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Effect of PbS quantum dots on molecular dynamics and conductivity of PTB7:PC71BM bulk hetrojunction as revealed by dielectric spectroscopy

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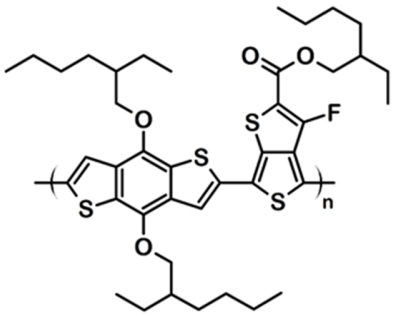
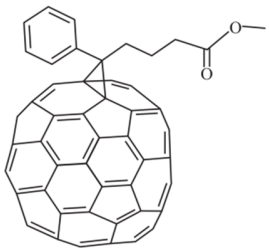
Electronic Supplementary Information

S1 Chemical structures



PTB7



PC71BM

Fig. S1 Chemical structure of the materials used.

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S2 AFM experimental data

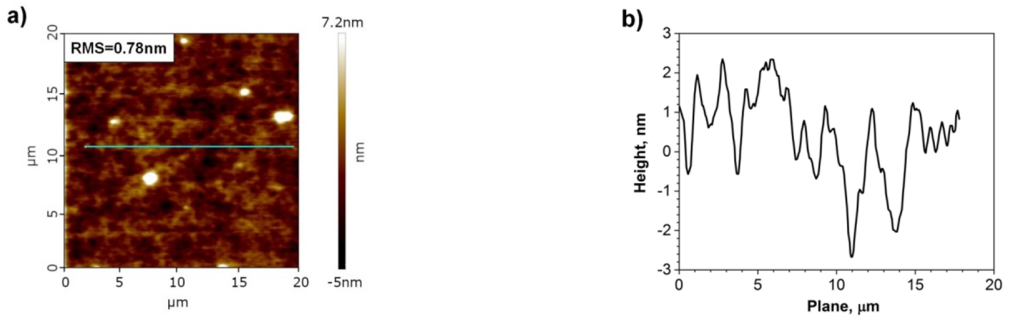

Fig. S2 (a) 2D AFM image of PTB7:PC71BM:PbS QDs (PbS QDs content 3 wt%), (b) its section profile.

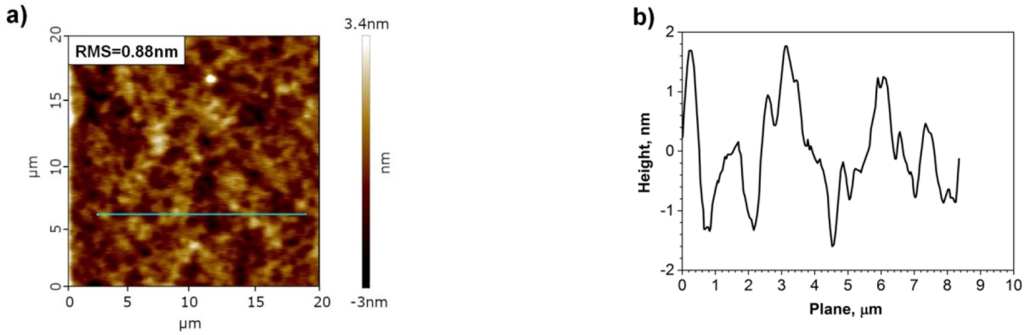

Fig. S3 (a)2D AFM image of PTB7:PC71BM:PbS QDs (PbS QDs content 10 wt%), (b) its section profile.

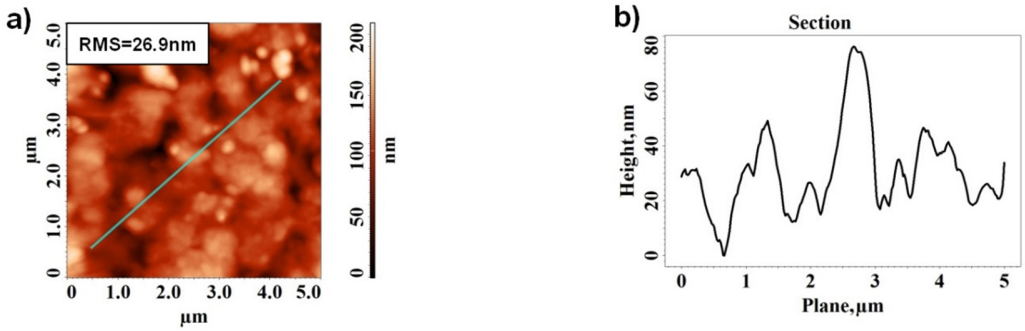

Fig. S4(a)2D AFM image of PTB7:PC71BM:PbS QDs (PbS QDs content 30 wt%), (b) its section profile.

S3 Havriliak-Negami fitting parameters

Table S1 Havriliak-Negami fitting parameters for *γ*-relaxation in PTB7:PC71BM:PbS

T(K)	$\Delta\varepsilon$	a	b	E_a(eV)	τ_0(s)
128	0.0565	0.27	0.63		
133	0.0568	0.28	0.62		
138	0.0571	0.30	0.61		
143	0.0573	0.31	0.60	0.26	$1.25\cdot10^{-12}$
148	0.0578	0.32	0.57		
153	0.0580	0.33	0.55		
158	0.0585	0.34	0.54		
163	0.0595	0.35	0.53		

Table S2 Havriliak-Negami fitting parameters for *β*-relaxation in PTB7:PC71BM:PbS

T(K)	$\Delta\varepsilon$	a	b	E_a(eV)	τ_0(s)
203	0.1315	0.66	1		
208	0.1315	0.67	1		
213	0.1315	0.68	1		
218	0.1315	0.69	1		
223	0.1315	0.69	1		
228	0.1315	0.70	1	0.34	$2.13\cdot10^{-9}$
233	0.1315	0.70	1		
238	0.1315	0.70	1		
243	0.1315	0.70	1		
248	0.1315	0.70	1		
253	0.1315	0.70	1		
258	0.1315	0.70	1		

S4 Evaluation of *dc* conductivity from the Cole-Cole diagrams

A validity of Cole-Cole fitting was verified by evaluation of *dc* conductivity, σ_{dc}, related to R_p according to equation[S1]

$$\sigma_{dc} = \frac{1}{R_p}\frac{d}{A} \qquad \text{(S1)}$$

where d is the thickness of the investigated sample and A is its surface area.

In Fig. S5, the σ_{dc} values computed with eqn(S1)in the temperature range from 0 to 150 °Carecompared with the values of conductivity retrieved at a frequency of 0.1 Hz.As follows from Fig. S5, the experimental σ_{dc} values coincide with those computed with eqn (S1), particularly in the temperature range above 50 °C. This finding confirms validity of fitting with eqn (S1).

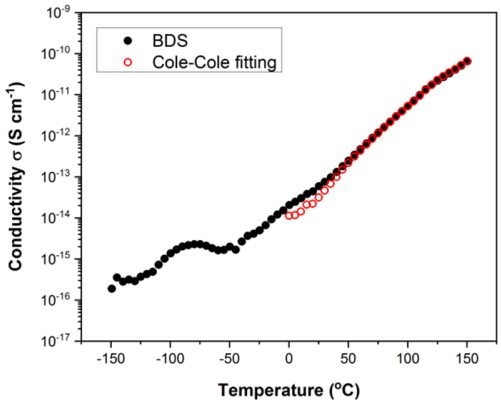

Fig. S5 *dc* conductivity versus temperature for PTB7:PC71BM:PbS QDs samples. The conductivity values are retrieved from the $\sigma(f)$ spectra (black solid symbols) and from Cole-Cole fittings (red open symbols).

Reference

S1 I. Smolarkiewicz, A. Rachocki, K. Pogorzelec-Glasser, R. Pankiewicz, P. Lawniczak, A. Lapinski, M. Jarek, J. Tritt-Goc, *Electrochim. Acta,* **2015**, 155, 38–44.