

Perylene-based metal-organic frameworks for photochemical applications

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Worldwide energy demand growth enforces the development of effective and “green” strategies concerning energy production. In the context of global warming and the associated climate change, a concept independent of fossil fuels is required. One strategy is the use of sunlight as energy source,^[1] therefore, materials with a high light capturing capability for an efficient use of this energy source have to be developed. Metal-organic frameworks (MOFs) are a promising material class in that regard, as they allow for the incorporation of well-defined organic chromophores into a ordered crystalline structure principally enabling to absorb light in a broad spectrum.^[2]

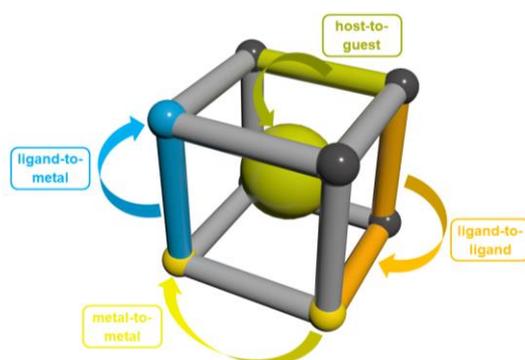


Figure 1: Possible energy transfer processes in MOFs.^[2]

The presented study focuses on the synthesis and characterization of perylene-based MOFs, for the investigation of photophysical energy transfer and its conversion to shed light on structure-property relationships.^[3] Three MOF structures incorporating the perylene-based linkers 1,6,7,12-tetrachloroperylene-diimide-*N,N'*-di-acetic acid and 1,6,7,12-tetrachloroperylene-diimide-*N,N'*-di-benzoic acid were successfully synthesized, isolated and fully characterized. Photophysical characterization of the obtained materials showed characteristics of H-type aggregates being dominant. The solid-state structures as obtained by SC-XRD are presented and photophysical implications thereof as well as potential applications are discussed.

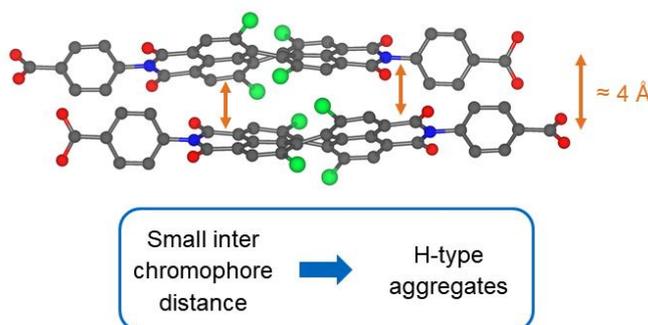


Figure 2: Section of the MOF crystal structure showing the aggregation of the chromophore linkers in the MOF structure leading to H-type aggregates.

[1] S. Chu, A. Majumdar, *Nature* 2012, 488, 294-303.

[2] D. E. Williams, N. B. Shustova, *Chemistry – A European Journal* 2015, 21, 15474-15479.

[3] D. C. Mayer, A. Manzi, R. Medishetty, B. Winkler, C. Schneider, G. Kieslich, A. Pöthig, J. Feldmann, R. A. Fischer, *Journal of the American Chemical Society* 2019, 141, 11594-11602.