Novel non-covalent electron donor-acceptor system based on a push-pull conjugate and exfoliated graphite

M. Volland[1], S. Decurtins[2], and D. M. Guldi[1]

1 Department of Chemistry and Pharmacy Friedrich Alexander-Universität Erlangen-Nürnberg, Germany, michel.volland@fau.de,
2 Department of Chemistry and Biochemistry, University of Berne, Switzerland

The discovery of graphene has created a whole new field of research due to the outstanding and unique properties of this one-atom-thick low dimensional material.[1] Beneath properties like transparency, extreme mechanical strength or elasticity it also shows very promising performances in the field of thermal and especially electrical conductivity,[2] rendering it a potent building block for charge transfer hybrid systems.[3]

In this work, a push-pull chromophore is used to enhance the exfoliation of graphite towards graphene by a top-down approach, namely liquid phase exfoliation. The aforementioned push-pull chromophore consists of a perylenediimide (PDI) and a tetrathiafulvalene (TTF) fused to a planar molecular π–conjugated structure, PDITTF.[4] The planarity of the molecule is expected to facilitate and enhance π-π interactions with the basal plane of graphene. Ground and excited state properties of the chromophore were investigated by means of absorption and fluorescence spectroscopy. To complete the basic characterization spectroelectrochemical experiments were performed.

Hereafter, the PDITTF-graphene hybrid systems were probed concerning their exfoliation efficiency as well as their photophysical characteristics, focusing particularly on electron-transfer reactions. The abovementioned top-down approach is based on the enrichment technique, adding natural graphite to a solution of PDITTF followed by ultrasonication and subsequent centrifugation. Additional Raman as well as TEM measurements corroborated the benefits of the push-pull chromophore on the exfoliation process. Electron transfer processes were monitored via femtosecond transient absorption spectroscopy.

References

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Figures

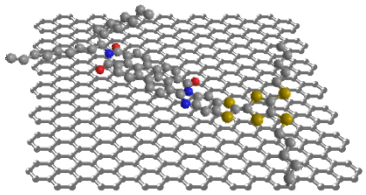

Figure 1. PDITTF-graphene hybrid