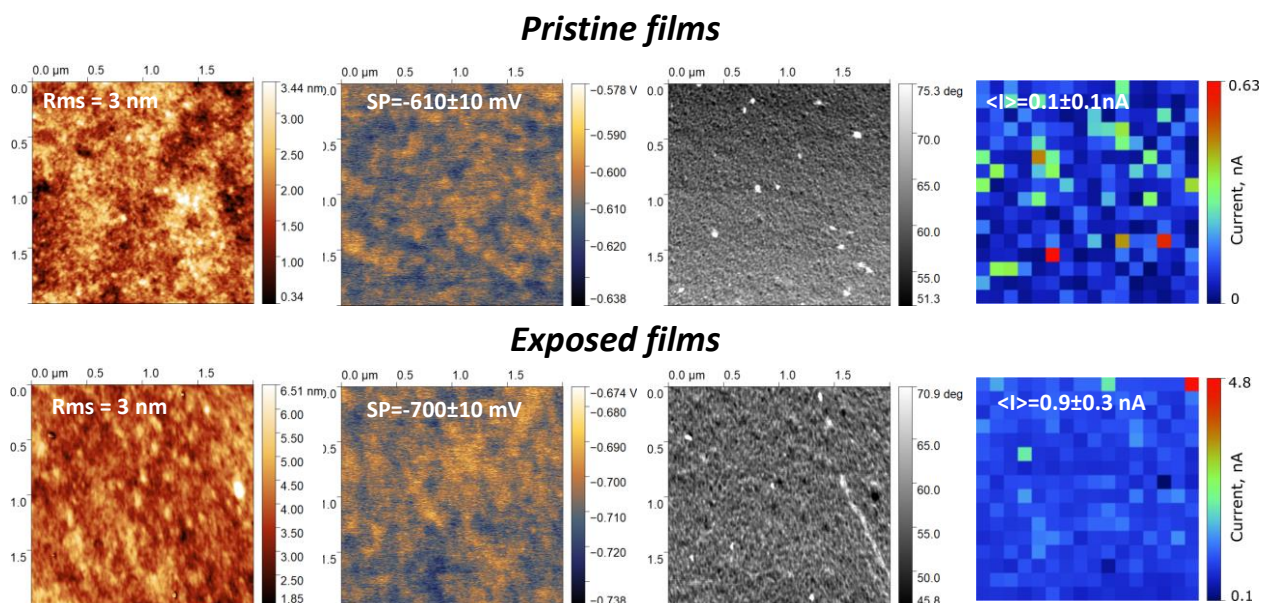


Figure S8. Left to right: AFM topography, surface potential, phase and current mapping images of **P1**/[60]PCBM films before (top) and after (bottom) exposure to gamma rays (6500 Gy)

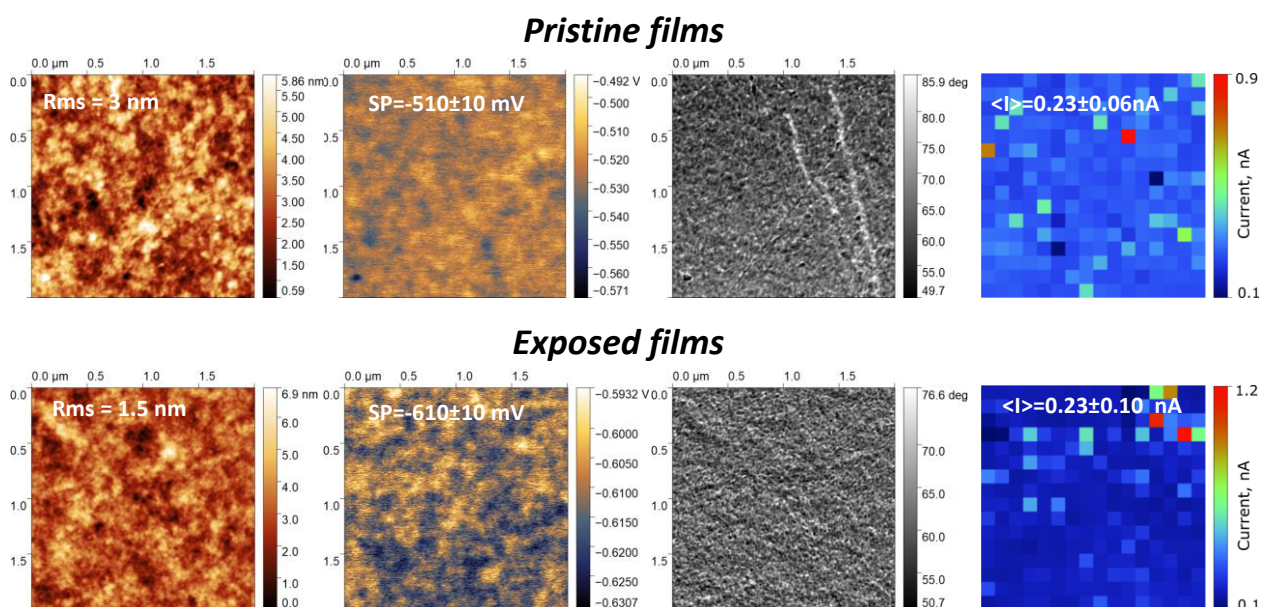


Figure S9. Left to right: AFM topography, surface potential, phase and current mapping images of **P2**/[60]PCBM films before (top) and after (bottom) exposure to gamma rays (500 Gy)

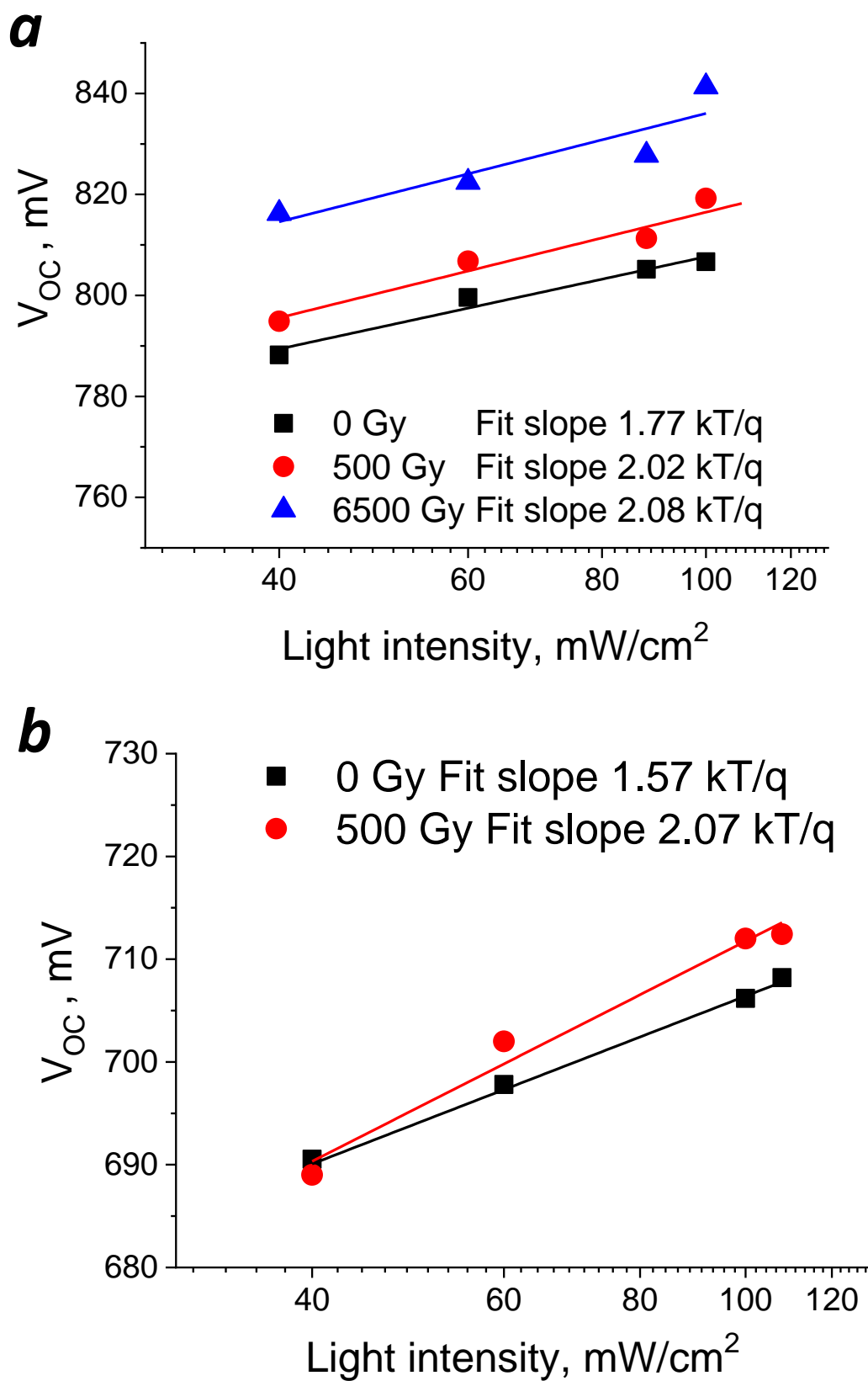


Figure S10. V_{OC} vs. light intensity dependences for organic solar cells based on the pristine and exposed to gamma rays **P1**/[60]PCBM (a) and **P2**/[60]PCBM (b) blend films

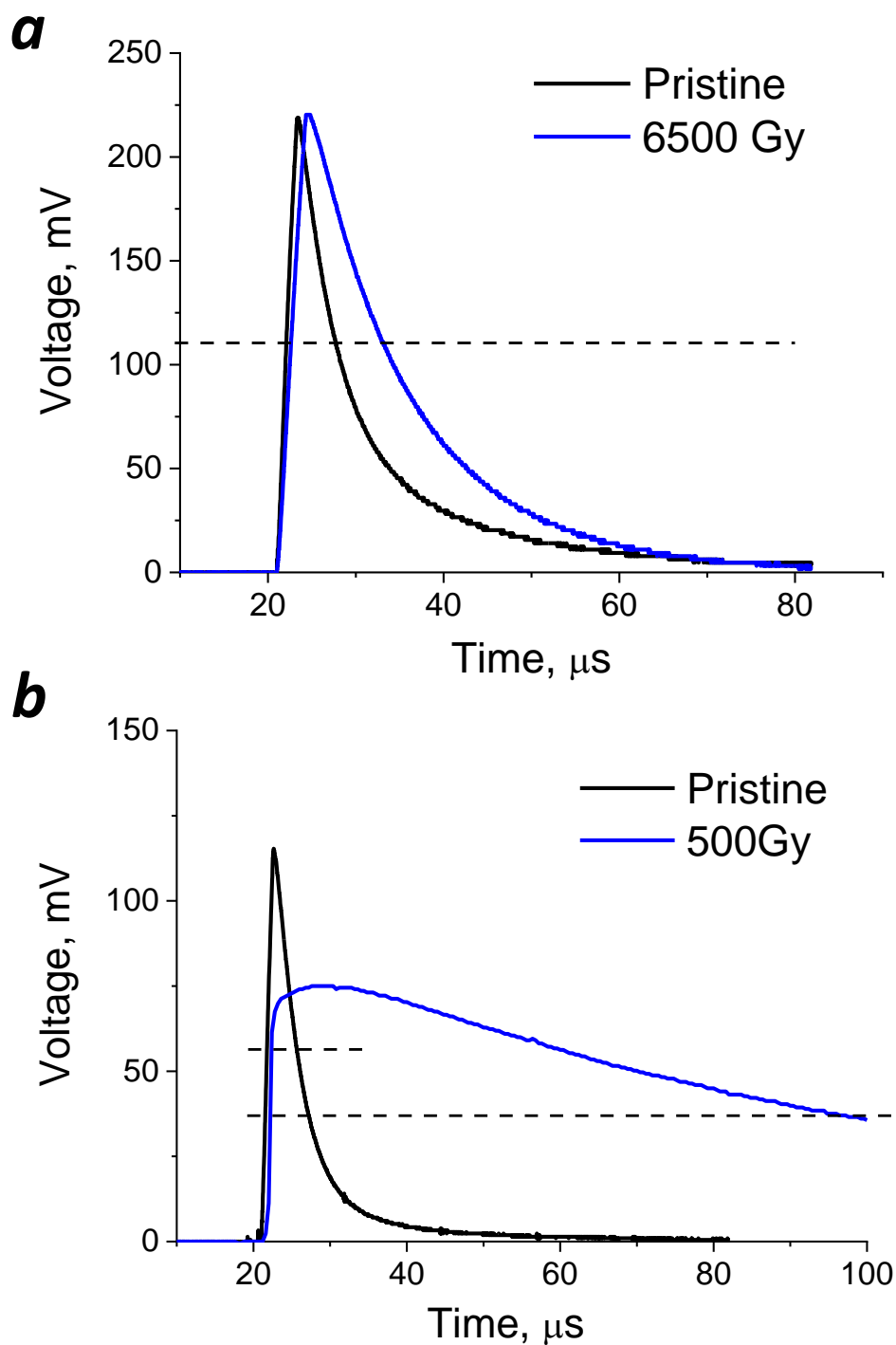


Figure S11. Transient photovoltage (TPV) profiles for organic solar cells based on the pristine and exposed to gamma rays **P1**/[60]PCBM (a) and **P2**/[60]PCBM (b) blend films

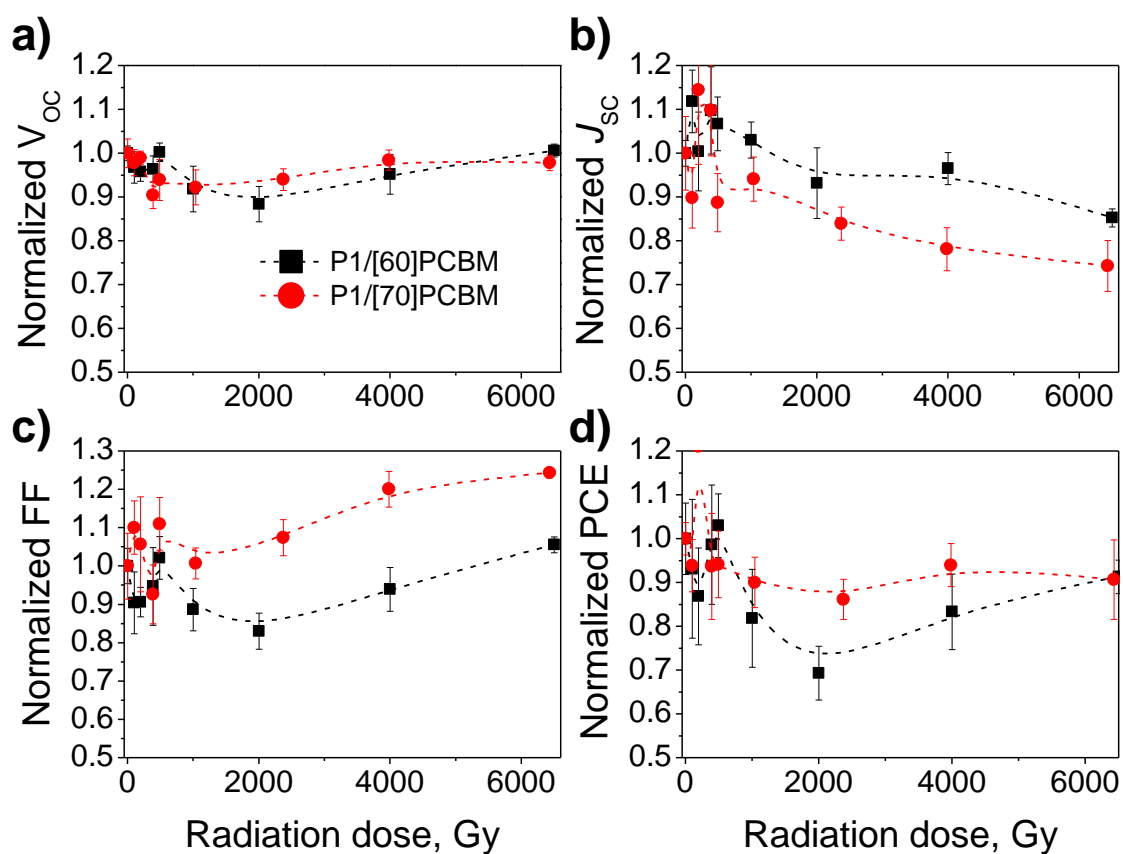


Figure S12. Normalized characteristics of the solar cells based on **P1**/[60]PCBM (black) and **P1**/[70]PCBM (red) plotted as functions of the radiation dose: open circuit voltage V_{OC} (a), short circuit current density J_{SC} (b), fill factor FF (c) and power conversion efficiency PCE (d)

Table S1. Characteristics of organic solar cells before and after exposure of the samples to different doses of gamma rays

Dose, Gy	V _{oc} , mV	J _{sc} , mA/cm ²	FF, %	PCE, %
P1/[60]PCBM*				
0	829 ±27	9.7 ±0.8	43 ±4	3.4 ±0.1
100	811 ±25	8.7 ±0.7	47 ±3	3.2 ±0.2
200	820 ±13	11.1 ±1.6	45 ±5	4.1 ±0.2
350	750 ±25	10.7 ±1.0	39 ±3	3.2 ±0.4
500	779 ±39	8.6 ±0.6	47 ±3	3.2 ±0.3
2050	765 ±33	9.1 ±0.5	43 ±2	3.1 ±0.2
4060	779 ±20	8.2 ±0.4	46 ±2	2.9 ±0.2
6350	816 ±19	7.6 ±0.5	51 ±2	3.2 ±0.2
P1/[70]PCBM*				
0	838 ±14	12.1 ±0.4	50 ±2	5.1 ±0.4
100	811 ±30	13.5 ±0.9	45 ±4	4.8 ±0.8
200	803 ±18	12.1 ±1.1	45 ±2	4.5 ±0.6
350	808 ±25	13.2 ±1.2	48 ±5	5.1 ±0.7
500	841 ±18	12.9 ±0.7	51 ±3	5.3 ±0.4
2050	770 ±44	12.4 ±0.5	45 ±3	4.2 ±0.6
4060	741 ±34	11.3 ±1.0	42 ±2	3.6 ±0.3
6350	798 ±38	11.7 ±0.4	47 ±3	4.3 ±0.4
P2/[60]PCBM**				
0	702 ±14	12.6 ±0.5	53 ±4	4.6 ±0.5
99	690 ±25	13.6 ±0.9	48 ±5	4.4 ±0.6
195	690 ±18	11.5 ±0.4	49 ±4	4.0 ±0.4
390	679 ±12	12.4 ±0.5	48 ±1	4.0 ±0.3
490	707 ±21	11.6 ±0.8	49 ±3	3.7 ±0.4

* - the active layer thickness was 90±5 nm.

** - the active layer thickness was 100±5 nm.