

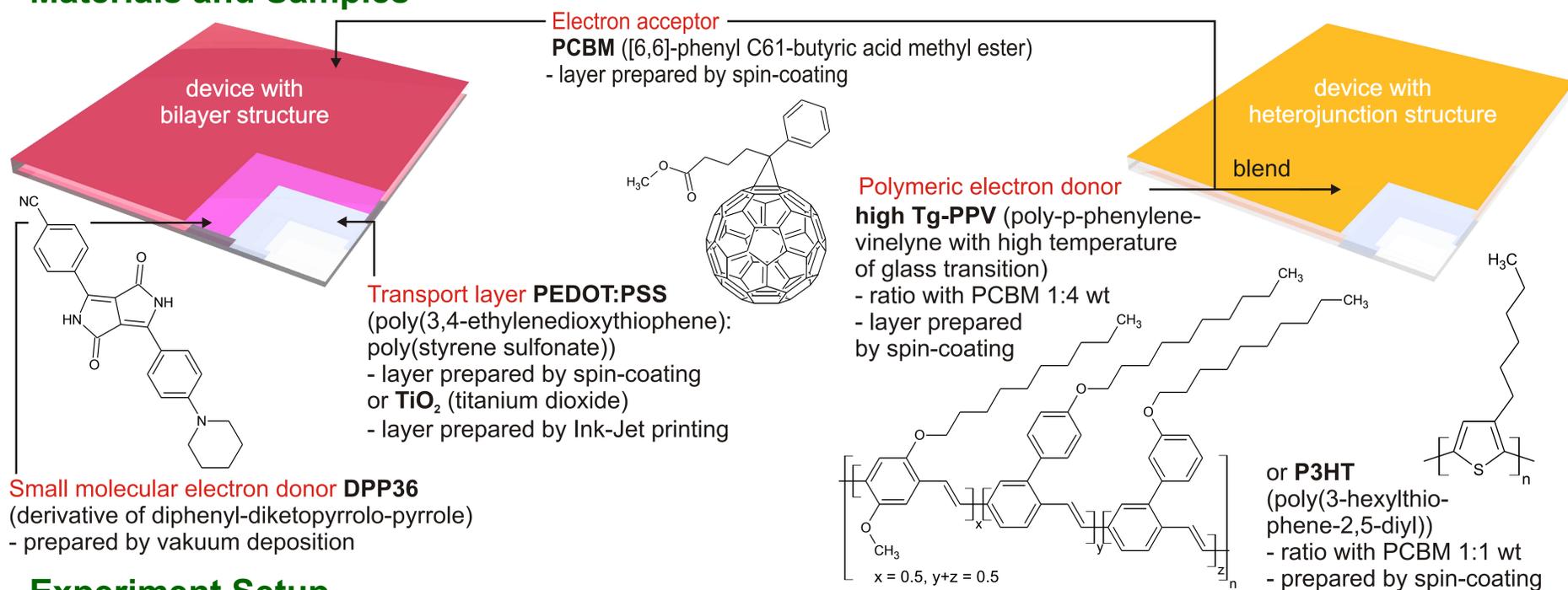
The Photodegradation of Polymers and Small Molecular Materials Applied in Organic Solar Cells

Introduction

Organic solar cells utilize absorption of light for generation of charge carriers. The photogeneration processes competes with several photophysical processes as fluorescence, phosphorescence, thermal relaxation and other, which do not have destructive effect on material. Decomposition of the organic functional materials may be also caused by chemical reactions on the surface or inside samples. Rate of photodegradation depends on many factors, but mainly on light intensity and oxygen concentration, sample thickness, multilayer construction, solvent used, etc. We studied rate of photodegradation, what is important parameter for future application of organic function materials, because it determines the devices lifetime.

Experiment

Materials and Samples

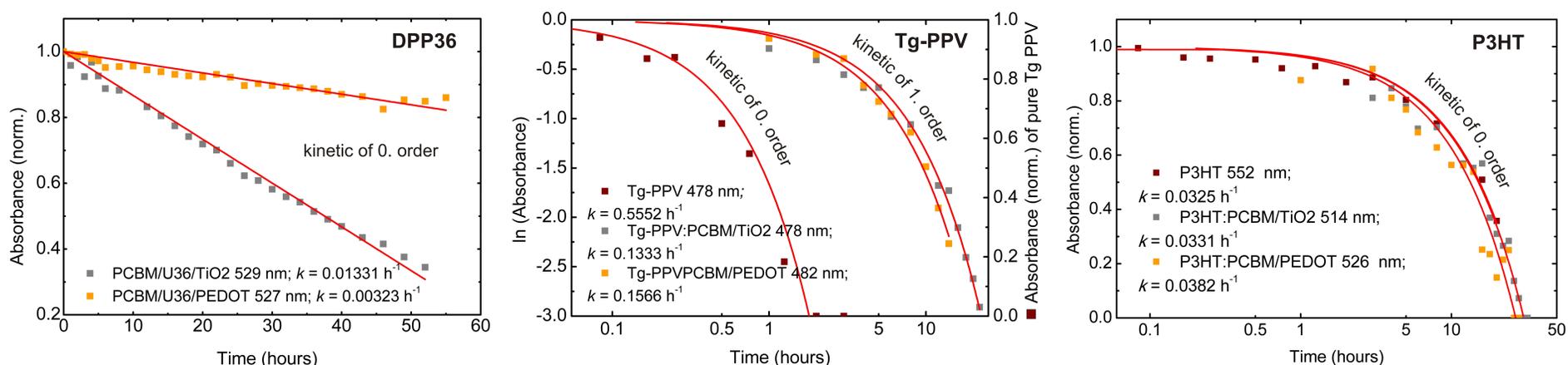


Experiment Setup

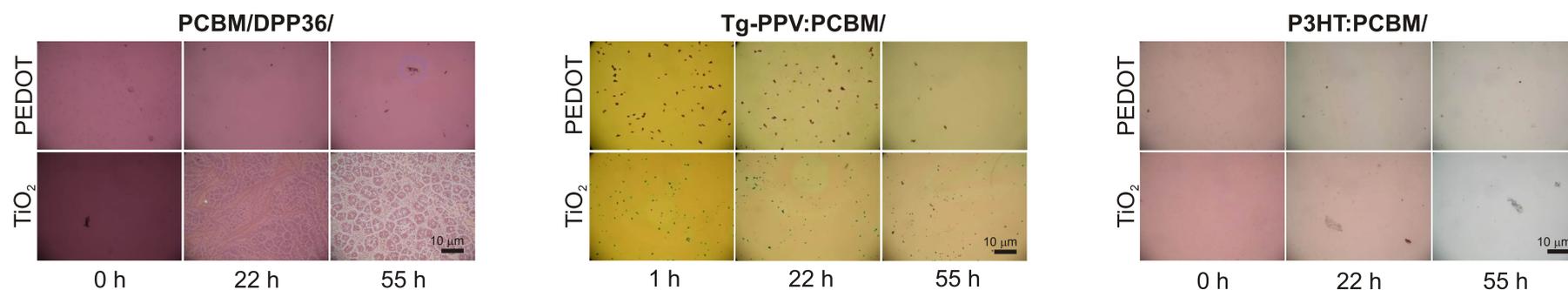
Photodegradation was studied without encapsulation at ambient air. Samples were irradiated in the Qsun Xe test chamber; model Xe-1-B with outdoor filter. The intensity of irradiation was 0.353 W m^{-2} . Temperature in test chamber was about $45 \text{ }^\circ\text{C}$.

Results and Discussion

Degree of degradation of materials was studied by measuring of UV-VIS absorption spectra by Varian Cary 50. Results are demonstrated in the following plots. Acquired spectra represent dependence of absorbance on time of irradiation of samples. Photodegradation rates are characterized by the kinetic rate constants. These constants are obtained from slopes of particular curves. Their values are shown in the figures.



Simultaneously appearance of surface of samples with transport layer was studied by the optical microscope NIKON Eclipse E200 and documented by photographs. We observed that layer of TiO₂ cracked in four hours. This change was reflected on disintegration of DPP36 layer.



Conclusion

We found influence of PCBM on stability of polymers (Tg-PPV and P3HT). In case of Tg-PPV photodegradation of pure polymer is five times faster than blended with PCBM. Kinetic rate constant of photodegradation of pure P3HT is similar to rate constants of P3HT blended with PCBM.

We found big difference between using of TiO₂ and PEDOT transport layer for DPP36. Type of transport layer does not play such an important role in photodegradation processes of used polymers. Rate of photodegradation of the low molecular DPP36 is much slower than in polymers. Kinetic of Tg-PPV blended with PCBM is more difficult compare to other studied materials.