EPFL

SEMINAR SERIES

HIGHLIGHTS IN ENERGY RESEARCH

17.10.2019, 16:00 - 17:00, EPFL Valais, 4th floor, TSEUZIER room

Phthalo- and Subphthalocyanines: Supramolecular Chemistry and Molecular Photovoltaics

Prof. Tomás TORRES

Institute for Advanced Research in Chemical Sciences, Dpt of Organic Chemistry, Autonoma University of Madrid, Spain

Host : Prof. Nazeeruddin

Phthalocyanines (Pcs)[1] are among the few molecules that reveal an intense red and NIR absorption and therefore, constitute promising dyes in molecular photovoltaics. Most recently they have reached record efficiency values participating as hole transporting materials in Perovskite sensitized solar cells (PSSCs). Phthalocyanines and derivatives stand out as donor /light harvesting molecules for the fabrication of both small-molecule organic solar cells and dye-sensitized solar cells (DSSCs). In this regard, A_3B ZnPcs functionalized with bulky substituents at three isoindole rings (i.e. A) and a highly directional carboxylic acid linker at the other isoindole (i.e. B), have reached photovoltaic high power conversion efficiencies in n-type hybrid devices with mesoporous TiO2. On the other hand Subphthalocyanines (SubPcs), [2] are intriguing compounds. Their 14 pi-electron aromatic core associated with their curved structures render them also appealing building blocks for the construction of multicomponent photo- or electroactive assemblies. Recently, SubPcs have been used as non-fullerene acceptors in both single (SHJ) and bulk heterojunctions (BHJ) solar cells. The organization of both Phthalo- and Subphthalocyanines at supramolecular level will be also discussed. Thus, columnar aggregates based on chiral SubPcs have been prepared, giving rise to ferroelectric self-assembled molecular materials showing both rectifying and switchable conductivity. These chromophores have been incorporated in multicomponent systems showing a panchromatic response and allowing the tuning and controlling intramolecular FÖRSTER Resonance Energy Transfer for Singlet Fission.

References

[1] a) M.-E. Ragoussi, T. Torres, *Chem. Commun*. **51**, 3957 (2015). b) M. Sekita, et al., *Angew. Chem. Int. Ed.* **55**, 5560 (2016). c) K. Cho, et al., *Adv. Ener. Mater*. 1601733 (2017). d) M. Urbani, *Coord. Chem. Rev*. 381, 1 (2019). e) O. Langmar, et al. *Angew. Chem. Int. Ed*., **58**, 4056 (2019).

[2] a) J. Guilleme, et al., *Angew. Chem. Int. Ed.* **54**, 2543 (2015). b) K. Cnops, et al. *J. Am. Chem. Soc.* **137**, 8991 (2015). c) C. Duan, et al., *Angew. Chem. Int. Ed.* **56**, 148 (2017). d) A. V. Gorbunov, et al., *Science Advances,* **3**, 1701017 (2017). e) G. Lavarda, et al. *Angew. Chem. Int. Ed.,* **57**, 16291 (2018). f) C. Schierl, et al. *Angew. Chem. Int. Ed.,* **58**, 14644 (2019).

Bio: Tomás Torres was born in Madrid, Prof. Tomás Torres is Director of the Institute of Advanced Research in Chemical Sciences (IAdChem), Professor of the Department of Organic Chemistry of the Autonoma University of Madrid (UAM) and Associate Senior Scientist of the IMDEA-Nanoscience Institute, in Madrid. Doctor in Chemistry (1978) by the UAM working in the Institute of General Organic Chemistry of the Higher Council for Scientific Research (CSIC) in Madrid (Director: Prof. Francisco Fariña). He carried out postdoctoral stays in the Department of Organic Chemistry and Spectroscopy of the Max-Planck Institute for Biochemistry of Martinsried, Munich (Prof. Wolfram Schäfer, 1978-1980) as a fellow of the Max-Planck Society, and in the Institute of General Organic Chemistry of the CSIC-Department of Organic Chemistry of the UAM (1980-1981), within the first class of "Reincorporation Fellows". He worked in the Department of Chemical Research of the company Abelló, S.A./ Merck, Sharp and Dohme (1981-1985) in Madrid as Senior Researcher. In 1984 he obtained a position as Associate Professor, and joined the UAM in 1985. In 2000, he became Professor of Organic Chemistry.

He has worked mainly in synthetic organic chemistry in areas ranging from pharmaceutical chemistry to the development of new organic materials. Since 1990 he has leading a research group that develops work in different aspects of synthetic and supramolecular chemistry. His research has focused mainly on the preparation of molecular materials based on phthalocyanines and on the study of their properties for applications in organic solar cells and photodynamic therapy of cancer and atherosclerosis.