Detection of Trapped Charges in the Blend Films of Polystyrene/SFDBAO Electrets by Electrostatic and Kelvin Probe Force Microscopy

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The effect of the modification of topography produced by injection process on the results is ignore.

The modification of the sample topography can't be avoided in the injected experiments. In the charges injection experiments, we found that the deflection setpoint value and the injection time are very important paramters affecting the sample topography, and try to adjust their values to acquire the minimal disruption of topography. Besides, we found that the phase produced by the modification of topography is minimal compared with the phase produced by trapped charges. For example, we show the topography image and phase image including two convex points A and B (A is the intrinsic convex point of film, while B is induced by charge injection process.) in Figure S1 (a) and S1 (b). The topography and phase images through two convex points A and B along the lines in Figure S1 (b) are showed in Figure S1 (c) and (d), respectively. One can see that there is little difference of the height between A and B as shown in Figure S1 (c), while the phase difference is very significant in Figure S1 (d). Thus, in our paper, we ignore the effect of the modification of topography produced by injection process on the results.
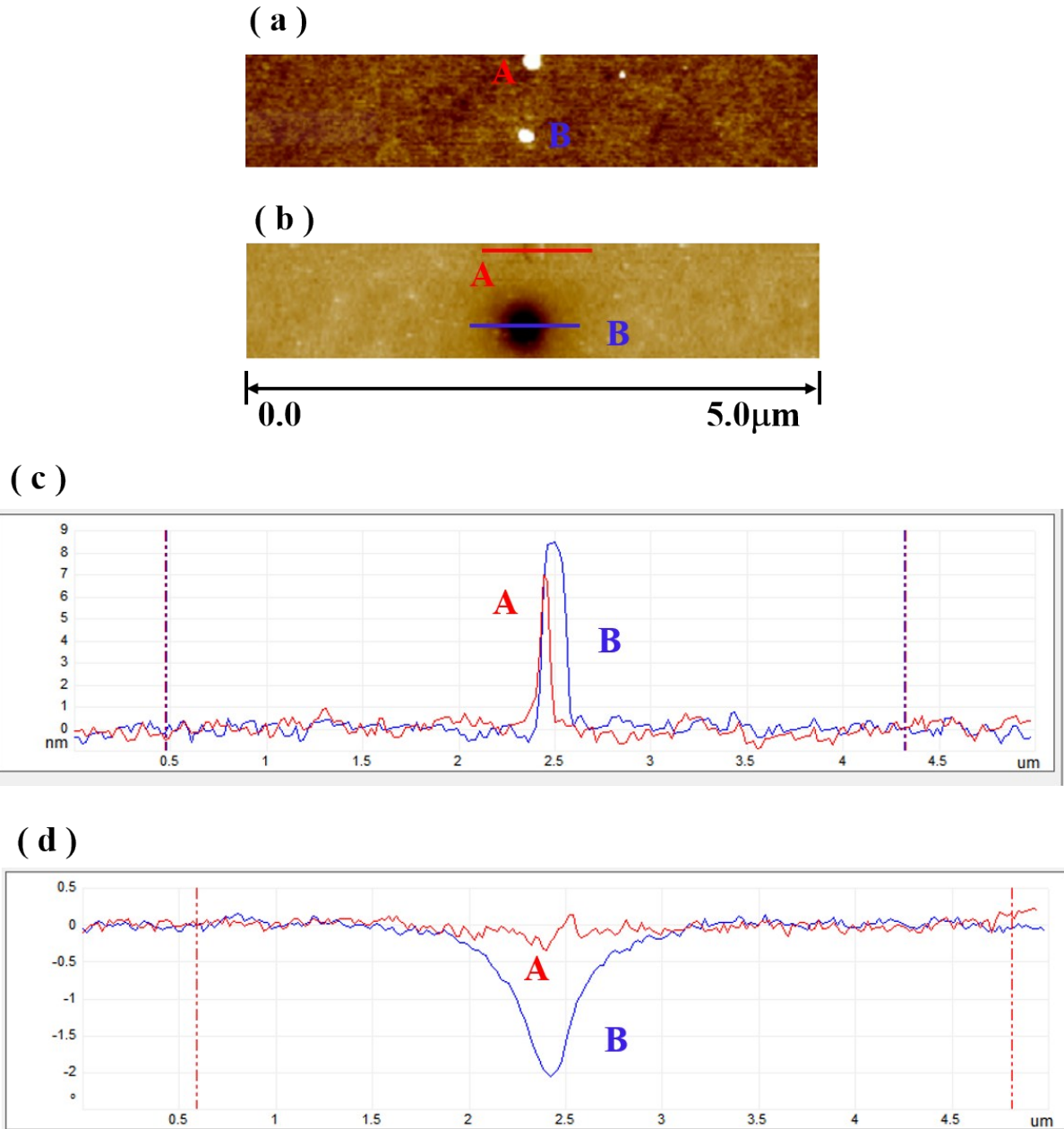
Figure S1 (a) The topography image of the PS/SFDBAO-20% blend film, including two convex points A and B (A is the intrinsic convex point of film, while B is induced by charge injection process.) (b) The corresponding phase image by EFM. The centerlines of the topography (c) and phase image (d) along the lines in Figure S1 (b).

Injection experiments are executed with different experimental conditions in our experiments.

The dose of charge injection using EFM has be executed with different experimental conditions in our experiments, such as different tips, different injection tip biases, different positions of the film and the films prepared at different time. However, we just show the tipcal example ±8V in the paper due to the little difference of the total trapped charges and the same decay tendency for the cases with different injtction tip biases. For example, we

exihibt the time evolutions of peak height (PH) extracted from EFM phase images for the charges spots injected with $V_{i\text{-}tip}$ = +4, 6, 8, 10 V for 10 s on the PS/SFDBAO-20% film in Figure S2. One can see that the PH decreases greatly in the beginning and then remains largely unchanged. The similar tendency is exhibited for the different injection tip biases. The corresponding quantity of the trapped charges are showed in Table S2. There is no obvious difference for the case with different injection tip biases. Thus, we just showed the experimental results of the cases $V_{i\text{-}tip}$ = $\pm$8V in our paper.
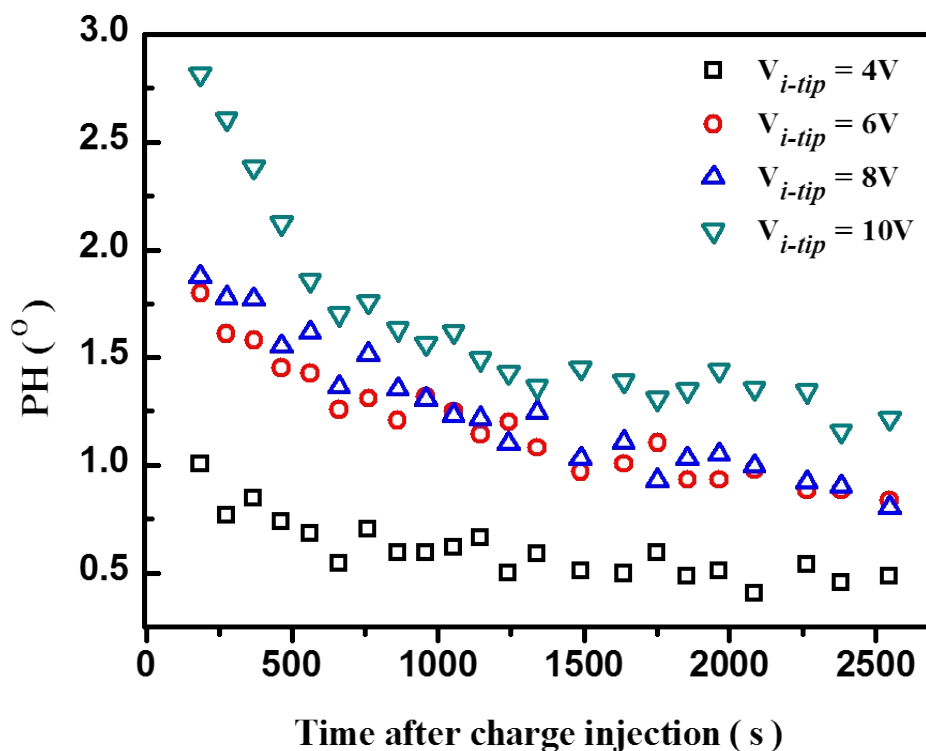

Figure S2 Time evolutions of peak height (PH) extracted from EFM phase images for the charges spots injected with $V_{i\text{-}tip}$ = +4, 6, 8, 10 V for 10 s on the PS/SFDBAO-20% film.

Injection tip biases (V)	+ 4 V	+ 6 V	+ 8 V	+ 10 V
PH (º)	1.002	1.7976	1.8762	2.8168
The quantity of trapped charges(C)	8.989×10^{-19}	1.204×10^{-18}	1.230×10^{-18}	1.508×10^{-18}

Table S2 The quantity of trapped charges of PS/SFDBAO-20% when injected with different tip biases.

The reliability of the dynamic behavior in Figure 5

We try to adjust the different experimental parameters to make sure the reliability of the dynamic behavior in Figure 5, including the samples prepered at different time, lift height of the tip, AC biases applied on the tip, and more longer interval time and so on. The findings accord with the conclusion in our paper (the diffussion rate of electrons is lager than that of holes). For example, we exhibit the experimental results for another Au and PS/SFDBAO-10% sample system (which are prepared with the same conditions in our paper) in Figure S3. One can see that the results are in agreement with that of our paper.
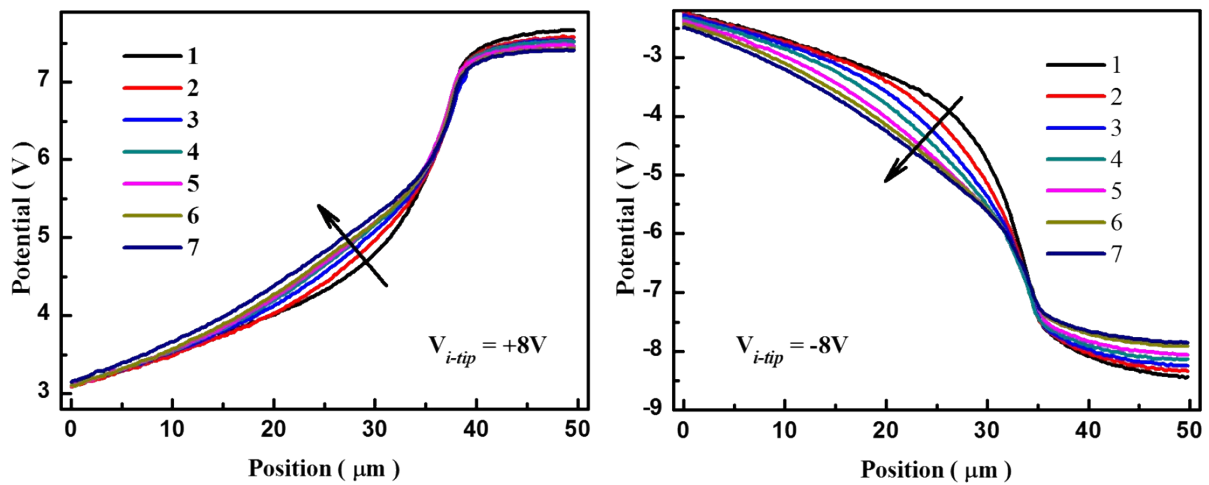

Figure S3 The variations of potential profiles with time after the Au electrode in the dotted box of Figure 5(a) injected with V$_{i\text{-}tip}$ = ±8 V are demonstrated. The time step between each curve is 120 s. The arrow directions represent the increase of time.