Photoinduced open circuit voltage in graphene-based polythiophene:fullerene solar cells

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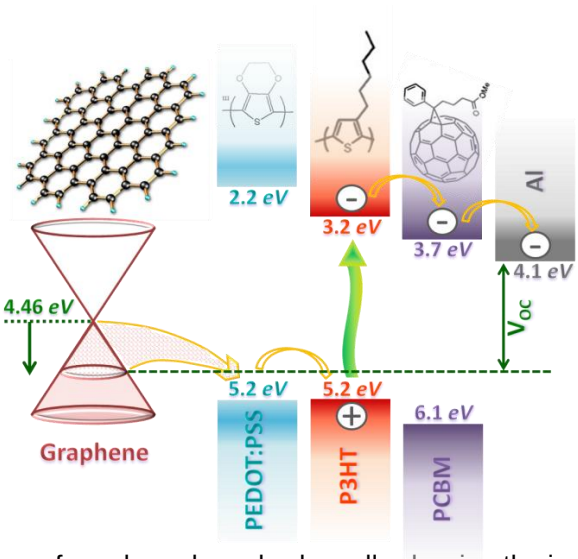
We observed significant photoinduced increase in the open circuit voltage of thin polythiophene:fullerene bulk heterojunction solar cells assembled on transparent layers of graphene, which correspond to similar changes in the electronic work function of the graphene electrodes. Graphene thin films were prepared using RNA as a surfactant with a method developed by us [1]. We used Kelvin Probe Force Microscopy, in the dark and under illumination [2], to demonstrate that the observed photoinduced changes (see Figure 1) are in good agreement with a dynamic graphene-insulator-metal model that, in addition to the customary assumptions of metal-insulator-metal models for thin film solar cells, takes into account the specific photophysical properties of graphene as a zero-band gap semiconductor. Band energy offset models that were previously used to model the open circuit voltage in graphene-based solar cells can be dismissed.

References

[1] F. Sharifi, R. Bauld, M.S. Ahmed, and G. Fanchini, Small **8**, 699–706 (2012)
[2] F. Sharifi, R. Bauld, and G. Fanchini, J. Appl. Phys. **114** , 144504 (2013)

Figure 1



Band energy level diagram of graphene-based solar cells showing the increase of Work Function and, consequently, open circuit voltage measured by KPFM under illumination.