TOR VERGATA
UNIVERSITÀ DEGLI STUDI DI ROMA

Dipartimento di Scienze e Tecnologie Chimiche

SEMINARIO

Lunedì 3 Aprile alle ore 14.30

~~*Aula Seminari*~~

~~*Dipartimento di Scienze e Tecnologie Chimiche*~~

AULA GISMONDI

Dr.ssa Claudia Bizzarri

Karlsruhe Institute of Technology, Institute of Organic Chemistry

Terrà un seminario dal titolo:

Molecular Photo(redox)active Functional Materials for Solar Energy Conversion and Bioimaging

Proponente: Prof. Pierluca Galloni

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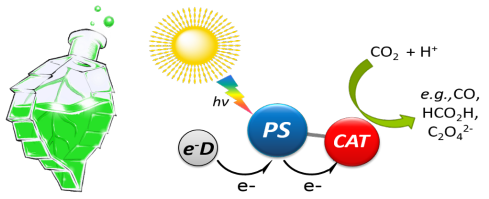
Abstract

While human activities heavily influence climate change and the depletion of earth resources, renewable resources must be exploited, ideally together with renewable energies. The use of transition metal complexes is promising to improve the photocatalytic activity and efficiency in solar energy conversion. Nevertheless, regarding the applicability, these catalysts should be readily available and cost-effective; thus, earth-abundant materials are highly desired. [1]

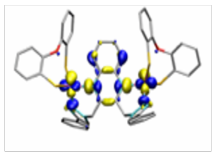
The seminar is focused on my recent research activity that is committed to finding and developing sustainable solutions, especially in (1) solar energy conversion and (2) bioimaging. The theme of my work relies on organic and metal-organic functional materials, which have a positive impact environmentally and economically. Furthermore, my research on Organic Chemistry is strengthened by my interdisciplinary background, as I also design coordination complexes and polymers and use physicochemical methods to characterize the final materials. Within my current research assignment as an independent research group leader at the Karlsruhe Institute of Technology since the end of 2016, I have been developing novel transition metal complexes based on earth-abundant metals, such as Cu(I), Zn(II), Fe(II or III), Ni(II) and Co(II). I have investigated their photochemical and electrochemical properties, giving particular importance to energy- and electron-transfer processes and to cooperativity effects among metal centers.

My team and I developed novel mononuclear and binuclear Cu(I) complexes with suitable photophysical and electrochemical properties for photosensitizers.[2] By modification of their diimine ligand, tuning of their properties could be achieved. Thus, their use in photocatalytic systems to reduce CO_2 with blue light in combination with the known catalyst $[Ni^{II}(cyclam)]Cl_2$ was tested, producing CO with a turnover number (TON) of up to 8. Dipyrrins and Zn(II) complexes thereof were also developed as promising light-antennae [3a-b] or emitters for fluorescent imaging of cells. [3c] The newly developed photosensitizers were also used for other visible-light-induced photo(redox) catalyzes (e.g. ATRA reactions). [2d] Recently, we focused on developing new CO_2 reduction catalysts based on Fe(II).[4] The new catalyst shows considerable activity as in the photo-driven catalysis induced by a Cu(II)-photosensitizer, giving CO with a TON of 576 and a quantum yield of up to 7 %. Competitive H_2 formation leads to syngas generation. Further insights on the newest results will be given, and how the next challenges will be tackled.

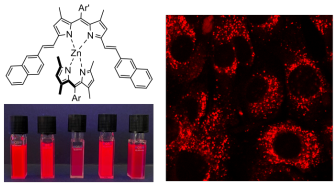
Solar Energy conversion and CO_2 reduction



Cooperativity



Far-red /NIR Emitters for bioimaging



[1] (a) C. Bizzarri *Eur. J. Org.* **2022**, e202200185; (b) M. Heberle, et al. *Chem Eur. J.* **2017**, *23*, 312–319; (c) N. Armaroli; V. Balzani; *Chem. Eur. J.,* **2016**, 22, 32

[2] (a) C. Bizzarri, A. P. Arndt, S. Kohaut, K. Fink, M. Nieger *J. Organometallic Chemistry* **2018**, *871*, 140-149; (b) L.-L. Gracia, L. Luci, C. Bruschi, L. Sambri, P. Weis, O. Fuhr, C.Bizzarri *Chem. Eur. J.* **2020**, *26*, 9929-9937 ; (c) M.Grupe, .., C. **Bizzarri, R.** Diller, *Chem. Eur. J.* **2021**, *27, 15252;* (d) C. Bruschi, X. Gui, N. Salaeh-arae, T. Barchi, O. Fuhr, S. Lebedkin, W. Klopper, C. Bizzarri. *Eur. J. Inorg. Chem.* **2021**, *39*, 4074. (e) C. Bizzarri, *in preparation*

[3] (a) D. Tungulin, Leier, J.; Carter, A. B.; Powell, A. K.; Albuquerque, Q. R.; Unterreiner, A.-N.; Bizzarri, C. *Chem. Eur. J.* **2019**, *25*, 3816. (b) Sani, U.; Tungulin, D.; Bizzarri, C.; Cucinotta, F. *RSC Advances*, **2020**, *10*, 2841-2845 ; (c) Tabone, R.; Feser, D.; Lemma, E. D.; Schepers, U.; Bizzarri, C. *Front. Chem.* **2021**, *9*, 754420

[4] L.-L. Gracia, E. Barani, J. Braun, A. B. Carter, O. Fuhr, A. K. Powell, K. Fink, C. Bizzarri *ChemCatChem* **2022**, e202201163.

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