# Supplimental Document: Investigating the Polymer/Fullerene Mixing of Solution Processed Bilayers Fabricated Using an Orthogonal Solvent

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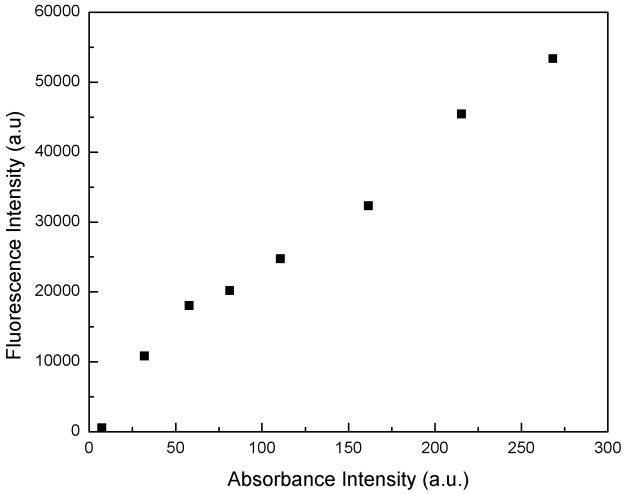


Figure 1: The fluorescence intensity of P3HT films of varying thicknesses vs their corresponding absorbance intensity

The fluorescence vs. absorbance intensity plot shown in Figure 1 was constructed by measureing the fluorescence and absorbance spectra of a series of P3HT films of different thicknesses. The spectra were integrated to obtain a total fluorescence and absorbance intensity for each sample and were plotted as shown. With the absorbance spectra for the BHJ samples, Figure 1 was used to determine the fluorescence intensity of the P3HT in each BHJ sample without the presence of PCBM.

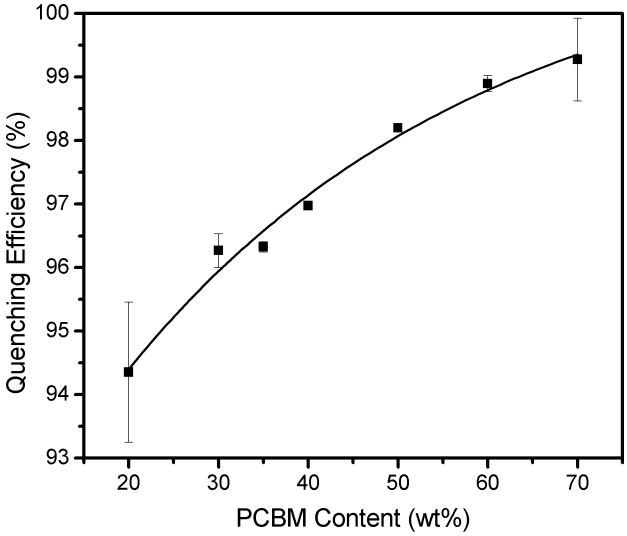


Figure 2: A plot of the quenching efficiency of the P3HT fluorescence vs PCBM wt%

Eq. 2 was then used to calculate the quenching efficiencies of the BHJ samples to produce

the plot shown in Figure 2, which shows the quenching efficiency of the P3HT fluorescence as a function of PCBM Content. Figure 2 allowed us to determine the amount of PCBM loading into the P3HT of the bilayer samples after measuring their quenching efficiencies. The quenching efficiencies for the bilayers for different P3HT thicknesses is shown in Figure 3. The average quenching efficiency was about 96%. From Figure 2 it is seen that a quenching efficiency of 96% corresponds to a PCBM content of about 30 wt%.

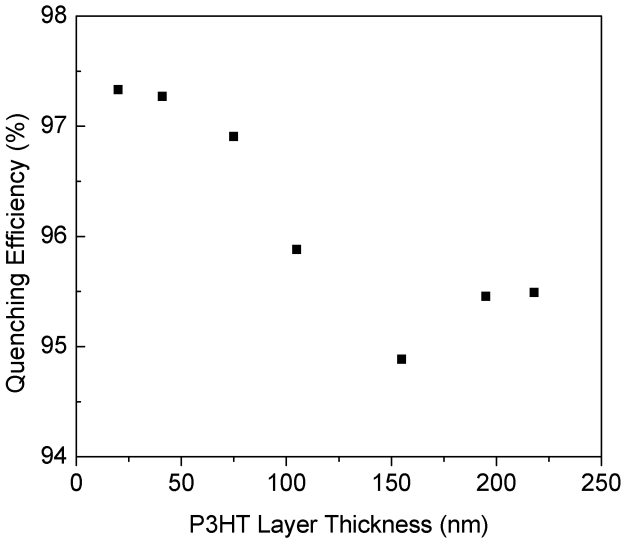


Figure 3: Measured PCBM loading in the P3HT of the bilayers vs P3HT thickness

To determine the effect of exposuring P3HT to $CH_2Cl_2$, a P3HT film was submerged in $CH_2Cl_2$ solvent for 60 seconds and then it was removed and dried. The absorbance spectra of before and after soaking the sample in $CH_2Cl_2$ is displayed in Figure 4. From Figure 4 we observe that after exposing the P3HT to $CH_2Cl_2$ a slight increase in crystallinity occurs, which shows that the solvent is able to diffuse into the polymer film and interact with the chains. Because $CH_2Cl_2$ is a poor solvent for P3HT, when $CH_2Cl_2$ is present, the chains rearrange themselves into a more favorable conformation to minimize contact with the poor solvent, causing them to stack into crystalline domains.

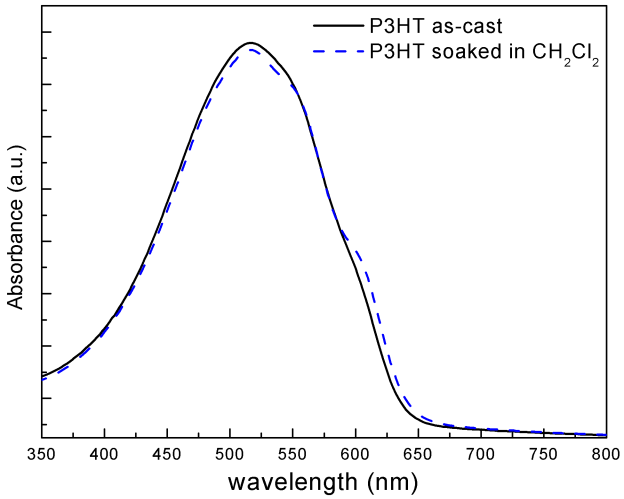


Figure 4: Absorbance spectrum of an as-cast P3HT film before (solid line) and after(dashed line) submerging in $CH_2Cl_2$

Figure 5 displays the weight percent of PCBM within the active layer of the bilayer structure before and after heating at 150°C for 10 minutes. The amount of P3HT in the P3HT layer is shown to be about 25 wt%. There is only a slight amount of vertical segregation of the PCBM after annealing.

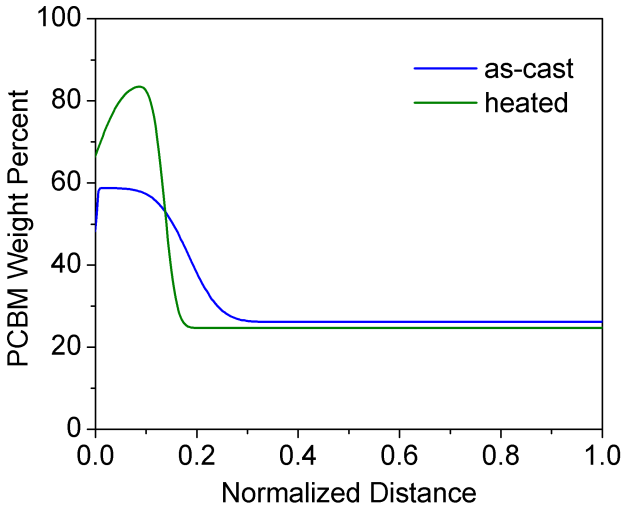


Figure 5: Measured PCBM loading in the P3HT of the bilayers vs P3HT thickness