Environmental effects on the Long-term stability of bulk-heterojunction Organic Photovoltaic Cells

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Abstract: The environmental stability of organic solar cell must be improved to increase their market potential. We present our approach highlighting transient absorption spectroscopy allowing detailed look on the loss processes caused by degradation.

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The bulk heterojunction (BHJ) concept for organic solar cells has been useful to match the requirements of high absorption yield and high exciton dissociation yields that otherwise would tend to contradict each other in organic photovoltaic materials. Careful morphology optimizations have led to power conversion efficiencies that are close to mass market requirements. This is however not true for the operational stability of BHJ solar cell that must still be substantially enhanced. The mayor reasons for degradation of solar cells will be highlighted, and how we address them using time-resolved spectroscopies. We are using time-resolved transient absorption to trace the populations of neutral and charged photoexcited states in photovoltaic devices. This allows us to detect the presence of loss processes that reduce the yield of extracted carriers. Therefore, we can assess which of the elementary processes in the photovoltaic event chain is affected by long-term degradation, which allows us in turn to find tailored strategies for the improvement of the stability of BHJ organic solar cells.