

Controlling the aggregation of planar photosensitizers and electroluminescent materials

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Aggregation of planar chromophores greatly affects their photophysical performance. It is possible to avoid the aggregation of phthalocyaninates by axially binding them to the surface of aluminosilicates. We have recently designed a multifunctional zeolite L-based hybrid material able to target, label and photoinactivate pathogenic and antibiotic resistant bacteria.[1,2] The outer surface was functionalized with a Si(IV) phthalocyanine derivative that forms toxic singlet oxygen upon red light irradiation, and with amino groups for targeting the living microorganisms. Currently, we aim to extend these concepts to *targeted, fully soluble and biodegradable platforms*, a prerequisite for biomedical applications.[3,4]

We have recently developed a straightforward one-pot synthesis of neutral, soluble Pt(II) coordination compounds bearing dianionic tridentate ligands. The complexes reached up to 87% photoluminescence quantum yield (PLQY) in thin films, with concentration independent colour and efficiency.[5] Consequently, we demonstrated their suitability as phosphorescent dopants in organic light-emitting diodes (OLEDs). Furthermore, the judicious choice of bulky peripheral substituents allowed us to completely prevent aggregation and to enhance color purity, a critical aspect when designing triplet emitters for electroluminescent devices.[6] On the other hand, we were able to deliberately induce self-assembly into bright nanofibers, which can interlock to yield highly emissive *organo- and hydrogels* (90% PLQY), thus constituting a versatile building block for luminescent architectures. The unique properties of the filaments arise from the metal-metal to ligand charge-transfer states of the aggregated species, which display strong Pt-Pt interactions. It is therefore possible to trace the self-assembly process with high sensitivity by monitoring the turn-on of the emission upon aggregation.[5] Currently, we investigate the electronic coupling between Pt(II) d-orbitals and electrodes at *single molecule level*, employing *scanning tunnel microscopy* and *scanning tunnel spectroscopy*.[7]

Our results elegantly show how a careful, rational design allow us to fully control the aggregation of planar chromophores, and, consequently, to tune their photophysical and photochemical properties.

Literature

[1] C. A. Strassert et al., *Angew. Chem. Int. Ed.* 2009, 48, 7928. [2] M. Grüner et al., *Photochem. Photobiol.* 2013, 89, 1406. [3] J. Voskuhl et al., *Soft Matter* 2013, 9, 2453. [4] M. F. Geer et al., *J. Org. Chem.* 2013, 78, 5568. [5] C. A. Strassert et al., *Angew. Chem. Int. Ed.* 2011, 50, 946. [6] M. Mydlak et al., *Chem. Mater.* 2011, 23, 3659. [7] P. Ewen et al., *Phys. Rev. Lett.* 2013, 111, 267401