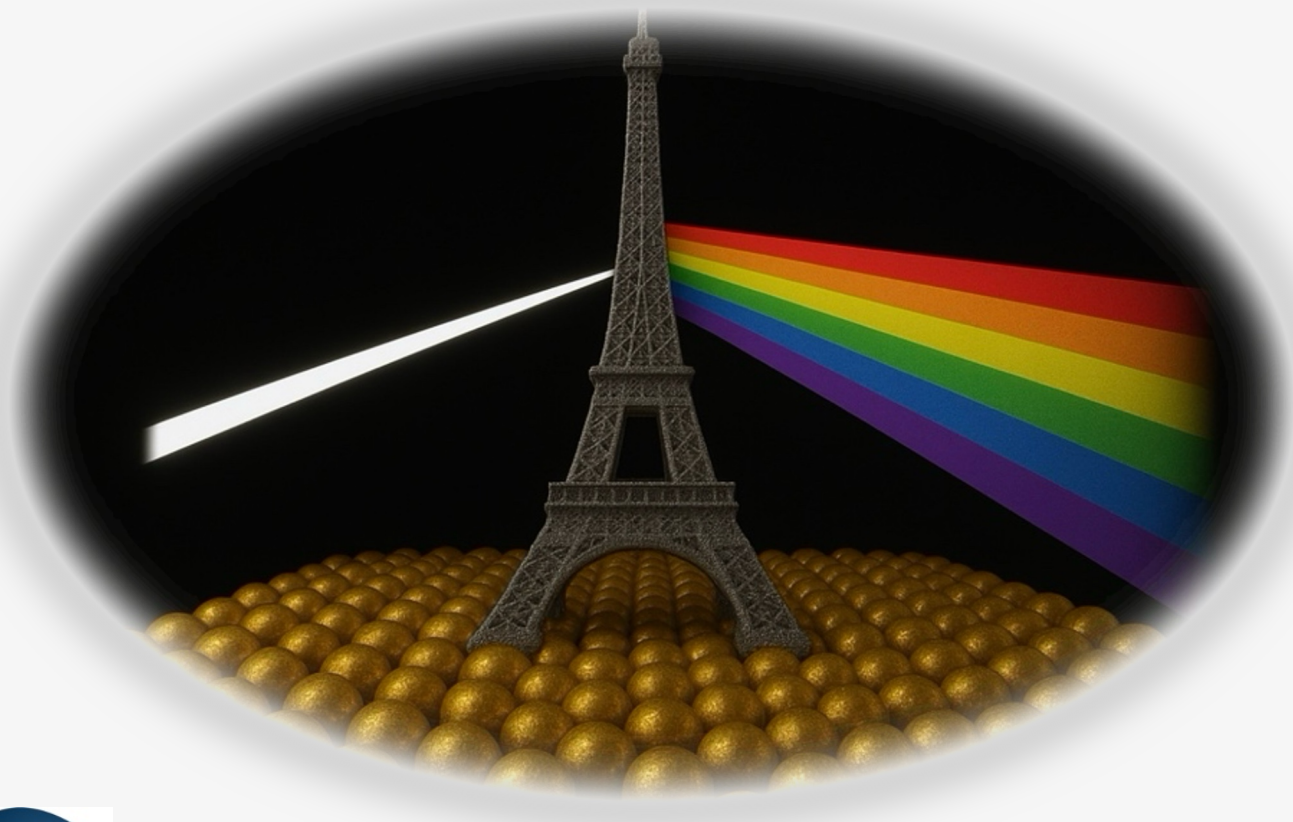
PHOTONANO'26

SP2P & Nanoscience Joint Scientific Meeting

Subdivision Photochimie, Photophysique, Photosciences (SP2P)
Subdivision Nanosciences
Division Chimie-Physique - Société Chimique de France (SCF)



11-13 may 2026

PARIS, UFR de Chimie, UPCité

WELCOME TO PHOTONANO'26

PHOTONANO'26 is a joint scientific meeting organized by the SP2P and Nanoscience subdivisions of the Société Chimique de France (SCF), dedicated to photosciences, nanomaterials, and light–matter interactions across scales. The conference also hosts the Annual Scientific Meeting of SP2P (SP2P'26), continuing a well-established series of national events that bring together the French photochemistry and nanoscience communities.

Held in the heart of Paris at Université Paris Cité, PHOTONANO'26 aims to foster interdisciplinary exchanges at the interface of photochemistry, photophysics, and nanoscience. Building on previous editions, this meeting provides a forum for discussing recent advances, sharing new ideas, and strengthening collaborations across disciplines.

The scientific program features plenary lectures, invited talks, contributed oral presentations, and poster sessions, with particular attention given to early-career researchers and PhD students. A central objective of the conference is to promote interactions between established scientists and emerging researchers, encouraging dialogue across career stages and scientific backgrounds.

We warmly thank all participants for their contributions, which are essential to the scientific quality and vitality of this meeting. We are especially grateful to the invited and keynote speakers for their insights, as well as to the members of the scientific and organizing committees for their commitment. We also acknowledge our institutional partners and sponsors for their valuable support.

PHOTONANO'26 covers a broad range of topics, including photochemistry, photophysics, plasmonics, nanomaterials, spectroscopy, modeling and simulation, as well as applications in photocatalysis, photovoltaics, molecular electronics, sensing, and related areas. Contributions bridging photochemistry and nanoscience are particularly encouraged.

We hope that PHOTONANO'26 will provide a stimulating environment for scientific exchange and the emergence of new collaborations, and that you will enjoy both the conference and your stay in Paris.

The Organizing Committee

PHOTONANO'26

ACKNOWLEDGEMENTS

The organizing committee of PHOTONANO'26 gratefully acknowledges the generous support of our sponsors and institutional partners.

Their commitment to advancing research and innovation in photochemistry, nanoscience, and related fields plays a key role in making this conference possible. Through their support, we are able to offer a high-quality scientific program and to encourage the participation of early-career researchers.

We warmly thank all our partners for their trust and engagement, and for contributing to the success of PHOTONANO'26.

The Organizing Committee
PHOTONANO'26

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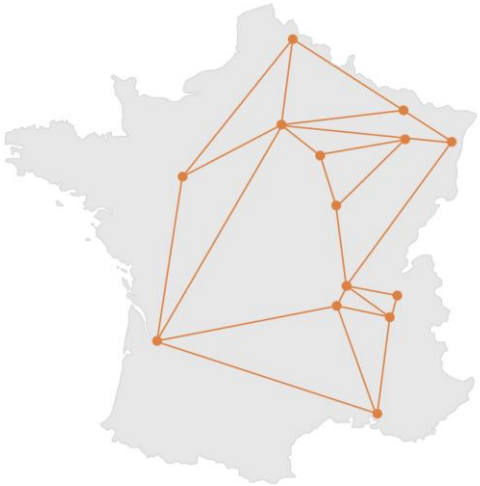

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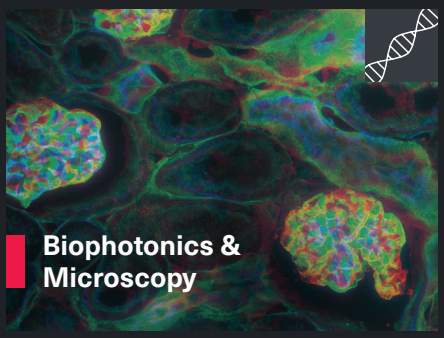

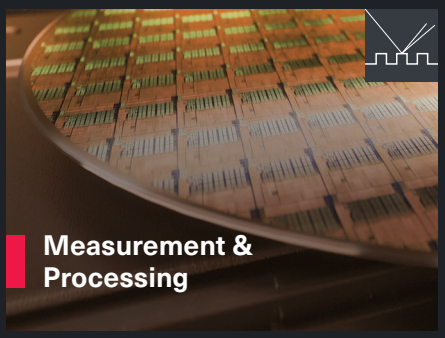

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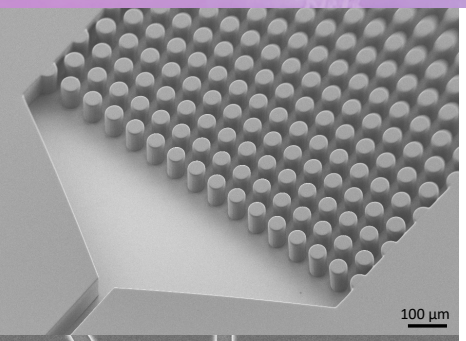

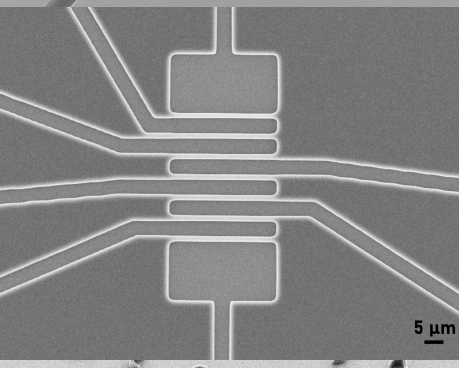

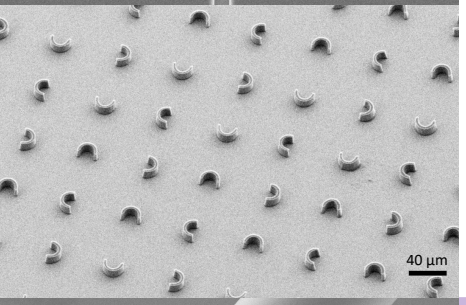

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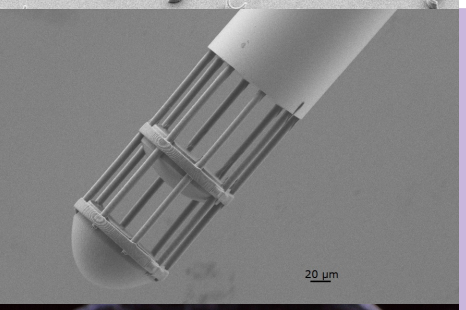

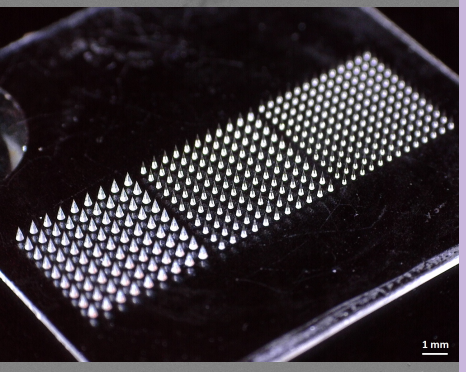

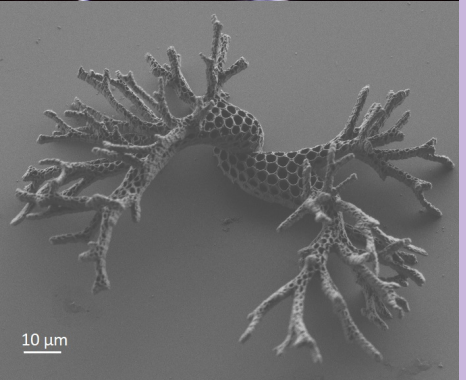

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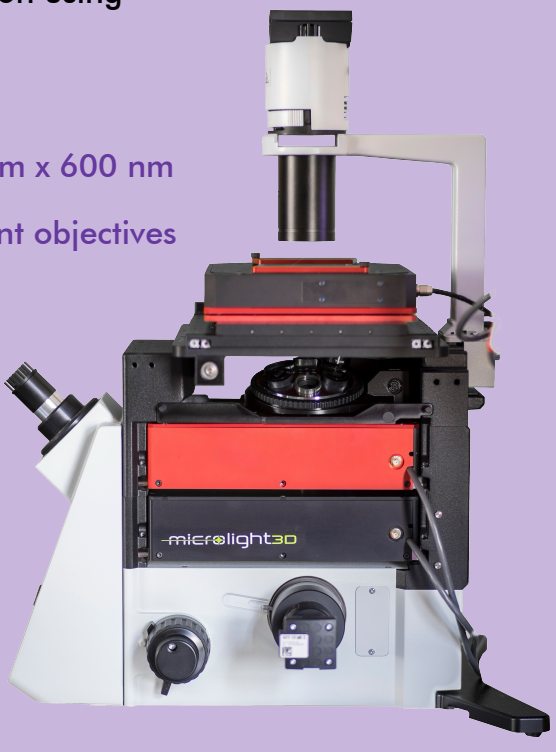

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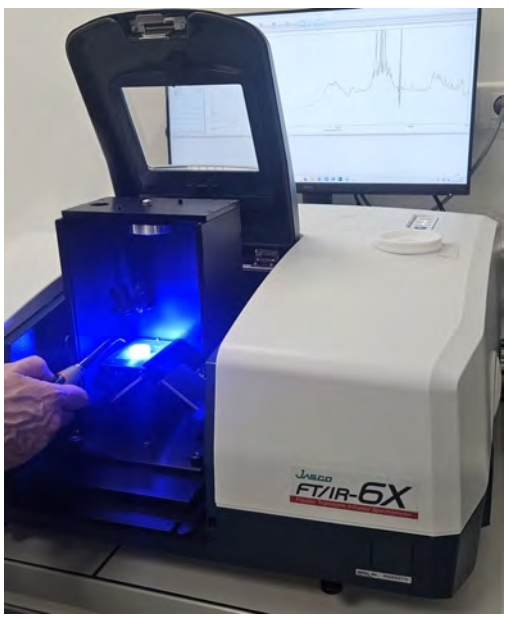

Photopolymerization

PROGRAM

Monday, May 11

12:30	13:30	**Registration**		
13:30	13:45	**Welcome / Introductive remarks**		
13:45	14:15	Invited#1	Gérard Davy, Troyes	Photochemical imaging of chiral plasmonic nanostructures
14:15	14:30	Oral#1	Fortage Jérôme, Grenoble	A successful combination of the triazatriangulenium dye TATA+ and the DuBois' nickel catalyst for efficient light-driven H2 production in water
14:30	14:45	Oral#2	Rossi Lucas, Clermont-Ferrand	Assessing photoaging of polymer materials with pyrene as a fluorescent polarity probe
14:45	15:00	Oral#3	Benjelloun Kaoutar, Rennes	Combining photochemistry and oxidative couplings to access innovative heteroatom-containing Polycyclic Aromatic Hydrocarbons
15:00	15:15	Oral#4	Capuzzo Marco, Paris	Enhancing and accelerating photon emission from single molecules in DNA origamis using plasmonic nanocube dimers
15:15	15:30	Oral#5	Frath Denis, Lyon	All visible light photochromes for the design of chiroptical switches
15:30	16:00	**Coffee Break**		
16:00	16:30	Invited#2	Ishow Elena, Nantes	Impact of structural confinement on the chemical and (photo)physical properties of photoactive organic nanoparticles
16:30	16:45	Oral#6	Favereau Ludovic, Rennes	Direct visualization of through space charge transfer within thermally activated delayed fluorescent emitters
16:45	17:00	Oral#7	Godard Jérémy, Paris	Free or coordinated to Ru(II): 1,10-phenanthroline derivatives, useful ligands for luminescence and PDT applications
17:00	17:15	Oral#8	Kumar Rohit, Bordeaux	Heterogeneity of Singlet Oxygen Reactivity with a Gel Nanofiber Network revealed by Nano-Photochemistry and Microscopy
17:15	17:30	Oral#9	Nag Rahul, Paris	Hot Electron-Driven Phototransformation of Chiral Plasmonic Assemblies
17:30	17:45	Oral#10	Ania Conchi, Orléans	Photoluminescent carbon nanodots as spectral converter layers of solar cells
17:45	18:00	Sponsors Presentations		
18:00	20h00	**Poster session#1 / Welcome Cocktail**		

Tuesday, May 12

8:45	9:00	Oral#11	Hyojeong Choi, Paris	Skin-Conformal MHz-Speed Organic Photodetectors for Long-Range Near-Infrared Communication
9:00	9:15	Oral#12	Machreki Manel, Rennes	Solar-Driven Silicon Tandem Photoelectrochemical System for Plastic Waste and CO2 Conversion
9:15	9:30	Oral#13	Wu Chengjun, Paris	Pyridone-Functionalized Benzodiazole Derivatives and their Related Cyclometalated Ir(III) complexes: Tunable and Intense Luminescence
9:30	9:45	Oral#14	Brasiliense Vitor, Gif-Sur-Yvette	Monitoring functionalization of individual nanoparticles through ultrasensitive quantitative phase nanometrology
9:45	10:00	Oral#15	Hellwig Petra, Strasbourg	Nanostructured Platforms for SEIRAS: Advancing the Study of Membrane Protein Function
10:00	10:30	**Coffee Break**		
10:30	11:00	Invited#3	Odobel Fabrice, Nantes	Engineering Semiconductor–Molecule Interfaces for Solar-Driven Redox Catalysis
11:00	11:15	Oral#16	Ha Duong Nguyet-Thanh, Paris	Nature's Architects: Engineering Viral Capsids into Plasmonic Metamaterials
11:15	11:30	Oral#17	Matta Kirollos, Champs-sur-Marne	Anisotropic Absorptance in Vertically-Aligned Ultra-Long Carbon Nanotubes
11:30	11:45	Oral#18	Thi Dinh Duyen, Paris	Molecular imprinted plasmonic platform for a high performance nano-sensor
11:45	12:00	Oral#19	Skrzypczak Aliocha, Rennes	Incorporation of photoswitches into nitronylnitroxide ligands
12:00	12:15	Oral#20	Rigaut Stéphane, Rennes	Photocontrol of NIR to red lanthanide emission with P-type or T-type photochromism
12:15	14:00	**Lunch**		
14:00	14:30	Invited#4	Degiron Aloyse, Paris	Exploring new prospects for optoelectronics with colloidal quantum dots hybridized with nanophotonic environments
14:30	14:45	Oral#21	Hanan Garry, Montreal	Photofunctional metal complexes of pi-rich amidine N-oxide ligands
14:45	15:00	Oral#22	Gansmuller Axel, Univ. Lorraine	In-situ photoNMR and its applications in photochemistry
15:00	15:15	Oral#23	Sureshkumar Anjaly, Rennes	Low-cost integrated photonics and non-linear optics using 3D printing on polymers associated to bipyrimidine for the creation of a broadband spectrum
15:15	15:30	Oral#24	Bhuiyan Mihsan, Gif-sur-Yvette	Luminescence of europium doped nanoparticles in water under high energy proton beam
15:30	15:45	Oral#25	Bui Anh Thy, Bordeaux	Practical insights into fluorescent microviscosity probes
15:45	16:15	**Coffee Break**		
16:15	16:45	Invited#5	Ithurria Sandrine, Paris	II-VI semiconductor nanoplatelets: an hybrid inorganic-organic playground
16:45	17:00	Oral#26	Molinaro Céline, Mulhouse	Selective photopolymerization and thermopolymerization induced by plasmonic excitation of gold nanoparticles
17:00	17:15	Oral#27	Caussin Louis, Rennes	ON/OFF Photoswitching of magnetism and luminescence in a compact bis(nitronylnitroxyl)dithienylethene diradical
17:15	17:30	Oral#28	Harris Mariah, Orsay	Optical Fluorescent Biosensors: A bright nanotool for early detection for bacteria
17:30	17:45	Oral#29	Wu Yi, Clermont-Ferrand	Atmospheric Photosensitization: Sulfite-Enhanced Phenol Transformation in Cloud Water
17:45	18:00	Oral#30	Barbata Ludovico G., Paris-Saclay	A novel photoswitchable copper-based mof for sustainable photocatalytic hydrogen generation
18:00	20h00	**Poster session#2**		
20h00		**Free evening @ Cours Saint-Emilion**		

Wednesday, May 13

8:45	9:00	Oral#31	Merhi Fatima, Rennes	Ni-functionalized GaAs photoelectrodes for solar-driven water splitting
9:00	9:15	Oral#32	Mc Donald Peter, Gif-sur-Yvette	Spectroscopic insights into mechanofluorochromic and long-lived emissive organic materials
9:15	9:30	Oral#33	Meunier Lucie, Lyon	Surface-modified rare earth fluoride nanoparticles: applications for cancer imaging and therapy
9:30	9:45	Oral#34	Chen Chao, Paris	Ultrathin Light-Emitting Electrochemical Cells From Photo and Redox Active Molecular Layers
9:45	10:00	Oral#35	Cassette Elsa, Orsay	Ultrafast Dynamics of Relaxation in Well-Dispersed & Size-Controlled Nanographenes
10:00	10:15	Oral#36	Tissot Antoine, Orsay	Luminescent flexible Metal-Organic Frameworks for shock detection
10:15	10:45	**Coffee Break**		
10:45	11:15	Invited#6	Méallet Rachel, Orsay	To be or not to be fluorescent : that is the question !
11:15	11:30	Oral#37	Piard Jonathan, Gif-sur-Yvette	When research-based teaching labs reveal near-unity multistep energy transfer in common orange STABILO ®
11:30	11:45	Oral#38	Ponroy Léa, Nantes	Synergistic effect of nano-assemblies of photosensitizers and magnetic nanoparticles for cancer phototherapy
11:45	12:00	Oral#39	Punathil Haseeba Nasreen, Orsay	Singlet fission: From Solution to Nanoparticles and Thin Films
12:00	12:15	Oral#40	Casimiro Lorenzo, Paris	Precise control of energy release in a photo-electroswitchable ionic couple
12:15	12:30	Oral#41	Ferrer Magin Benedict, Mulhouse	Increased Efficiency of DUV Photolithography of Chitosan bioresist with new water-soluble PAGs
12:30	14:00	**Lunch**		
14:00	14:30	Invited#7	Moinard Morgane, Nancy	Development of Third-Generation Photosensitizers for Anticancer Photodynamic Therapy
14:30	14:45	Oral#42	Sarkar Krishnendu, Paris-Saclay	Cathodoluminescence spectroscopy analyses of defects trapping in InGaN/GaN nanowire heterointerfaces
14:45	15:00	Oral#43	Mendez Medrano Andrea, Paris	Production of H2O2 by photoreduced polyoxometalates by activation of molecular oxygen
15:00	15:15	Oral#44	Atakpa Pirenam Augustin, Paris	Heterogenized NIR-Photocatalysts via Van-der-Waals Interactions Application to Photooxidations
15:15	15:30	Oral#45	Wu Yan, Paris	Polymerization of bispyridylbutadiyne on surface evidenced by STM and application in photocatalysis
15:30	15:45	Oral#46	Tawakalit Abdulyekeen, Orsay	Thermoresponsive nanostructures induced by radiolysis for applications in (photo-)catalysis
15:45	16:00	**Concluding remarks - End of the conference**		

VENUE

The conference will take place :

Amphi Buffon
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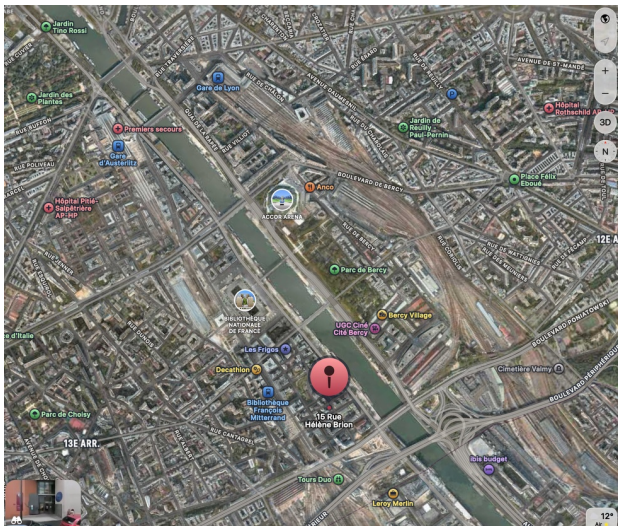
75013 Paris



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INVITED SPEAKERS

Sandrine Ithurria, Paris
II-VI semiconductor nanoplatelets: an hybrid inorganic-organic playground

Fabrice Odobel, Nantes
Engineering Semiconductor–Molecule Interfaces for Solar-Driven Redox Catalysis

Aloyse Degiron, Paris
Exploring new prospects for optoelectronics with colloidal quantum dots hybridized with nanophotonic environments

Elena Ishow, Nantes
Impact of structural confinement on the chemical and (photo)physical properties of photoactive organic nanoparticles

Rachel Méallet, Orsay
To be or not to be fluorescent : that is the question !

Davy Gérard, Troyes
Photochemical imaging of chiral plasmonic nanostructures

Morgane Moinard, Nancy
Development of Third-Generation Photosensitizers for Anticancer Photodynamic Therapy
SP2P PhD Prize 2025

Photochemical imaging of chiral plasmonic nanostructures

Davy Gérard[1]

[1]*L2n, Université de Technologie de Troyes, Troyes, France*

Email: davy.gerard@utt.fr

Chirality is ubiquitous in nature and plays a particularly important role in chemistry, especially in molecular chemistry and biochemistry. Optical methods are widely used to probe chirality, for instance to identify enantiomers. Indeed, circularly polarized light can be regarded as a chiral form of light, with left- and right-handed polarizations corresponding to its two enantiomers.

The development of nanophotonics has enabled the emergence of artificial chiral materials based on nanostructures, allowing tailored chiral responses and enhanced chiroptical interactions. Beyond far-field observables (such as circular dichroism or circularly polarized luminescence), nanostructures can also exhibit chiral responses confined to the near field. Even more intriguingly, such near-field chirality can arise in achiral nanostructures, an effect often referred to as “hidden chirality.” This highlights the need for near-field imaging techniques capable of directly probing these effects.

In this presentation, I will demonstrate the use of a photopolymer (PMMA-DR1) to image both chiral and achiral nanostructures. This photopolymer acts as a molecular photomotor, inducing mass transport that can be monitored using atomic force microscopy (AFM). I will present the imaging of chiral “hot spots” in coupled nanorods (see Figure), as well as the imprinting of hidden chirality in an achiral structure [1,2].

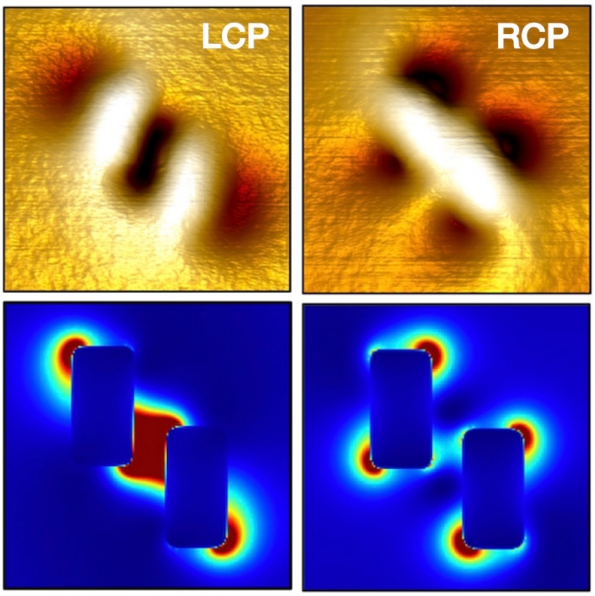

Figure: Experimental demonstration of a chiral hot spot. The two bottom images show numerical simulations (FDTD) of the electric field intensity around gold nanorods (140 × 70 nm²) separated by a 40 nm gap. A gap mode is excited under left circularly polarized excitation, but not under right circularly polarized excitation. The top images show experimental AFM measurements, where the chiral hot spot has been imprinted into a photopolymer under LCP.

Acknowledgements

This work is part of the BERNARDO project of PEPR LUMA and was supported by the French National Research Agency, as a part of the France 2030 program, under grant ANR-24-EXLU-0001.

References

1. T. Aoudjit, A. Horrer, S. Kostcheev, R. Bachelot, J. Plain, D. Gérard, T, Photochemical imaging of near-field and dissymmetry factor in chiral nanostructures**,** Adv. Opt. Mater**. 2023**, 11, 2203015.
2. A. Horrer, Y. Zhang, D. Gérard, J. Béal, M. Kociak, J. Plain, R. Bachelot, Local optical chirality induced by near-field mode interference in achiral plasmonic metamolecules, Nano Lett. **2020**, 20, 509-516.

IMPACT OF STRUCTURAL CONFINEMENT ON THE CHEMICAL AND (PHOTO)PHYSICAL PROPERTIES OF PHOTOACTIVE ORGANIC NANOPARTICLES

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[1]*Nantes University, CNRS, CEISAM, UMR 6230, Nantes, France*
[2] *Nantes University, CNRS, IMN, UMR 6502, Nantes, France*

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Emissive organic nanoparticles, made of self-assembled π-conjugated molecules, have nowadays become key players in the field of nanomedicine,[1] super-resolution imaging[2] and biosensing.[3] Their widespread use stems from their easy and modular manufacturing upon flash precipitation, and straightforward further surface functionalization with polyelectrolytes. Additionally, the high density of functional molecules enables efficient overlap of their π-backbones, leading to amplified electronic energy transfer within the nanoparticles, offering efficient analyte detection upon FRET mechanism. While numerous studies have been devoted to purely fluorescent nanoparticles made of one or several components, their extension to photochromic units, also endowed with reversible photoactivity, has been much less scrutinized. After a brief survey on the general features of such nanoparticles, we will show that the use of azo photochromes, also known for their fascinating photomechanical properties, provides insight into the internal structure and time evolution of nanoparticles in aqueous solution, which is of utmost importance for long-term storage.[4]

Acknowledgements

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Engineering Semiconductor–Molecule Interfaces for Solar-Driven Redox Catalysis

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The great promise of solar fuels as clean energy carriers in the future has stimulated scientists toward the development of cheap, eco-compatible and sustainable processes for H_2 production and CO_2 reduction from sunlight. There are three main approaches to make solar fuels, namely : i) the combination of photovoltaic cells (PVs) with electrolyzers, which are mature technologies and currently give the highest performances; ii) the development of photoelectrochemical cells (PECs), requiring semiconductor combined with electrocatalysts grafted on their surfaces and lastly; iii) photocatalytic systems operating in solution, either in the form of a homogenous system made of molecules solubilized in a solution, or with colloidal semiconductor nanoparticles (SC NPs) dispersed in solution.

This presentation will first deal with the development of dye-sensitized photocatalysis (DSP), which is composed of a dye, a reduction catalyst (Cat_{Red}) co-grafted onto n-type semiconductor (n-SC) nanoparticles (NPs), such as titanium dioxide (TiO_2) and an external sacrificial electron donor (SED) to regenerate the oxidized dye.[1] The elimination of the SED, representing a serious obstacle for application, has been successfully eliminated with the design of a dual-functional hybrid photocatalytic system that executes both a reduction and an oxidation reaction at the same time upon employing the photogenerated e- and h^+ pair to produce two valuable chemicals such as H_2 or CO and aldehyde (Figure 1a).[2] The second part will be devoted to the development of hybrid solar photoelectrochemical cells (PECs), that integrate efficient and selective molecular catalysts on the surface of high performance semiconducting photoelectrodes. The potential of rarely used semiconductors such as $Cu(In,Ga)S_2$ chalcopyrite and amorphous hydrogenated silicon (a:SiH) absorbers coated with molecular catalysts will be demonstrated for CO_2 activation.[3] Scope and limitations of such systems will be discussed in the light of other approaches.

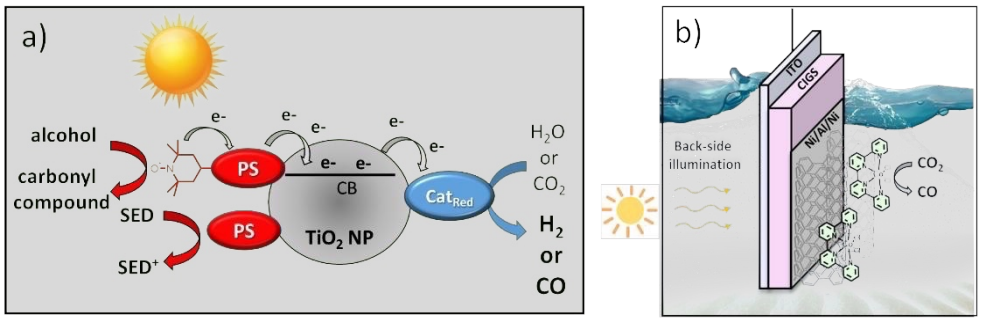

Figure 1. (a) schematic illustration of the DSPs and (b) hybrid PECs for CO_2 reduction

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EXPLORING NEW PROSPECTS FOR OPTOELECTRONICS WITH COLLOIDAL QUANTUM DOTS HYBRIDIZED WITH NANOPHOTONIC ENVIRONMENTS

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Colloidal quantum dots (cQDs) offer exciting opportunities for light sources, detectors and solar cells. They can self-assemble into solid compact layers and their properties can be adjusted with great flexibility during their synthesis to address frequency windows that are otherwise difficult and/or expensive to cover with standard semiconductors[1]. One of the current frontiers in the field is to increase the performances and to obtain new functionalities by hybridizing cQD films with tailored photonic environments, such as gratings, metasurfaces or optical antennas[2]. In this presentation, I will show that such hybridization produces quite unexpected features, such as carrier lifetimes that are essentially independent of their photonic environment[3]. I will rationalize these observations with carrier thermalization arguments[4,5], discuss their fundamental implications and show how these effects can be leveraged to explore new concepts of light sources[6] and photodetectors[7,8].

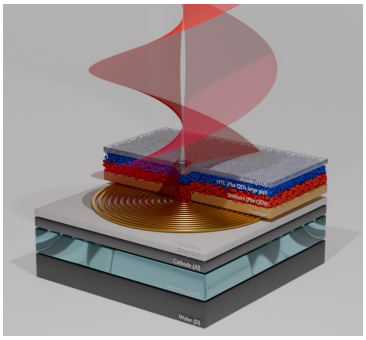

Figure: schematic of a quantum dot LED emitting a broadband vortex beam—an example of advanced light structuration resulting in helical wavefronts and a phase singularity at the center of the beam (credit: Marie Petolat).

Acknowledgements

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II-VI semiconductor nanoplatelets: an hybrid inorganic-organic playground

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Semiconductor nanoplatelets present narrow optical properties thanks to their thickness, defined at the atomic scale without roughness. It makes them appealing for optoelectronic devices. Besides their basal facets are extended over 1000s of nm^2 which make them appealing for the self-assembly of molecules.[1]

Here, we will first show with the synthesis of heterostructures, it is possible to grow NPLs with more than one emission thus breaking the Kasha's rule. With core/crown/crown CdSe/CdTe/CdSe NPLs composed at 95% of CdSe, a dual emission is obtained where a green emission arises from the recombination of the exciton through the band edge in 4 ML CdSe NPLs while a red emission arises from the type II band alignment between CdSe and CdTe.[2] Other heterostructures have then been synthesized to further improve the Quantum yield and the emission linewidth.[3] These NPLs can be introduced in light emitting diodes which exhibit dual NPLs as in the active materials. More recently, we introduced these bi-color NPLs into a dielectric photonic cavity, allowing the spectral linewidth to be controlled and reduced to 2 nm.[4]

Finally, I will show that pristine ligands can be exchanged with chiral ligands, in the aim of circular dichroism optical properties.[5] We are showing a direct ligand exchange in ethanol from carboxylate to tartrate ligands, inducing the self-assembly of the tartrate ligands in two different conformations exhibiting opposite circular dichroism signals. The emergence of the circular dichroism optical properties comes from a good coupling of the ligands on the surface and an orthorhombic crystal distortion. The dissymmetric factor can reach values as high as 1.2% for extended NPLs.

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To Be or Not to Be Fluorescent: That Is the Question!

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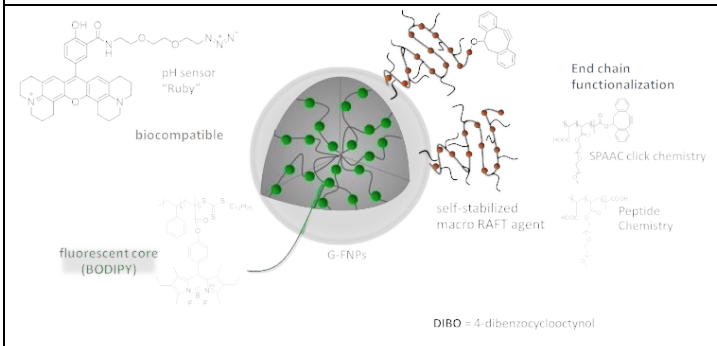
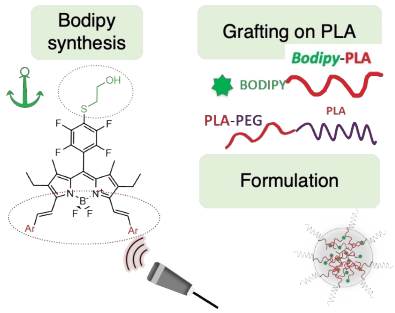
Fluorescence plays a dual role in the development of nanoparticle-based biotechnologies, acting either as a powerful analytical probe or as a limiting factor depending on the targeted application. This work presents two complementary strategies that illustrate this paradigm.

First, pH-sensitive fluorescent nanoparticles were engineered and immobilized on glass substrates [1], enabling ratiometric monitoring of bacterial proliferation with high sensitivity and reliability (Scheme 1). Second, non-fluorescent nanoparticles (Scheme 2) were developed as efficient photoacoustic contrast agents [2], where strong optical absorption—rather than fluorescence—is essential for generating high-resolution biomedical images.

By comparing these approaches, fluorescence emerges not as an intrinsic or default property, but as a tunable design parameter that can be either exploited or suppressed depending on the functional requirements. This perspective highlights its central role in advancing diagnostics, biosensing, and personalized nanomedicine.

Scheme 1 : pH-sensitive fluorescent NPs	Scheme 2 : non-fluorescent NPs for photoacoustic
	

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Université Paris-Saclay Chemistry Doctoral School (2MIB: Sciences Chimiques – Molécules, Matériaux, Instrumentation et Biosystèmes); French National Research Agency (ANR-21-CE09-0024-01)

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Development of Third-Generation Photosensitizers for Anticancer Photodynamic Therapy

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Cancer remains a leading cause of mortality worldwide, largely due to the limited selectivity of conventional therapies and the persistence of microscopic residual disease. Photodynamic therapy (PDT) is a promising minimally invasive approach based on the light activation of a photosensitizer (PS) to generate cytotoxic reactive oxygen species (ROS). However, its clinical efficacy is still limited by the poor selectivity of first- and second-generation PS. In this context, third-generation PS incorporating active targeting ligands have emerged as an effective strategy to improve tumor selectivity and therapeutic outcomes.

A first research axis focuses on ovarian cancer metastasis targeting *via* folate receptor alpha (FRα). We developed a stable folic acid analogue (AAF1) and its corresponding PS conjugate as a third-generation targeted system[1]. Current work investigates the impact of regioselective conjugation on photophysical and biological properties using dedicated synthetic strategies. In parallel, a second analogue is under development to further enhance stability and introduce immunostimulatory features to potentiate PDT-induced anti-tumor immune responses.

A second research axis explores peptide-based targeting of Neuropilin-1 (NRP-1), a receptor involved in tumor angiogenesis and overexpressed in several cancers, including non-small cell lung cancer[2]. Four peptide-PS conjugates were designed, synthesized, and evaluated biologically *in vitro*, leading to the identification of a lead compound, exhibiting an optimal balance between stability, selectivity, photodynamic efficacy, and safety. This candidate is currently under investigation for *in vivo* studies.

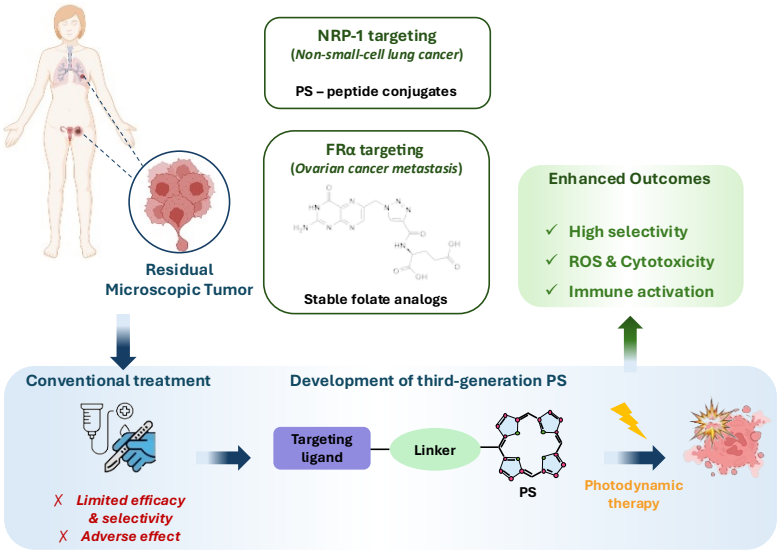

***Figure 1**. Development of third generation PS for anticancer PDT.*

Acknowledgements

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ORAL PRESENTATIONS

Oral#1	Fortage Jérôme, Grenoble	A successful combination of the triazatriangulenium dye TATA+ and the DuBois' nickel catalyst for efficient light-driven H_2 production in water
Oral#2	Rossi Lucas, Clermont-Ferrand	Assessing photoaging of polymer materials with pyrene as a fluorescent polarity probe
Oral#3	Benjelloun Kaoutar, Rennes	Combining photochemistry and oxidative couplings to access innovative heteroatom-containing Polycyclic Aromatic Hydrocarbons
Oral#4	Capuzzo Marco, Paris	Enhancing and accelerating photon emission from single molecules in DNA origamis using plasmonic nanocube dimers
Oral#5	Frath Denis, Lyon	All visible light photochromes for the design of chiroptical switches
Oral#6	Favereau Ludovic, Rennes	Direct visualization of through space charge transfer within thermally activated delayed fluorescent emitters
Oral#7	Godard Jérémy, Paris	Free or coordinated to Ru(II): 1,10-phenanthroline derivatives, useful ligands for luminescence and PDT applications
Oral#8	Kumar Rohit, Bordeaux	Heterogeneity of Singlet Oxygen Reactivity with a Gel Nanofiber Network revealed by Nano-Photochemistry and Microscopy
Oral#9	Nag Rahul, Paris	Hot Electron-Driven Phototransformation of Chiral Plasmonic Assemblies
Oral#10	Ania Conchi, Orléans	Photoluminescent carbon nanodots as spectral converter layers of solar cells
Oral#11	Hyojeong Choi, Paris	Skin-Conformal MHz-Speed Organic Photodetectors for Long-Range Near-Infrared Communication
Oral#12	Machreki Manel, Rennes	Solar-Driven Silicon Tandem Photoelectrochemical System for Plastic Waste and CO2 Conversion
Oral#13	Wu Chengjun, Paris	Pyridone-Functionalized Benzodiazole Derivatives and their Related Cyclometalated Ir(III) complexes: Tunable and Intense Luminescence
Oral#14	Brasiliense Vitor, Gif-Sur-Yvette	Monitoring functionalization of individual nanoparticles through ultrasensitive quantitative phase nanometrology
Oral#15	Hellwig Petra, Strasbourg	Nanostructured Platforms for SEIRAS: Advancing the Study of Membrane Protein Function
Oral#16	Ha Duong Nguyet-Thanh, Paris	Nature's Architects: Engineering Viral Capsids into Plasmonic Metamaterials
Oral#17	Matta Kirollos, Champs-sur-Marne	Anisotropic Absorptance in Vertically-Aligned Ultra-Long Carbon Nanotubes
Oral#18	Thi Dinh Duyen, Paris	Molecular imprinted plasmonic platform for a high performance nano-sensor

Oral#19	Skrzypczak Aliocha, Rennes	Incorporation of photoswitches into nitronylnitroxide ligands
Oral#20	Rigaut Stéphane, Rennes	Photocontrol of NIR to red lanthanide emission with P-type or T-type photochromism
Oral#21	Hanan Garry, Montreal	Photofunctional metal complexes of pi-rich amidine N-oxide ligands
Oral#22	Gansmuller Axel, Univ. Lorraine	In-situ photoNMR and its applications in photochemistry
Oral#23	Sureshkumar Anjaly, Rennes	Low-cost integrated photonics and non-linear optics using 3D printing on polymers associated to bipyrimidine for the creation of a broadband spectrum
Oral#24	Bhuiyan Mihsan, Gif-sur-Yvette	Luminescence of europium doped nanoparticles in water under high energy proton beam
Oral#25	Bui Anh Thy, Bordeaux	Practical insights into fluorescent microviscosity probes
Oral#26	Molinaro Céline, Mulhouse	Selective photopolymerization and thermopolymerization induced by plasmonic excitation of gold nanoparticles
Oral#27	Caussin Louis, Rennes	ON/OFF Photoswitching of magnetism and luminescence in a compact bis(nitronylnitroxyl)dithienylethene diradical
Oral#28	Harris Mariah, Orsay	Optical Fluorescent Biosensors: A bright nanotool for early detection for bacteria
Oral#29	Wu Yi, Clermont-Ferrand	Atmospheric Photosensitization: Sulfite-Enhanced Phenol Transformation in Cloud Water
Oral#30	Barbata Ludovico G., Paris-Saclay	A novel photoswitchable copper-based mof for sustainable photocatalytic hydrogen generation
Oral#31	Merhi Fatima, Rennes	Ni-functionalized GaAs photoelectrodes for solar-driven water splitting
Oral#32	Mc Donald Peter, Gif-sur-Yvette	Spectroscopic insights into mechanofluorochromic and long-lived emissive organic materials
Oral#33	Meunier Lucie, Lyon	Surface-modified rare earth fluoride nanoparticles: applications for cancer imaging and therapy
Oral#34	Chen Chao, Paris	Ultrathin Light-Emitting Electrochemical Cells From Photo and Redox Active Molecular Layers
Oral#35	Cassette Elsa, Orsay	Ultrafast Dynamics of Relaxation in Well-Dispersed & Size-Controlled Nanographenes
Oral#36	Tissot Antoine, Orsay	Luminescent flexible Metal-Organic Frameworks for shock detection
Oral#37	Piard Jonathan, Gif-sur-Yvette	When research-based teaching labs reveal near-unity multistep energy transfer in common orange STABILO ®
Oral#38	Ponroy Léa, Nantes	Synergistic effect of nano-assemblies of photosensitizers and magnetic nanoparticles for cancer phototherapy

Oral#39	Punathil Haseeba Nasreen, Orsay	Singlet fission: From Solution to Nanoparticles and Thin Films
Oral#40	Casimiro Lorenzo, Paris	Precise control of energy release in a photo-electroswitchable ionic couple
Oral#41	Ferrer Magin Benedict, Mulhouse	Increased Efficiency of DUV Photolithography of Chitosan bioresist with new water-soluble PAGs
Oral#42	Sarkar Krishnendu, Paris-Saclay	Cathodoluminescence spectroscopy analyses of defects trapping in InGaN/GaN nanowire heterointerfaces
Oral#43	Mendez Medrano Andrea, Paris	Production of H2O2 by photoreduced polyoxometalates by activation of molecular oxygen
Oral#44	Atakpa Pirenam Augustin, Paris	Heterogenized NIR-Photocatalysts via Van-der-Waals Interactions Application to Photooxidations
Oral#45	Wu Yan, Paris	Polymerization of bispyridylbutadiyne on surface evidenced by STM and application in photocatalysis
Oral#46	Tawakalit Abdulyekeen, Orsay	Thermoresponsive nanostructures induced by radiolysis for applications in (photo-)catalysis

A successful combination of the triazatriangulenium dye TATA$^+$ and the DuBois' nickel catalyst for efficient light-driven H_2 production in water

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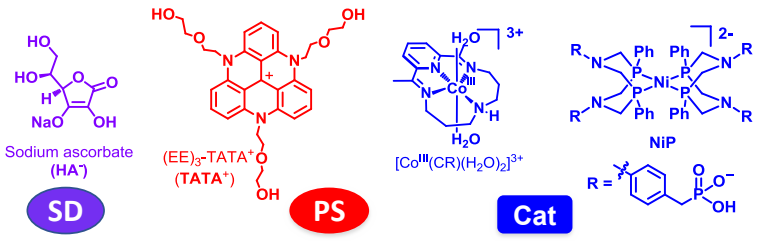
In 2018, we introduced a novel class of organic dyes from the triazatriangulenium family as outstanding photosensitizer for visible-light-driven hydrogen production in water [1]. A highly efficient and sustained catalytic H_2 production was achieved in a purely aqueous acidic medium (pH 4.5) by combining the water-soluble tris(ethoxyethanol)-triazatriangulenium derivative (**TATA**$^+$) with a cobalt tetraazamacrocyclic Schiff base catalyst ($[Co(CR)(H_2O)_2]^{3+}$), and ascorbate (**HA**$^-$) as a sacrificial electron donor (Scheme 1). Notably, the stability of this molecular system surpassed that of the benchmark photosensitizer $[Ru(bpy)_3]^{2+}$ (bpy = 2,2'-bipyridine). In this study, we explored the photocatalytic activity of the water-soluble derivative of the so-called Dubois nickel H_2-evolving catalyst (**NiP**)[2] in combination with **TATA**$^+$ in similar experimental conditions (Scheme 1) [3]. At pH 4.5, with **HA**$^-$ as a sacrificial electron donor, very high turnover numbers per catalyst (TON_{Cat}) were indeed obtained ranging from 2800 up to 19 500 depending on the catalyst concentration (50 to 1 µM). This catalytic activity surpassed both that of the cobalt catalyst and that previously achieved using the DuBois nickel catalyst with other photosensitizer families [2].



Scheme 1. Three-component systems for photocatalytic H_2 production.

An in-depth photophysical study based on transient absorption spectroscopy and Stern-Volmer plots will also be presented to estimate the kinetic of electron transfers occurring within the photocatalytic system and propose a mechanism for light-driven H_2 production. Additionally, we evaluated for the first time the high stability of the **TATA**$^\bullet$ radical (a key factor in the exceptional performance of **TATA**$^+$-based photocatalytic system) using EPR and UV-visible spectroscopy combined to theoretical calculations. Simulations of the room-temperature X-band EPR spectrum's hyperfine structure confirmed the expected radical's delocalization across the TATA platform, with the central atom bearing only 38% of the Mulliken spin density. Time-dependent DFT computations of **TATA**'s UV-visible signature further corroborated the delocalized nature of its molecular orbitals.

These results further highlight the great potential of the triazatriangulenium dyes to design original artificial photosynthesis systems for efficient H_2 production and CO_2 reduction.

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Assessing photoaging of polymer materials with pyrene as a fluorescent polarity probe

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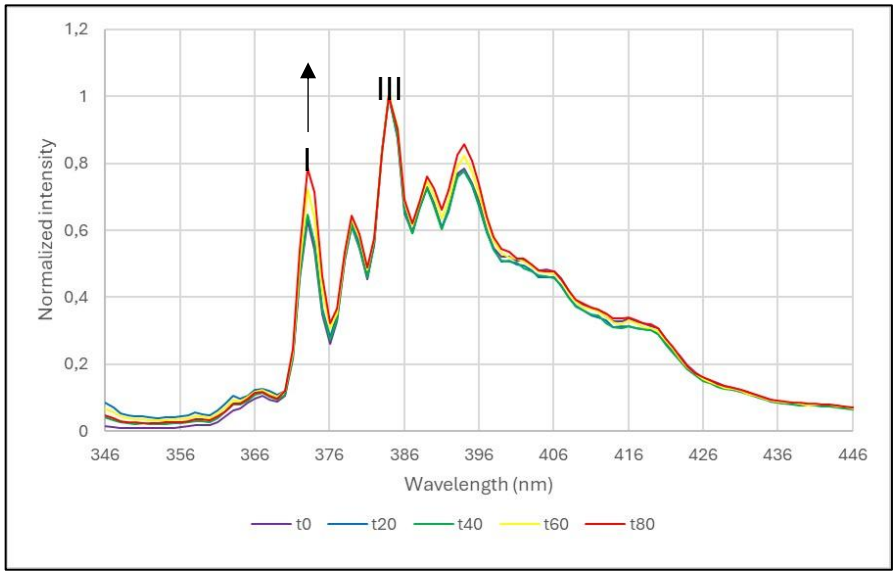
The consequences of photoaging at different scales are traditionally assessed by complementary techniques such as FTIR and UV-visible spectroscopies, gel fraction, thermal and mechanical analyses... However, these techniques are not sufficiently sensitive to detect early-stage modifications in polymer chemical structure, such as the formation of oxidation products, nor changes in macromolecular architecture (chain scission, crosslinking, etc.). Due to their sensitivity to several parameters of their microenvironment (polarity, pH, mobility) [1], the introduction of fluorescent probes into polymers seems promising to monitor photoaging, potentially prior to any other technique [2, 3].
This work focuses on the use of pyrene as a fluorescent probe sensitive to the polarity and local mobility of its environment. Pyrene fluorescence is characterized by its fine vibronic structure, whose intensity ratio of the 1st and 3rd vibronic bands (I/III ratio) is a direct indicator of the polarity of the medium (Fig. 1). Following preliminary study of pyrene fluorescence when introduced into polymers, the I/III ratio will be correlated with the results of conventional techniques used for detecting the consequences of photoaging in polymers (FTIR, UV-vis spectroscopies and contact angle).



Photoaging time (h)	Ratio I/III
0	0,635
20	0,634
40	0,641
60	0,710
80	0,812

Figure 1 : Fluorescence emission spectra of pyrene impregnated in PP photooxidised films (after different photoaging times) (excitation wavelength : 336 nm). Table of the I/III ratio as a function of photoaging time.

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Combining photochemistry and oxidative couplings to access innovative heteroatom-containing Polycyclic Aromatic Hydrocarbons

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Over the last century, chemists have shown great interest in polycyclic aromatic hydrocarbons (PAHs).[1] This interest increased after the discovery of graphene, a two-dimensional material made exclusively of sp²-hybridized carbon atoms and exhibiting exceptional electronic properties.[2] Since then, increasingly extended π-conjugated systems have been developed, leading to the synthesis of molecular nanographenes (PAHs whose dimensions exceed one nanometer). These compounds show great potential for the development of organic optoelectronic devices such as OLEDs (Organic Light-Emitting Diodes), OPVs (Organic Photovoltaics), and batteries. [2]

Introducing heteroatoms into PAHs provides a powerful strategy to modulate their structure, reactivity, and electronic properties.[3] For instance, incorporating nitrogen atoms enables coordination chemistry, combining the photophysical properties of transition metals with those of the PAH framework.[4] Our research group pioneered the insertion of phosphorus into PAHs, taking advantage of the specificities of this heteroatom.[5]

This research project aims to develop new synthetic routes for the incorporation of heteroatoms particularly phosphorus and silicon into extended PAHs (Figure 1). To this end we will combine photocyclization and chemical cyclodeshydrogenation.[6] To reach our objective, we plan to synthesize literature-known alkynes containing large PAHs frameworks. These intermediates will serve as key building blocks for the preparation of the target heterocycles, using original methodologies: the silver-mediated phosphole cyclization[7, 8] and the silirene to silole methodology.[9]

We aim to investigate how extended conjugation and the incorporation of heteroatoms will influence the optical, redox, and possibly chiroptical properties of the target molecules.

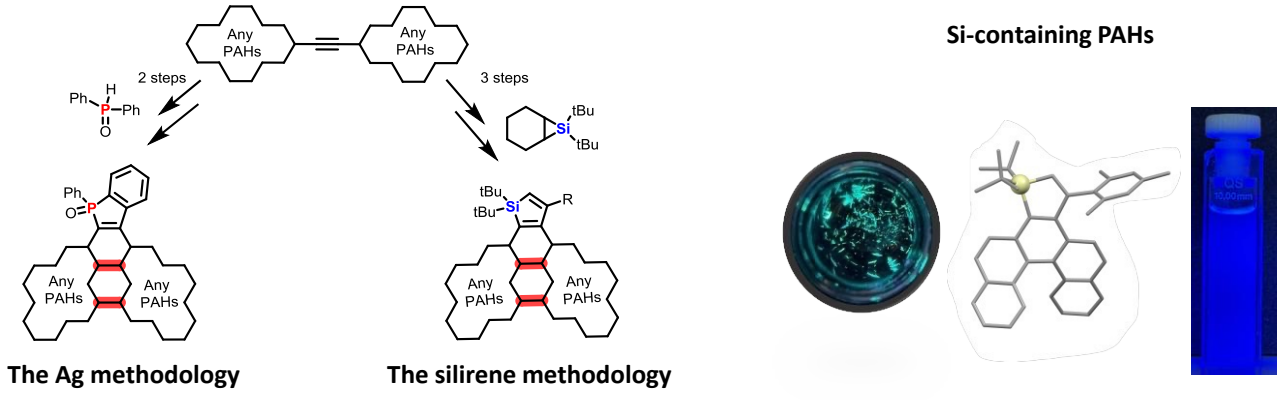

Figure 1 : Synthetic strategy toward Phosphole and Silole derivatives and exemple of structural characterization of the Silole with photoluminescence in Solution and the Solid State.

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Enhancing and accelerating photon emission from single molecules in DNA origamis using plasmonic nanocube dimers

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Single quantum emitters, such as single molecules, are essential building blocks of quantum technologies but require cryogenic conditions to produce indistinguishable photons [1]. However, at room temperature, photon emission is mostly incoherent and light interacts only weakly with the emitter. To overcome these limitations and reach coherent light-emitter interactions at room temperature, we designed a tower-like DNA origami structure (Fig. 1-a) that precisely positions a single fluorescent molecule within the plasmonic hotspot formed between the tips of two metallic nanocubes. Our group recently proposed this geometry [2] to reach strong-coupling conditions with higher fidelity than using spherical particles [3].

To assemble these hybrid dimer structures, the plasmonic nanoparticles are coated with DNA strands that hybridize with complementary strands extending from the emitter-containing DNA origamis. Two DNA origamis are designed to assemble dimers of either spherical (Fig. 1-b) or cubic (Fig. 1-c-d) nanoparticles in order to investigate the influence of the lightning-rod effect offered by the tips of plasmonic nanocubes. We produce dimers of gold or silver nanocubes since silver particles should offer higher quantum yields and larger Purcell factors (Fig. 1-e).

Correlated fluorescence lifetime - intensity measurements, conducted in a high-refractive-index glycerol-based aqueous solution, reveal an acceleration of the emission decay rate by up to ~1000 for gold and silver dimers (Figure 1-f) and intensity enhancements reaching up to ~300 for silver dimers. These bright emitters with extremely short lifetimes confirm the potential of hybrid plasmonic DNA nanostructures to produce sources of indistinguishable single photons at room temperature.

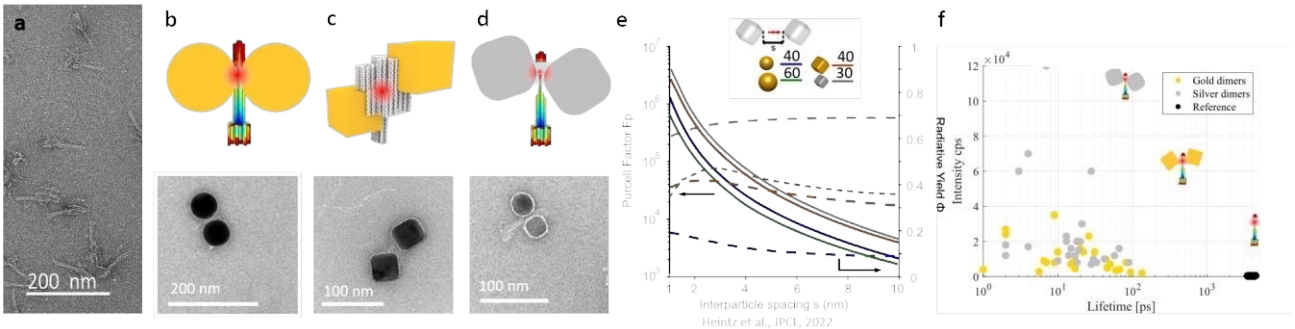

Figure: (a) TEM image of nanocubes' DNA origami. Scheme and TEM image (b) of an assembled structure with gold nanospheres. Scheme and TEM image (c) of an assembled structure with gold nanocubes. Scheme and TEM image (d) of an assembled structure with silver nanocubes. (e) Purcell factor (solid lines) and radiative yields (dotted lines) for 40 nm gold nanospheres (blue), 60 nm gold nanospheres (green), 40 nm gold nanocubes (red) and 30 nm silver nanocubes (grey). (f) Distribution of lifetimes-intensities of single molecules with gold nanocubes dimer (yellow), with silver nanocubes dimer (grey) and without any plasmonic dimer (black).

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ALL VISIBLE LIGHT PHOTOCHROMES FOR THE DESIGN OF CHIROPTICAL SWITCHES

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Constructing sophisticated luminescent dyes around a tetrahedral boron(III) centre is a particular approach that has fuelled the creativity of chemists motivated by their use in organic electronics and applied photonics or as molecular probes in biomedical analysis, sensors and materials science.[1] We have recently described a very simple and efficient gram-scale synthetic pathway towards Boranils substituted directly on the boron center by 1,1'-bi-2-naphtol derivatives (BINOL).[2] These chiral dyes typically feature high molar absorption coefficient in the range of 35,000 to 90,000 $M^{-1}.cm^{-1}$, absorption dissymmetry factor (g_{abs}) in the range of 2.5–5.5 x 10^{-4} at the maximum wavelength of absorption of Boranils and Circularly Polarized Luminescence (CPL) brightness up to B_{CPL} = 5.4 $M^{-1}.cm^{-1}$. Based on this new family of CPL emitters, we are currently developing supramolecular chiral soft-materials such as stimuli-responsive gels and liquid crystals.[3,4] As an illustration, we will describe molecular switches taking advantage of the control of energy transfer to a photochromic diarylethene (DAE) core to modulate chiroptical properties in liquid crystals thin films (*Figure 1*).

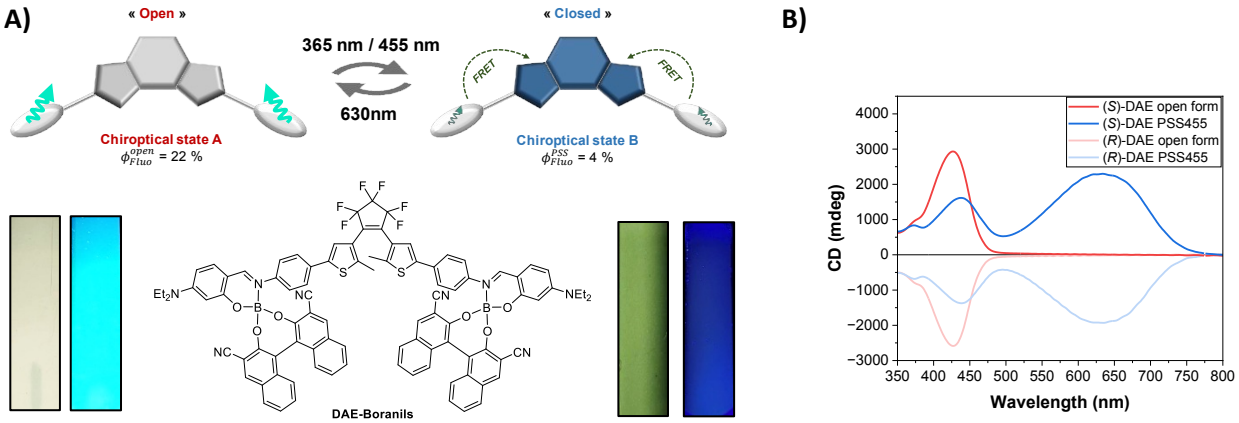

Figure 1 (A) Schematic and structural representations and (B) chiroptical signatures of the DAE-boranils.

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Direct visualization of through space charge transfer within thermally activated delayed fluorescent emitters

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Organic molecular semiconductors are emerging as promising materials for next-generation optoelectronic applications, including organic photovoltaics (OPVs), organic light-emitting diodes (OLEDs), and quantum information systems such as molecular qubits. A critical aspect of harnessing their full potential lies in the management of exciton spin states.[1] Indeed, controlling the energetic ordering of singlet and triplet excited states has become a central focus in the design of high-performance organic optoelectronics, such as OLEDs.

Here, I would like to share our recent results regarding that research domain, with the design of donor-acceptor compounds presenting dual through-bond (TB) and through-space (TS) charge transfer (CT) thermally activated delayed fluorescence (TADF) process.[2-3] Our molecular design allows us to precisely control the interplay between TB and TS intramolecular CT transitions, ultimately resulting in TADF. Using transient optical and magnetic spectroscopies, we thoroughly investigate the steric and electronic contributions that impact the interplay between the singlet and triplet excited-states states and their related role in the emission process, providing a comprehensive framework for understanding and controlling TS CT dynamics in organic chromophores.

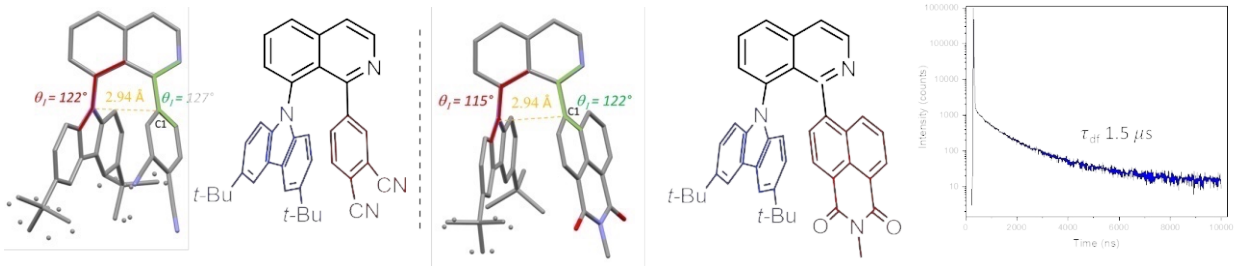

Figure: Chemical structures of the tBu-carbazole-isoquinoline derivatives presented in this communication.

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Free or coordinated to Ru(II): 1,10-phenanthroline derivatives, useful ligands for luminescence and PDT applications

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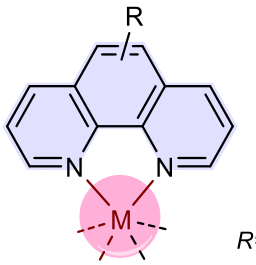
1,10-phenanthroline derivatives are powerful ligands that can efficiently chelate several metals, in particular Fe, Ru and Os. The resulting homo- or heteroleptic complexes have exhibited notable photophysical properties,[1] mainly due to an access to ^{3}MLCT excited states. Ru(II) complexes especially have a great potential in biology as photosensitizers for photodynamic therapy (PDT).[2] Nanoparticles can be functionalized by these complexes[3] in the perspective of applications in theranostic.[4] Even without complexation with a metal, some 1,10-phenanthrolines have shown promising abilities as luminescent probes with solvatochromism and dual emission properties.[5] Collaborators of these studies will be cited during the talk and are co-authors of the cited below bibliographic references.



R= Alkyl, Aryl, CN, OH, NH_2, X, etc.

M= Fe, Ru, Os, etc.

Figure : Substituted 1,10-phenanthroline (in blue) chelating a metal (in red)

Acknowledgements

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Heterogeneity of Singlet Oxygen Reactivity with a Gel Nanofiber Network revealed by Nano-Photochemistry and Microscopy

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Light-controlled self-assembly of small organic molecules presents a promising approach for designing responsive soft materials. Low Molecular Weight Gelators (LMWGs) can organize into a fibrous network through non-covalent interactions like hydrogen bonding, π-π stacking, van der Waals forces, and electrostatic interactions,[1] efficiently trapping solvent molecules to form supramolecular gels. Our group has demonstrated the gel formation of the supergelator 2,3-didecyloxyanthracene (DDOA)[2] generated by a clean photochemical reaction from a solution of the pro-gelator α-diketone-2,3-didecycloxyanthracene (dkDDOA).

In this study, first, a blue light source at 455 nm is used to convert the pro-gelator (dkDDOA) into DDOA, which self-assembles into fluorescent gels in polar solvents such as propylene carbonate, DMSO or acetonitrile. Subsequently, a red-light irradiation at 635 nm of the photosensitizer Methylene Blue produces singlet oxygen[3] that oxidatively modifies DDOA, as demonstrated by NMR and UV-Vis spectroscopy. An irreversible gel disassembly is thereby induced. Quantitative Bleaching Lifetime Imaging Microscopy (BLIM) enables per-pixel rate determination of the photochemical degradation of DDOA nanofibers. This study demonstrates the microscopic heterogeneity in singlet oxygen reactivity inside the DDOA gel. Due to the high localization of the reaction within 3-5 microns of a focused laser beam, individual nanofibers or nodes can be targeted and disassembled. Together, these results demonstrate a fully light-regulated cycle of gel formation and degradation, highlighting the potential of photochemical strategies for fundamental studies of self-assembly at the nanoscale and next-generation responsive materials.

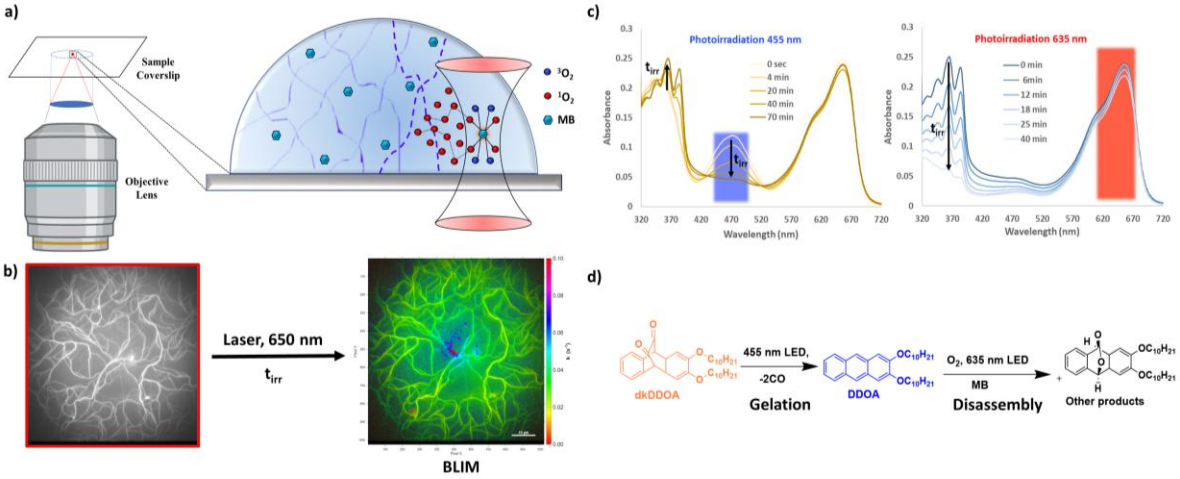

Figure: a) Schematic representation of photo-generated singlet oxygen via Methylene Blue, which diffuses and induces irreversible DDOA gel disassembly; b) Quantitative BLIM with a focused laser beam; c) UV-Vis and d) Schemes of photoconversion of dkDDDOA into DDOA (gelation) and of the photo-oxidation of DDOA into endo-DDOA (disassembly).

Acknowledgements

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Hot Electron-Driven Phototransformation of Chiral Plasmonic Assemblies

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Solar energy induced asymmetric reactivity is a sustainable means to obtain affordable pharmaceutical chemicals and new agrochemical, food industry items.[1] The outstanding extinction cross-sections and optical tunability of plasmonic photocatalysts make them suitable candidates towards solar driven enantioselective reactivity. The development of plasmonic objects with chiroptical features is novel in the field, in which atomic scale chirality is mandatory to ensure an asymmetric interaction with the molecular substrate. This is possible on a crystalline surface without any mirror-symmetry perpendicular to the surface.[2] A strategy relies in the synthesis of plasmonic nanostructures exposing high Miller-index facets, composing of asymmetric kink sites rendering the surface intrinsically chiral.

In this work, we exploit the photogeneration of non-thermalized hot electrons to drive the site-selective formation of a noble metal shell onto helical colloidal templates.[3] We hypothesize that the selective photoreduction of the metallic precursor in the inter-particle hot spots under simulated solar irradiation will form highly anisotropic metallic helices where the exposition of crystalline facets with chiral atomic arrangements could be favored. Our results demonstrate that the plasmon-induced photoreduction of noble metal salts onto helical assemblies of spherical Au nanoparticles[4] form thin metallic shells (Figure 1). This approach enables a controlled transition between two distinct regimes of chiroptical response: an initial state characterized by chirality emerging from the spatial organization of achiral building blocks, and a final state where chiroptical activity is encoded directly in the chiral morphology of the metallic nanostructure. These findings offer insight into the dynamic tuning of plasmonic chirality and open avenues for the design of reconfigurable chiral materials.

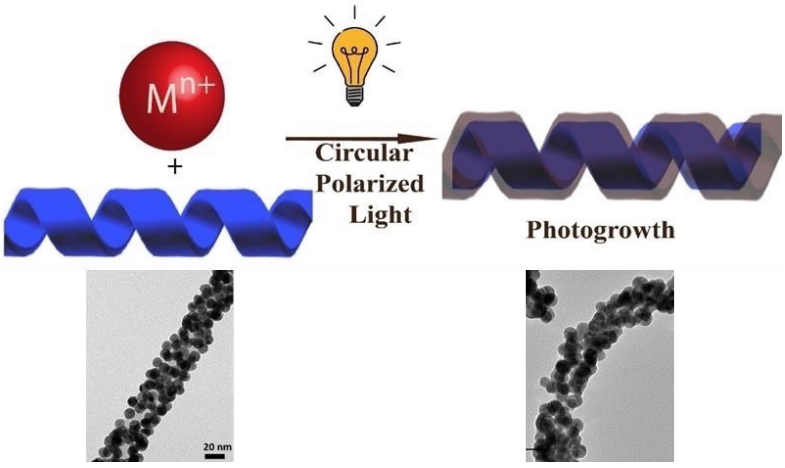

Figure 1. Photogrowth of Metallic Au –shell on AuNP@Nanohelix.

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PHOTOLUMINESCENT CARBON NANODOTS AS SPECTRAL CONVERTER LAYERS OF SOLAR CELLS

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Photonic converter materials have emerged as a solution in photovoltaic applications to enhance the efficiencies of solar devices, thanks to the broadening of their range of absorption to the UV and IR regions. Among them, carbon nanodots (CDs) are potential candidates as converter materials owing to their tunable photoluminescence features, abundance of precursors and low cost. In this study, photoluminescent CDs have been synthesized from various precursors and approaches [1,2], and characterized in colloidal aqueous suspensions and after immobilization in transparent polymeric matrices for their use as photonic converters. In suspension, the CDs showed broadband emission and large Stoke shifts owing to multiple radiative transitions (Figure 1). Photoluminescence quantum yields in solution (4.5-4.6 %), increased by 1.5-2 times after immobilization in the polymers. The CD/polymer films displayed high optical transparency (85-89 % transmittance) and AFM images showed high quality thin layers. The photonic conversion layers were coated on various solar cells, and tested in indoor and outdoor conditions, showing an improved conversion performance of up to 3 % in polycrystalline Si-cells and of up to 18% in dye sensitized solar cells.

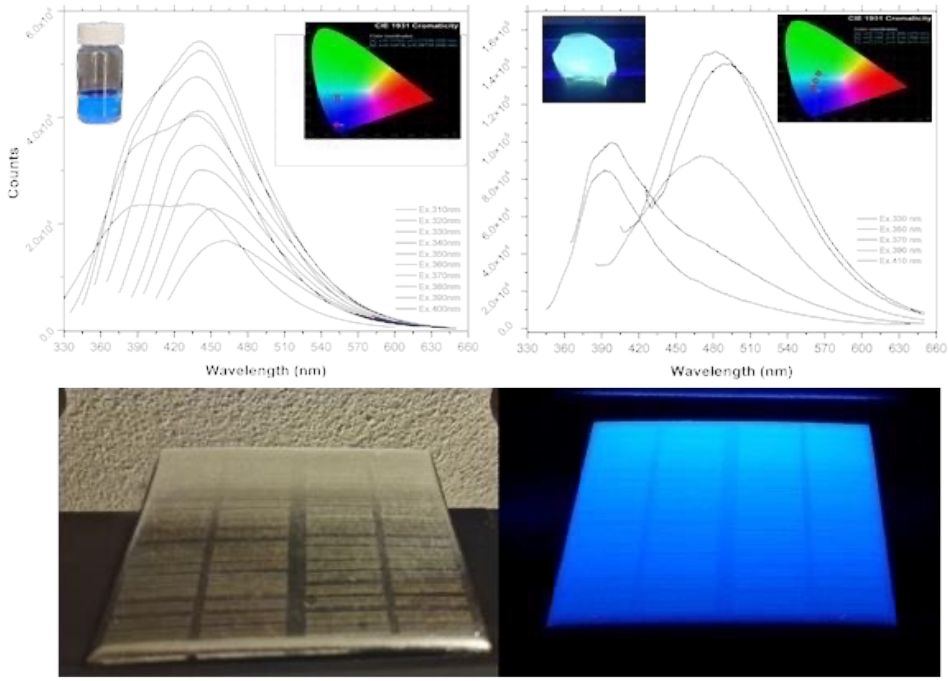

Figure 1. (top) Photoluminescence emission bands at various excitation wavelengths of CDs (left) aqueous suspensions and (right) immobilized in a polymeric matrix. Insets: 1931 chromaticity coordinates. (down) Images of polycrystalline Si-based solar cell coated with a CD/polymer layer under (left) ambient and (right) UV irradiation [2a].

Acknowledgements. Financial support of LEAP-RE (NANOSOLARCELLS) and LEAP-SE (ONESELF) programs

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Skin-Conformal MHz-Speed Organic Photodetectors for Long-Range Near-Infrared Communication

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Near-infrared (NIR) photodetectors are essential for wearable optoelectronic devices due to their low bio-scattering and reduced ambient interference. However, ultrathin organic photodetectors (OPDs) often face a trade-off between mechanical compliance and high-speed operation due to increased resistance upon deformation and RC-limited bandwidth.[1] In this study, we developed a 3 μm thick skin-adhering NIR OPD that achieved a detection sensitivity of 0.84 × 10^{14} Jones at 790 nm and a -3 dB bandwidth of over 1 MHz, while maintaining performance even at 66% compressive strain and bending radii of less than 5 μm. This was achieved thanks to a self-assembled carbazole phosphonic acid monolayer (3-Br-4PACz) with introduced brominated functional groups. The strong dipoles of this monolayer improve interfacial energy alignment, enhancing hole extraction and suppressing recombination. As a result, this device exhibits reduced series resistance, low dark current (~0.03 nA cm^{-2}), high external quantum efficiency (~74%), and a fast response time (~770 ns). The ultrathin SAM stabilizes interfacial energy while maintaining mechanical flexibility, enabling high-speed operation even in a deformed state. These findings demonstrate that SAMs designed at the molecular level can separate bandwidth from mechanical compliance, suggesting the potential for developing high-performance skin-integrated near-infrared photodetectors (NIR OPDs).[]

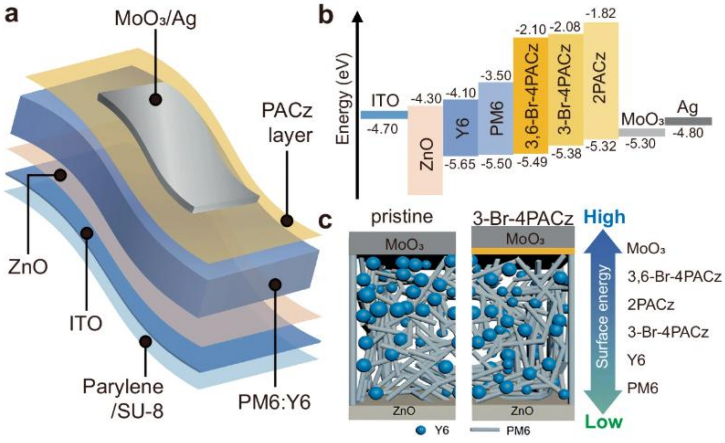

Figure : **a** Schematic of the ultraflexible NIR-OPD architecture. **b** Energy band diagram of each layer. **c** Y6 distribution of the bulk-heterojunction components between the MoO_3 and 3-Br-4PACz/MoO_3 samples.

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This research was supported by the National Research Foundation of Korea (NRF), funded by the Korea Government (MSIT) (RS-2024-00411764)

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Solar-Driven Silicon Tandem Photoelectrochemical System for Plastic Waste and CO_2 Conversion

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Solar-driven coupling of waste valorisation and carbon dioxide (CO_2) conversion offers a promising route toward circular carbon technologies. Here, we present an integrated silicon-based tandem photoelectrochemical system enabling simultaneous plastic waste oxidation and CO_2 reduction under illumination. Post-consumer polyethylene terephthalate (PET) was depolymerized to ethylene glycol and selectively oxidized at an *n*-Si/Ni photoanode, producing formic and glycolic acids with Faradaic efficiencies up to 90%. Controlled interfacial charge transfer promotes selective C–C bond cleavage while limiting overoxidation. In parallel, CO_2 reduction occurs at a *p*-Si photocathode modified with Bi–In catalysts, where photogenerated electrons drive selective conversion. The tandem configuration enables concurrent anodic and cathodic reactions in a single cell and operates stably under continuous illumination. The combined photovoltages reduce external bias requirements, enhancing solar-to-chemical energy conversion. This work highlights silicon photoelectrodes as efficient platforms for light-driven plastic waste and CO_2 conversion.

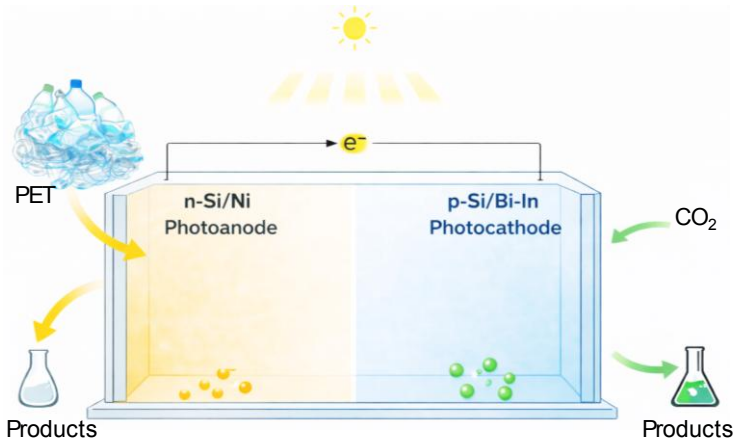

Figure 1: Schematic of a Solar-Driven Silicon Tandem Photoelectrochemical System for Coupled Plastic Waste Valorisation and CO_2 Conversion

Acknowledgements

This work was funded by the European Union's Horizon Europe Programme under the Marie Skłodowska-Curie Actions (HORIZON-MSCA-2024-PF-01), project SOLAR-CATMOF. The authors also acknowledge Corinne Lagrost and Jules Galipaud from the ASPHERYX platform for providing access to XPS facilities and technical support.

Pyridone-Functionalized Benzodiazole Derivatives and their Related Cyclometalated Ir(III) complexes: Tunable and Intense Luminescence

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We report high-yields synthesis of a series of pyridone-functionalized donor-acceptor-donor benzodiazole-based derivatives (Benzoxadiazole = **1a**, Benzothiadiazole = **1b**, Benzoselenadiazole = **1c**). These novel compounds exhibit tunable and intense fluorescence efficiency. Emission wavelengths range from 534 to 589 nm, excited-state lifetimes are 7–11 ns, and photoluminescence quantum yields (Φ_{PL}) reach up to 95% for the Benzoxadiazole (**1a**) derivatives. Benzothiadiazole (**1b**) and Benzoselenadiazole (**1c)** show slightly lower Φ_{PL}, which may arise from differences in molecular conformation and/or heavy atom effects as depicted by the X-Ray structural analysis. The pyridone functionalization allows systematic modulation of emission color, highlighting the electronic tunability of these compounds.

Furthermore, these derivatives also serve as versatile and unprecedented ligands for cyclometalated iridium(III) complexes, which highlight the potential of these benzothiadiazole derivatives as building blocks for functional photonic materials and provide insights into the design of efficient emissive systems for optoelectronic applications, including light-emitting devices and sensors.

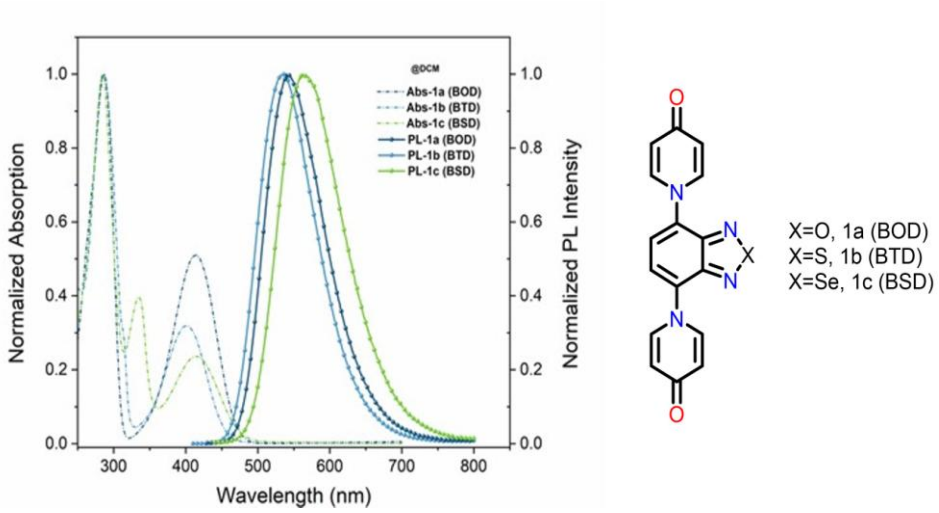

Figure: Normalized UV-Vis absorption and PL spectra of 1a–c

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Monitoring functionalization of individual nanoparticles through ultrasensitive quantitative phase nanometrology

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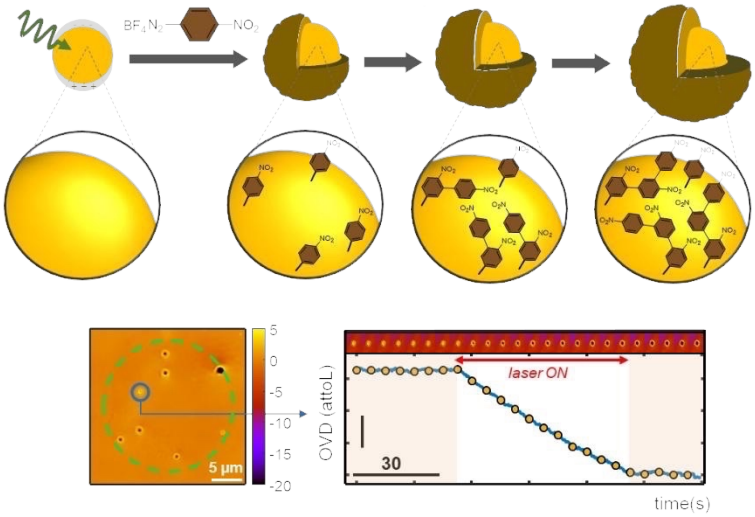
Surface modification of nanoparticles constitutes a key step in the design of plasmonic based sensors. Most commonly, functionalization of plasmonic gold nanoparticles (AuNPs) with organic moieties is carried out via self-assembled monolayers (SAMs), associated with one or several post functionalization steps. Several applications, however, require the preparation of thicker, yet extremely precise, layers, for which much less techniques are available.

Nanoparticle functionalization methods based on optical activation of solution species are well positioned to meet these challenges. They enable great spatial and temporal control over surface functionalization, particularly when coupled to operando methodologies in closed-loops [1]. Transposition of optical monitoring strategies to nanoscale objects is however delicate: Owing to the small amount of surface groups, high sensitivity is required, while interpretation of the scattered signal must also consider diffractive effects. Moreover, as reactivity nanoobjects often show high dispersity, analysis of reactivity at single particle level is often required.



In this communication, we show that an operando strategy based on high resolution quantitative phase microscopy can be a great strategy to overcome these challenges. Using high resolution and non-invasive quantitative phase imaging based on Zernike filtering (ZWIM) [2], we analyze the growth of organic layers on the surface of individual AuNPs. We show that it can be used to monitor and used to quantitatively monitor surface modification kinetics, reliably tracking the formation of layers thinner than 10 nm. We demonstrate that even extremely thin layers, undetectable with scanning electronic microscopy, can have a strong effect on surface reactions and discuss strategies to achieve precise photoinduced polymerization.

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Nanostructured Platforms for SEIRAS: Advancing the Study of Membrane Protein Function

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Understanding how membrane proteins function at the molecular level remains a major challenge, largely due to their low abundance, structural complexity, and the difficulty of probing them in physiologically relevant environments. Surface-enhanced infrared absorption spectroscopy (SEIRAS) offers a powerful solution, enabling sensitive investigation of proteins at very low concentrations. However, its performance critically depends on the design of the underlying nanostructured substrate.

To address this challenge, we systematically explore and compare different nanostructured platforms—electrolessly deposited gold nanoparticles[1], graphene nanodots[2], and lithographically defined gold slit nanoantenna arrays[3]—as tailored interfaces for enhanced vibrational spectroscopy of membrane proteins. For gold-based substrates, nanoscale morphology is a decisive parameter: optimal electroless deposition yields isolated nanostructures that maximize signal enhancement, while minor deviations drastically reduce performance. In addition, protein immobilization strategies, such as electrostatic adsorption or Ni–NTA/His-tag coordination, reshape the nanoparticle network into three-dimensional architectures that further enhance signal amplification.

Graphene nanodots provide a chemically versatile and stable platform, supporting both SEIRAS and SERS measurements. They enable reliable immobilization of membrane proteins such as cytochrome *bd-I* oxidase, preserving structural integrity while achieving reproducible signal enhancement and detection limits down to the nanomolar range over several days.

To achieve precise control over plasmonic properties, we further develop gold slit nanoantenna arrays with tunable geometries. By adjusting the slit dimensions, the plasmonic resonance can be positioned across the mid-infrared fingerprint region, resulting in geometry-dependent enhancement in both SEIRAS and SERS without compromising protein structure.

We demonstrated the functional relevance of these optimized platforms by probing, for example the mechanism of lactose permease (LacY). Using SEIRAS, we identified Glu325 as the key residue responsible for the unusually high apparent pKa (~10.5) required for substrate binding, and showed that Arg302 plays a crucial role in its deprotonation, providing direct insight into the coupling between protonation and transport activity.[4]

Together, these results demonstrate that the rational design of nanostructured interfaces enables sensitive, reproducible, and mechanistically informative studies of membrane proteins, opening new perspectives for biosensing and bioenergetics research.

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Nature's Architects: Engineering Viral Capsids into Plasmonic Metamaterials

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The ability to construct three dimensional architectures via nanoscale engineering is important for emerging applications of nanotechnology in sensors, catalysis, controlled drug delivery, microelectronics, and medical diagnostics. Because of their well-defined and highly organized symmetric structures, high robustness over wide ranges of temperature, pH, buffer, and in the presence of organic solvents, viral capsid proteins then provide a 3D scaffold for the precise placement of plasmon materials yielding hierarchical hybrid materials. In this study, we use a rod-shaped virus, Tobacco mosaic virus (TMV) and icosahedral virus, Turnip yellow mosaic virus (TYMV).

I will present the synthesis and characterization of new nano-bio-hybrid materials, which are soluble and stable in solution. Plasmonic nanoparticles of different sizes (5, 10 and 20 nm) and chemical nature (AuNP, Au@Au-AgNP...) were grafted directly on rod-shaped capsid (TMV-C) presenting cysteine at its surface, or on TYMV (Figure 1). After purification, the resulting nano-biohybrids were characterized by different technics (DLS, TEM, XPS...) [3].

Finally, I will show some applications with these new nano-biohybrid materials (SERS, metal-enhanced fluorescence, photothermia…).

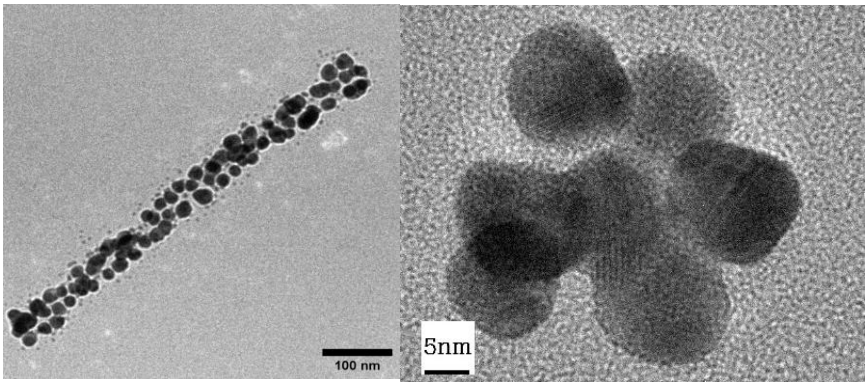

Figure 1: TEM images of AuNPs grafted onto TMV (left) and onto TYMV (right).

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Anisotropic Absorptance in Vertically-Aligned Ultra-Long Carbon Nanotubes

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Carbon-based materials, including graphene and carbon nanotubes are known as excellent absorbers of electromagnetic radiation over an ultra-broad spectral range from Ultra-Violet to Far-Infrared [1,2]. The low volume filling factor of carbon nanotubes to the air ensures smooth transition of incidence light, hence attenuating possible reflection from the top forest interface [3]. While a vast majority of scalable synthesis methods of carbon lead to disordered media, CVD emerges as an efficient technique to produce uniformly distributed Vertically-Aligned Ultra-Long Carbon Nano-Tubes (VA-UL-CNTs) of heights exceeding 1 mm. The corresponding aspect-ratio of nearly 10^{12} provides an excellent directionality along the substrate out-of-plane direction while absorbing any transmitted incident light. Along with the exceptional optical properties of CNTs including giant birefringence and dichroism [4], this translates into the anisotropic directional and angular optical properties. In this work, we report experimentally the transition of absorptance, from nearly 100 % at normal incidence to almost 0 % at grazing incidence in the infrared region of light in the wavelength range between 2 µm and 20 µm, yielding a wide angular window of about 20° near the grazing where absorptance remains strongly suppressed. Supported by theoretical modeling and numerical analyses, VA-UL-CNTs demonstrates highly selective directional absorptance while providing broadband spectral absorptance.

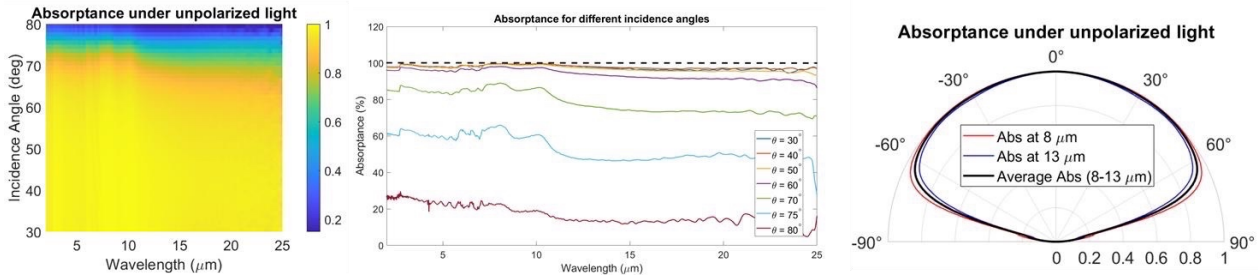

Figure : Directional absorptance measured experimentally for VA-UL-CNTS.

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MOLECULAR IMPRINTED PLASMONIC PLATFORM FOR A HIGH PERFORMANCE OF NANO-SENSOR

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Molecularly imprinted polymers (MIPs) are polymer matrices that contain cavities formed by a template molecule, enabling the selective recognition of specific molecules through complementary binding sites [1]. On a plasmonic substrate, the electric field is distributed non-uniformly, with highly intense localized regions known as “hotspots” [2]. An increased density of these hotspots on the substrate surface results in stronger Raman and localized surface plasmon resonance (LSPR) signals. Therefore, integrating MIPs onto plasmonic substrates could enhances both surface-enhanced Raman scattering (SERS) and LSPR signals, significantly improving the detection of pollutants [3].

In this work, we use two types of plasmonic platform. The first one is composed of gold nanoparticles fabricated by electrodeposition and the second one consists of gold nanoparticle dimers fabricated by electron-beam lithography. On both substrate we deposit a Polypyrrole-based imprinted polymer. This conjugated polymer is deposited by electrochemistry in the presence of Rhodamine (RhB) which acts as a target.

For the substrate fabricated by lithography, the growth of the MIP occurs only within the gap of the dimers. However, no clear incorporation of RhB was detected. On the contrary, when using electrodeposited AuNPs, the MIP and the inserted RhB can be detected by LSPR and SERs spectra Extraction and rebinding of rhodamine was easily evidenced and an LOD of 27 nM by Raman and of 85 nM by LSPR were obtained.

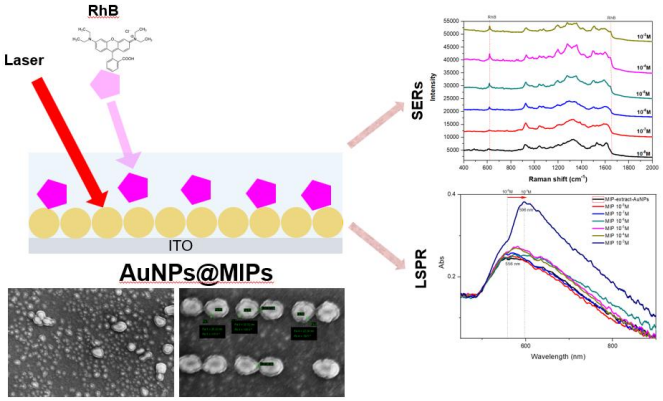

Figure 1 : Scheme of AuNPs@MIP, SERs and LSPR spectra of MIP after rebinding various concentration of RhB

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Incorporation of photoswitches into nitronylnitroxide ligands

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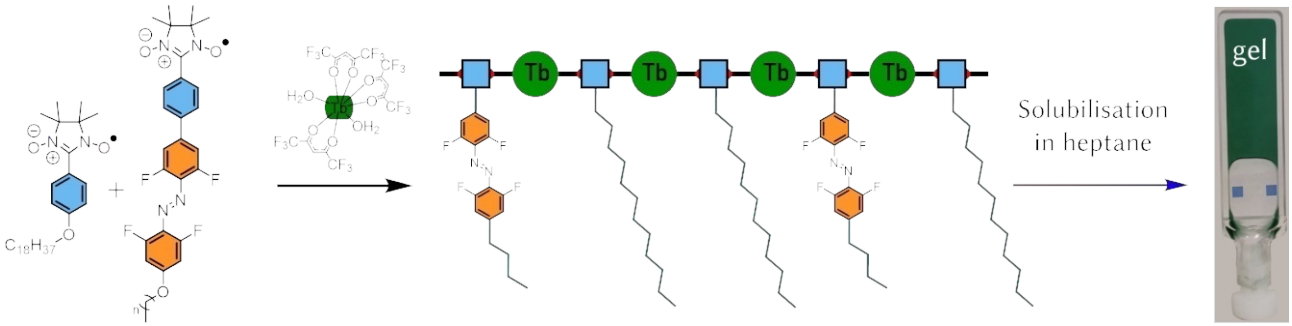

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Photocontrol of NIR to red lanthanide emission with P-type or T-type photochromism

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Photochromism has been widely used for optical control of luminescent materials with potential applications such as super resolution imaging or authentication solutions. The specificities of lanthanide-based emission combined with such light control may lead to innovative solutions in the fields of bioimaging and smart materials. Our group targets the development of photochromic lanthanide complexes, with a special interest in the NIR emitting ions, scarcely studied in comparison to the red emitting europium(III) ion. First, we have designed a P-type photochromic β-diketonate ligand (i.e displaying a photochemical back reaction) bearing a DTE unit that is very unique for the switching ON and OFF of lanthanide emission from NIR emitters (Yb, Nd, Er) to visible light emitters (Eu, Sm). Their related complexes show a dynamic emission response under UV excitation, in solution or in polymer films, with a reset under visible light excitation. We are also exploring the extension of this work through the design of T-type photochromic ligands to achieve time resolved reinitialization of the emission via an accurate thermal back reaction of the photochromic system (Fig. 1). The processes were investigated with the help various spectroscopic methods, including photodynamic studies, and theoretical calculations du unravel the photophysical mechanisms.

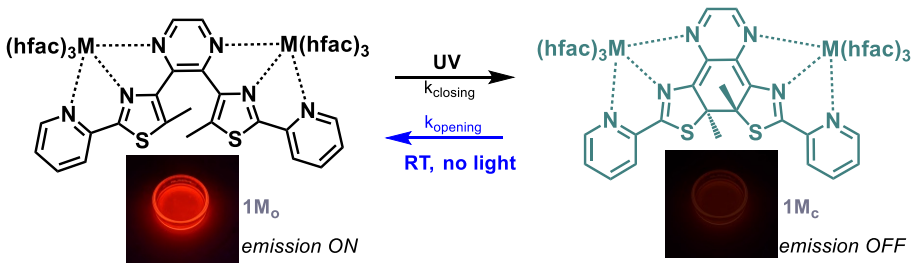

Figure 1: Photomodulation Eu(III) luminescence using a T-type photochromic ligand

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Photofunctional metal complexes of pi-rich amidine *N*-oxide ligands

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Photofunctional transition metal (TM) complexes have traditionally come from the second- and third-row of the d-block due to their favorable photophysical properties. These metal ions are, however, scarce, expensive, and pose more environmental concerns than their first-row TM alternatives. Despite these benefits, complexes with first-row TM ions often exhibit less desirable photophysical characteristics, such as shorter excited-state lifetimes and lower photostability. Overcoming these challenges through ligand design, coordination geometry optimization, and tuning of their electronic properties is crucial to unlock the potential of these metal ions for applications in solar energy conversion and photocatalysis.

Herein, we present a novel class of Co(III)-amidine *N*-oxide complexes exhibiting low-energy Ligand-to-Metal Charge-Transfer (LMCT) absorptions beyond 500 nm (Figure).[1] Higher lying pi-orbitals on the ligand scaffold lead to novel photophysical properties wherein the complexes exhibit higher energy emissions than the LMCT state, ie, they do not obey Kasha's rule. The nanosecond excited-state lifetimes of these Co(III) complexes pave new avenues for strong pi-donor ligands in the optoelectronic properties of complexes of abundant TM ions.

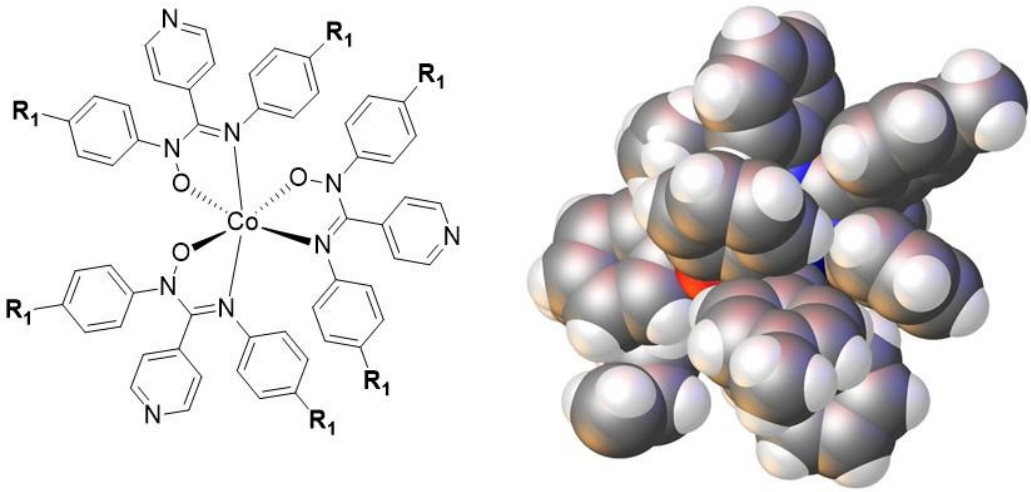

Figure : Co(III)(Amidine-*N*-oxide)$_3$ (left) and its X-ray crystal structure (right).

Acknowledgements: GSH thanks the Université de Bordeaux for a visiting professorship.

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In-situ photoNMR and its applications in photochemistry

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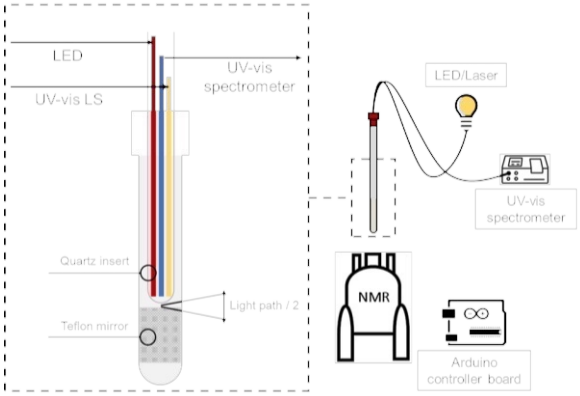
The development of drug delivery approaches is crucial for efficient spatial and temporal treatment of tumor or local control of vasodilation. One of the prominent approaches is the activation of a prodrug by light releasing active molecules in the desired area. In this context photoactivated chemotherapy (PACT) and photodynamic therapy (PDT) have attracted significant attention the last decades. Molecules suitable for both PACT and PDT must be stable and non-toxic in solution in the dark, while being activated by light, to release or activate species capable of suppressing cancer cells.

Since the study of such photo triggered reactions is usually limited by UV-vis studies that prove transformation of the reactants and/or production of the activated product, developing approaches that allow to efficiently resolve all products, side products, and potential transient species, is extremely important in order to comprehend the possible cytotoxic effects of these prodrugs. Up to now, the reasons for the scarce characterization of photolysis products are due to the methodological challenges linked to the complexity of the reaction mixture exhibiting transient species and including the potential formation of paramagnetic species.

To address these challenges our methodology relies on an in-situ photo-NMR approach where the use of optical fiber bundles allows sample illumination inside the NMR spectrometer. We can therefore make use of the high chemical resolution provided by NMR in order to follow photoreaction kinetics for all reactants and photoproducts including possible transient species. In addition, our setup also allows UV/vis absorbance measurements to be performed inside the NMR magnet to follow simultaneously the optical properties of the photoproducts. This feature allows to link molecular structure to optical properties and to determine pure photoproduct absorbance spectra in order optimize photoreaction conditions.



To illustrate the high potential of our methodology, two practical examples are presented. The first example describes the effect of extended illumination of the trans-[$RuNOPy_4F$]Cl_2 Ruthenium complex which exhibits nitrosyl release, but also multiple ligand exchanges with the most stable exchange product being trans-[RuPy4Cl2]. We show that the product is interestingly found both in diamagnetic (Ru^{II}) and paramagnetic (Ru^{III}) forms depending on the presence of light. In this study we employ solution NMR spectroscopy combined with in situ light irradiation to accurately follow the thermo-, photo- and redox processes within the system. The second example focusses on benzylidene-thiazolidine-2,4-dione (BTZD), which is a glitazone derivative that exhibits P-type photochromism and can undergo Z → E photoinduced isomerization upon irradiation at 310 nm.[1] Like in many other photoswitches exhibiting cis-trans isomerism, the absorbance spectra of (E)- and (Z)-BTZD overlap, which hinders quantitative isomerization and prevents the acquisition of the pure photo-product absorbance spectrum. To overcome this limitation, we employed the *in situ* UV-vis/NMR setup to characterise the photostationary states (PSS) and acquire photoisomerization kinetic profiles from the simultaneously measured NMR and absorbance spectra. Comparing the results obtained using the *in situ* setup with regular *ex situ* measurements, we demonstrate that the collective *in situ* data allows the determination of the pure photoproduct absorbance ((E)-BTZD) and can be used for irradiation wavelength optimization.

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Low-cost integrated photonics and non-linear optics using 3D printing on polymers associated to bipyrimidine for the creation of a broadband spectrum

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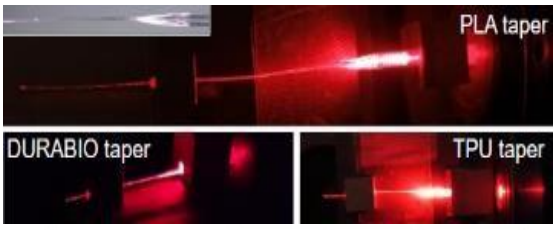
In recent years, 3D printing technologies have enabled the rapid production of a wide variety of parts and elements/pieces. At the same time, various micro-photonic components are still manufactured in cleanrooms, which generates significant operating costs. The idea behind this prospective work is to study the possible manufacture of optical fibers and giant tapers in integrated photonics using (bio)- polymers materials and 3D printers (G-code programming). After studying the extrusion speeds and temperatures of wires through a 150 µm diameter nozzle, it was possible to optimize the manufacture of tapers allowing high spatial compression of light (by a factor of several tens, that is compression mm to several tens µm). Optical propagation losses could be determined by a cut-back method used in integrated optics [1]. The future application plans to do in nonlinear optics, creation of broad spectra coupled or not to resonances (concepts of micro- resonators), it would be interesting to incorporate, for example, the bipyrimidine compound [2] into these organic materials during fiber weaving. With this goal in mind, a series of bipyrimidine based chromophores are prepared with alkoxy styryl groups and connected with electron accepting 2,2'-bipyrimidine cores which has been rooted for designing the pyrimidine that contain conjugated systems with complementary colors for luminescence and two photon absorption properties. Therefore, it is to be mixed with polymers and used in optoelectronic applications such as sensors and micro-resonators in the field of integrated photonics, as well as to create a broadband emission spectrum for nonlinear optics.



Taper fibers	PLA	DURABIO	TPU
Optical losses α (dB/mm)	0.34	1.08	0.15

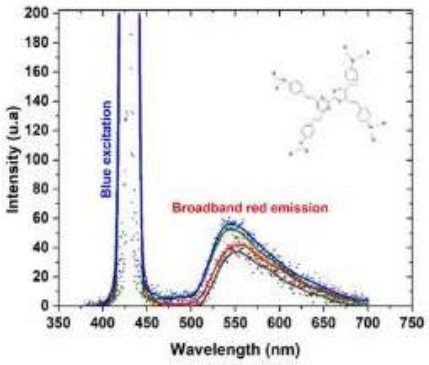


Fig. 1. Left: Top view of photonic injection into giant cones on DURABIO/PLA/TPU (bio)polymers. Guided propagation optical losses were measured between 0.15 and 1.08 dB/mm for the three organic candidates concerned. Right: Spectrometer measurements of a broad spectrum emitted/created in the red by bipyrimidine powder excited by a sharp blue laser.

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LUMINESCENCE OF EUROPIUM DOPED NANOPARTICLES IN WATER UNDER HIGH ENERGY PROTON BEAM

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Europium as a Rare Earth Element (REE) is widely used in fluorescent lamps, LED displays, anti-counterfeiting applications thanks to its excellent photoluminescence properties such as sharp red emission, large stokes shift and longer luminescence lifetime. To examine the characteristic localized dose rate effect (Bragg Peak) in water under proton beam irradiation, Europium doped Yttrium orthovanadate (Eu: YVO_4) nanoparticles (50-nm size) system has been used throughout our work. For a high energy proton beam (i.e., 25 MeV), it deposits a large part of energy in the Bragg peak while intensely ionizing the solution. During the energy deposition, the luminescence intensity decreases and depends on the position in the 1-cm cuvette along the proton track (Fig 1). To understand the impact of radical species provided by the water radiolysis processes and direct quenching of luminescence of the nanoparticles at Bragg peak, the system interaction with the proton beam is analyzed at various dose rates and chemical conditions. On the other hand, the recovery of the signal upon withdrawal of a high energy proton beam at different intensities reveals an equilibrium or a complex reaction system. A comparative study has been performed using single and multichannel optical fiber throughout this work for probing the luminescence along the track (Fig 1). We expect a critical discussion in light of the luminescence lifetime measurements of Eu: YVO_4 nanoparticles, also analyzed along the proton beam track.

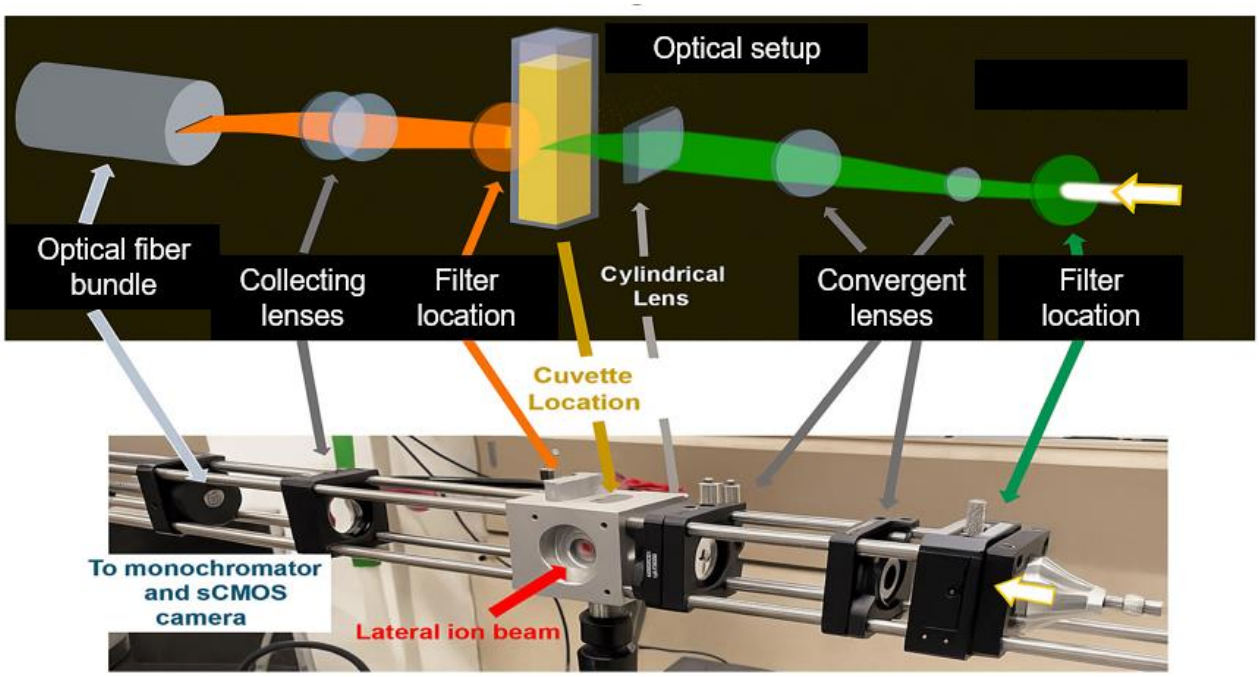

***Figure 1*:** Optical setup for proton beam irradiation (Audouin et al., 2025).

Acknowledgements

This project is funded by the dismantlement department of CEA.

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Practical insights into fluorescent microviscosity probes

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Viscosity is fundamental to numerous processes, with implications across fields including synthetic chemistry, biology, medicine, and industrial applications. However, techniques that can accurately characterize local rheological properties when only small sample volumes are available remain limited. In this context, fluorescent microviscosity probes, which provide a direct optical means of monitoring fluid properties at the micro- to nanoscopic scale through fluorescence intensity or lifetime measurements, have gained popularity in recent years. Accordingly, their use currently spans a broad range of applications, from in situ monitoring of polymerization reactions to fluorescence microscopy imaging of cellular processes.[1]

In this contribution, we will explore the limitations in interpreting the viscosity-dependent fluorescence response of these dyes and question their quantitative use in complex media. In particular, we will focus on *meso*-phenyl-BODIPY derivatives (a class of molecules often referred to as "fluorescent molecular rotors"), specifically engineered to probe low microviscosities. Limitations in the calibration procedure that depend on the molecular design will be demonstrated. In addition, using binary and ternary polyethylene glycol mixtures, we propose a framework to reconcile the observed response with the cybotactic environment of the dyes.[2] These results should help strengthen studies of complex fluid properties in confined systems, such as those encountered in industrial or biological contexts.

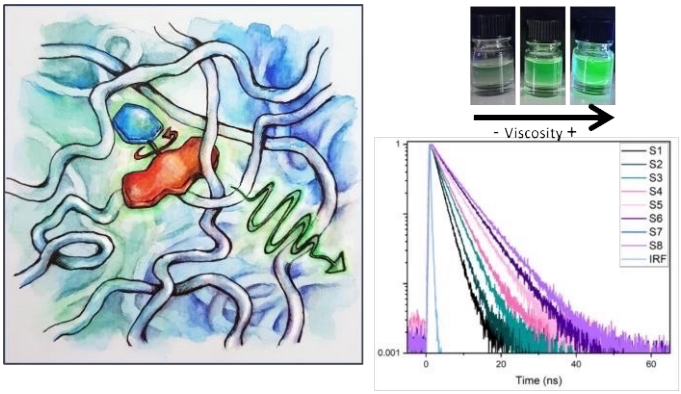

Figure : Schematic representation of a microviscosity probe in macromolecular mixtures and fluorescence lifetime increase with the viscosity of the solvent.

Acknowledgements

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Selective photopolymerization and thermopolymerization induced by plasmonic excitation of gold nanoparticles

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Localized surface plasmon induced polymerization of free-radical acrylate monomers is an efficient, smart, and versatile method for fabricating metal/polymer hybrid nanoparticles (NPs). This approach enables accurate control over polymer thickness and spatial distribution on the NP surface. Through its decay processes, the plasmon emits light, hot charge carriers and heat (i.e. thermoplasmonic), each of which can be used to induce polymerization. While the photochemical pathway has been widely exploited to generate hybrid NPs, the thermoplasmonic approach has not been used in this context. We investigated both photochemical and the thermoplasmonic pathways to graft polymer onto gold NPs. Each pathway is selectively activated using a dedicated formulation: a photopolymerizable formulation containing a photo-initiator or a thermopolymerizable formulation containing a thermal initiator.

For photopolymerization, the spatial distribution of the polymer reveals the electric field of the NP, especially in geometries with strong field localization, such as nanorods and nanotriangles (NTs). In the case of nanodisks and nanohexagons, with less field localization, a continuous polymer layer is observed (Fig. 1a). [1]

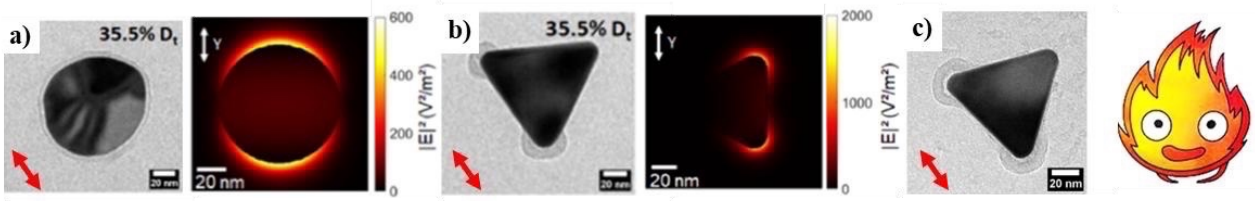

Figure 1: TEM images associated with field intensity map showing photopolymerisation [1] at the vicinity of a a) nanodisk, b) nanotriangle and c) thermopolymerization at the tips of a nanotriangle. [4]

For thermopolymerization, we developed and characterized a specific formulation with a threshold polymerization temperature of 130°C, validated in the context of dense gold NP samples. [2] This formulation exhibits no absorption in the visible range, ruling out any photopolymerization mechanism. By tuning the laser regime, from continuous wave to fs pulses, we demonstrated the ability to generate millimetric polymer dots to nanometric polymer shells around each NPs; on the same dense gold NPs samples through thermoplasmonics. [3] On colloidal gold NT, we further observed that the thermopolymerization does not form a continuous layer around the NT (Fig. 1b). Instead, the localized pattern of polymer on the NT reveals a non-homogeneous temperature distribution within this structure, which can be mapped by our thermopolymerizable formulation. [4]

Acknowledgements

This work was partly carried out at the IPCMS-Ultrafast user facility funded by PEPR LUMA (reference ANR-22-EXLU-0002).

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ON/OFF Photoswitching of magnetism and luminescence in a compact bis(nitronylnitroxyl)dithienylethene diradical

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Dithienylethenes (DTEs) are ideal candidates for photoswitching of the magnetic and luminescent properties in many compounds.[1] Particularly, their functionalization with nitronyl-nitroxide (NIT) radicals in various structures has enabled the control and photomodulation of the exchange interaction between the radicals.[2] As the strength of this exchange interaction depends on the number and nature of the spacers separating the radicals,[3] we focused on a novel and synthetically challenging target featuring a direct connection between the NIT and the DTE core, to maximize the contrast in magnetic properties between the two isomeric states (**1**, Figure 1a).

Our experimental studies using variable temperature EPR and SQUID measurements revealed a pronounced change in the exchange interaction upon photoisomerization, ranging from nearly non-interacting radicals in **1o** (J_{ex} = -1 cm^{-1}, $\hat{H} = -J\hat{S}_A\hat{S}_B$) to strongly antiferromagnetically coupled ones in **1c** (J_{ex} = -103 cm^{-1}, Figure 1b). These experimental observations are in good agreement with theoretical calculations predicting a spin-polarization-mediated antiferromagnetic coupling of comparable magnitude. Additionally, luminescence measurements carried out on **1o** and **1c** led for the first time to an efficient photocontrol of the NIT-based luminescent response (Figure 1c). Finally, the impact of directly grafting the NIT moiety onto the photochromic core on the thermal stability and photoisomerization quantum yields was investigated.[4]

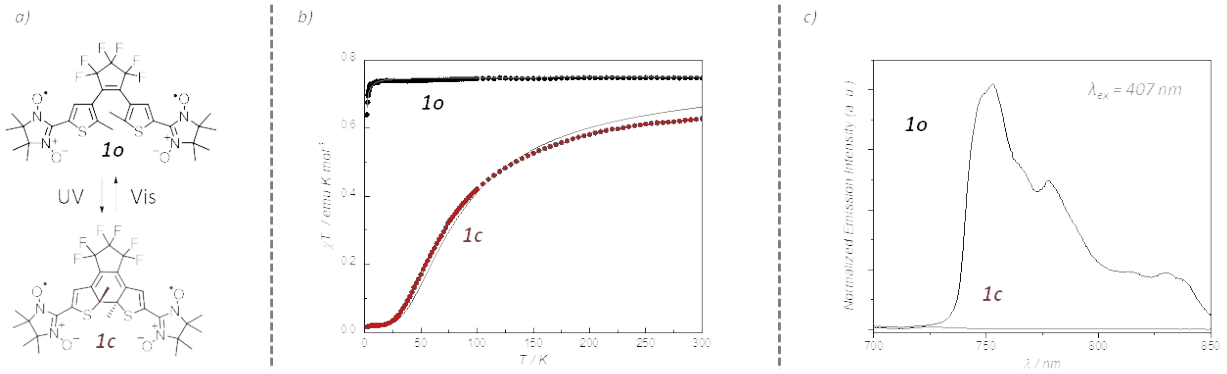

Figure 1 : *a) Isomerization scheme of **1**, b) Exchange interaction photomodulation of **1**, c)Photomodulation of the NIT-based luminescence of **1**.*

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Optical Fluorescent Biosensors: A bright nanotool for early detection for bacteria

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Throughout human history, bacterial infections have posed significant health challenges that constantly requires improved medicines and efficient detection methods.[1] To address this second issue, we developed an optical biosensor based on fluorescent organic nanoparticles (FONs) with a pH sensor to detect bacteria growth. These FONs offer higher photostability and tunable emission wavelengths, making them ideal for biosensing.[2] Previous studies by M. Pan showed the potential of FONs with a BODIPY in the hydrophobic core and a hydrophilic shell for their versatility and early bacterial growth detection.[3] In this present work, we created an optical fluorescent biosensor by combining a pH-sensitive fluorophore (probe)[4] onto green BODIPY FONs[5] by click chemistry, utilizing dual-ratiometric fluorescence for sensing. Their photophysical properties were tested in pH buffers where the fluorescence intensity increased in acidic media and a pKa of 5.3 ± 0.2 was determined. After, the toxicity against bacteria and bacterial growth detection were studied.

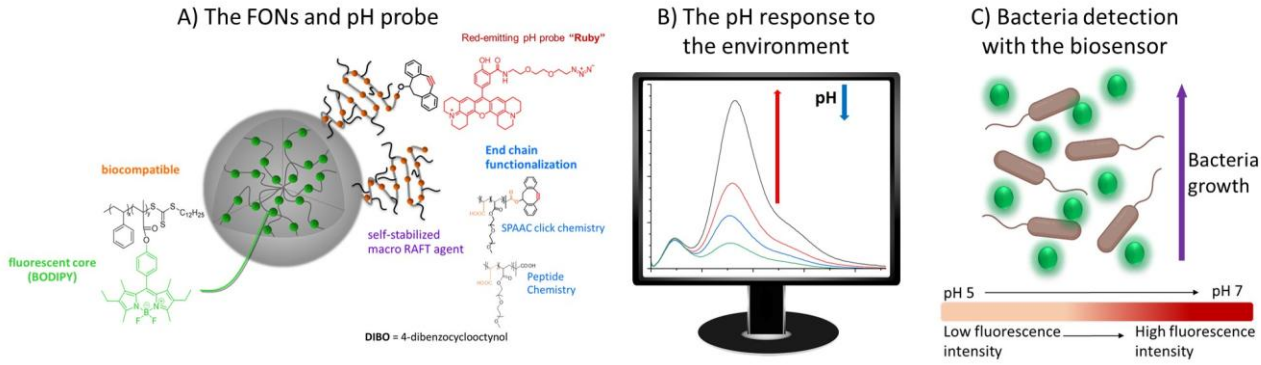

Figure 1: A schematic representation of the optical fluorescent biosensor design (A), their pH response in fluorescence as pH decreases (B), along with how the biosensor will detect bacteria (C) (parts of the image made by biorender).

Acknowledgements

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Atmospheric Photosensitization: Sulfite-Enhanced Phenol Transformation in Cloud Water

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Clouds, which contain diverse inorganic and organic compounds, serve as a critical microenvironment for complex chemical reactions, particularly under solar irradiation[1]. Among the reactive intermediates formed, excited triplet states of organic compounds ($^3C^*$) are generated through photoexcitation of light-absorbing organics (e.g., brown carbon, BrC)[2]. In addition to its inherent oxidative capacity and electron transfer with O_2 to produce singlet oxygen ($^1O_2$), its reactivity with inorganic species such as sulfite (S(IV)) has attracted increasing attention. The traditional discussion on sulfate (S(VI)) formation from S(IV) is centered on the role of oxidants like hydroxyl radical ($^{\bullet}OH$), ozone, and hydrogen peroxide. However, the potential pathway involving $^3C^*$ and the underlying reaction mechanism remain highly uncertain. In this study, phenol, a crucial atmospheric pollutant, was selected as the target compound to investigate the photochemical reaction between $^3C^*$ and S(IV) in cloud water. 2-benzoylbenzoic acid (BBA) was employed as a precursor for $^3C^*$ under simulated solar irradiation. The apparent rate constants (k_{obs}) of phenol phototransformation were determined to be k_{obs} = 1.54 × 10^{-4} s^{-1} (*hv*-BBA-S(IV) system) and k_{obs} = 1.92 × 10^{-5} s^{-1} (*hv*-BBA system), showing an approximately 7-fold enhancement by introducing S(IV). Quenching experiments demonstrated that a series of sulfur-centered radicals, including $SO_3^{\bullet-}$, $SO_4^{\bullet-}$, $SO_5^{\bullet-}$, together with $^1O_2$ contributed to phenol removal, with $^1O_2$ playing the major role. The formation rate and steady state concentration of $^1O_2$ in the *hv*-BBA-S(IV) system were quantified as R_{1O2} = 1.05 × 10^{-7} M s^{-1} and $[^1O_2]_{ss}$ = 4.00 × 10^{-13} s^{-1}, respectively. Furthermore, transient absorption spectroscopy revealed that the second-order rate constant between $^3BBA^*$ and S(IV) was 5.70 × 10^9 M^{-1} s^{-1}. These results indicate that the reactivity between $^3C^*$ and S(IV) may serve as an important source of $^1O_2$ and contribute significantly to the transformation and fate of organics in atmospheric aqueous phases.

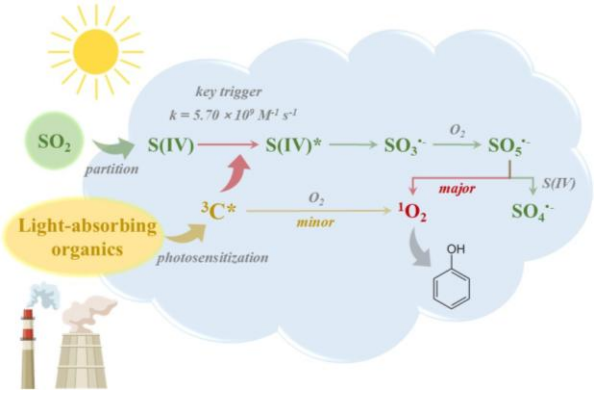

Figure Proposed mechanism of sulfite-enhanced phenol transformation with photosensitizer

Acknowledgements

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A NOVEL PHOTOSWITCHABLE COPPER-BASED MOF FOR SUSTAINABLE PHOTOCATALYTIC HYDROGEN GENERATION

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With increasing global energy demands and growing concerns over climate change, the development of greener energy sources has become urgent. In this context, hydrogen (H_2) production plays a key role, as H_2 is considered one of the energy vectors of the future, with applications in fuel cells and as a storage medium for renewable energy. However, currently H_2 is mainly produced from reforming process of fossil energies leading to huge amount of CO_2. Therefore, development of greener production processes is necessary. Photocataly tic hydrogen generation using only sunlight, water and photocatalysts represents a promising alternative to conventional methods due to its low cost and scalability. Upon light activation, the photocatalyst generates e^-/h^+ pairs; the electrons reduce H^+ to H_2 while a sacrificial agent scavenges the holes, minimizing charge recombination. Although high-performance photocatalysts often rely on noble metals (such as Pt, Pd or Au) used as cocatalysts, considerable research effort is being directed toward developing noble-metal-free materials for efficient photocatalytic water splitting [1]. Recent studies have shown that Cu-based metal organic frameworks (MOFs) are very promising for H_2 photocatalytic generation [2].

In this work, we present a novel photo switchable copper-based MOF Cu(I)AzoBiPy, synthesized via simple room-temperature mixing of CuI and the linker 4,4'-bipyridine in acetonitrile solution, and evaluated for photocatalytic H_2 production. Composites with commercial TiO_2 P25 were prepared at various mass ratios and the composition was optimized for better photocatalytic activity. Both the MOF and the composites were thoroughly characterized by XRD, FTIR, UV-Vis, EPR, XPS, TEM, and time resolved microwave conductivity (TRMC). Photocatalytic tests were performed using triethanolamine (TEOA) as a sacrificial electron donor under a 150 W mercury lamp (Fig. 1), achieving a promising H_2 production rate of 5.53 mmol g^{-1} h^{-1} for the Cu(I)AzoBiPy/TiO_2 1:20 composite.

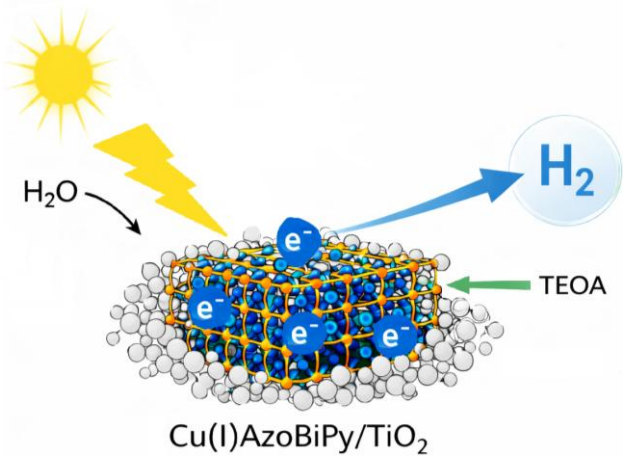

Fig.1: Schematic illustration of photocatalytic H_2 production with Cu(I)AzoBiPy/TiO_2 composites.

Acknowledgements

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Ni-functionalized GaAs photoelectrodes for solar-driven water splitting

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Solar-driven water splitting presents a promising route for converting sunlight into chemical fuel (Hydrogen, H_2) offering a sustainable pathway for clean energy production.[1] Among the various semiconductors employed for photoelectrochemical (PEC) water splitting, GaAs is considered one of the most attractive candidates due to its suitable direct bandgap (1.42 eV) and excellent charge transport properties.[2] However, a major challenge remains: GaAs, like other III-V materials (e.g., InP, GaP), is unstable in aqueous media particularly under oxidative conditions, where self-oxidation is thermodynamically favored over the oxygen evolution reaction (OER), leading to GaAs degradation and performance loss.[3]

In this work, we report the modification and investigation of GaAs-based photocathodes integrated with Si substrates for solar-driven water splitting. The photocathodes were modified with Ni particles and studied in alkaline medium. The Ni/GaAs/Si:p photocathodes demonstrated their capability to photoelectrochemically reduce water into green hydrogen under illumination.[4] In the second part of this work, we study the GaAs photoanodes and their capability to drive OER. Nickel is employed as a bifunctional layer, serving both as a protective coating for the underlying GaAs and as an OER electrocatalyst.

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Spectroscopic insights into mechanofluorochromic and long-lived emissive organic materials

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Mechanofluorochromism is a change in fluorescence profile of a solid upon application of stress. Emission is termed long-lived when the measured decay time is on the microsecond to millisecond or longer timescale. Organic materials that exhibit both these phenomena are highly promising for use in many applications, including information encryption, mechanosensing, bioimaging/sensing, and optoelectronic devices. The aim of this study was to elucidate photophysical mechanisms in donor-acceptor organic crystalline materials that exhibit both of these phenomena, and then apply them to information encryption. Mechanistic understanding is key for establishing design principles to tune emission pathways. A combination of steady-state and time-resolved spectroscopy techniques allow for unravelling of the complex decay pathways that govern these materials. This is highlighted here through studies on a mechanofluorochromic keto-coumarin derivative, revealing prompt fluorescence from states of different excited-state character, delayed fluorescence, and room temperature phosphorescence. The long-lived emission lifetime is increased significantly by doping this material into an organic matrix, allowing two-level information encryption to be demonstrated.

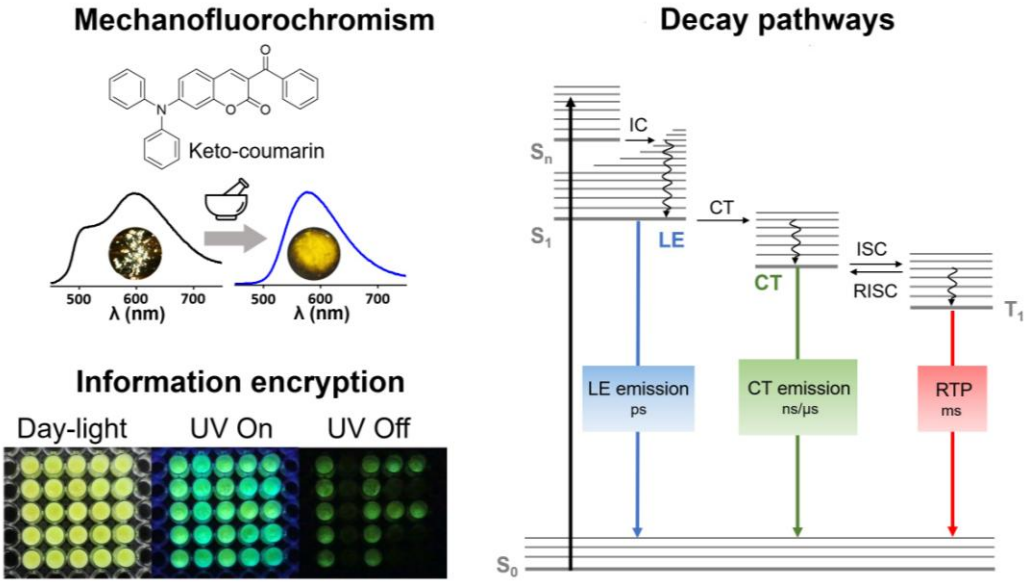

Figure 1: Mechanofluorochromism, information encryption, and Perrin-Jablonski diagram highlighting the various decay pathways present in a keto-coumarin molecule.

Acknowledgements

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Surface-modified rare earth fluoride nanoparticles: applications for cancer imaging and therapy.

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Photodynamic Therapy (PDT) is among the strategies for cancer treatment at clinical level. PDT is based on the uptake of a photosensitizer (PS) which, upon excitation by light in a wavelength in the NIR, reacts with oxygen and generates reactive oxygen species (ROS - radicals, singlet oxygen), able to kill cancer cells directly and/or damage tumor microvessels. However, PDT suffers from a limited use due to the shallow tissue penetration of light and is thus limited when deep tissues are concerned. To overcome that drawback, X-rays activated Photodynamic Therapy (XPDT) appears as a promising approach and reach deeper tumors by exploiting the high tissue penetration of X-rays. The mechanism of X-PDT is based on the conversion of X-ray photons into visible light capable of efficiently exciting photosensitizers. This conversion can be achieved using nanoscintillators (NS), able to transfer the emission to adjacent photosensitizers.

In the present work, the design of nanoprobes capable of generating ROS under low energy X-rays irradiation will be described. [1] Here, the X-ray doses will come from a Spectral Photon Counting CT (SPCCT), a new imaging modality based on conventional CT but using energy-resolving detectors. The spectral information enables material separation and provides additional contrast with clinically relevant information. A key feature of spectral CT is K-edge imaging, which allows selective and quantitative detection of elements such as iodine, gold, bismuth, gadolinium, or ytterbium.

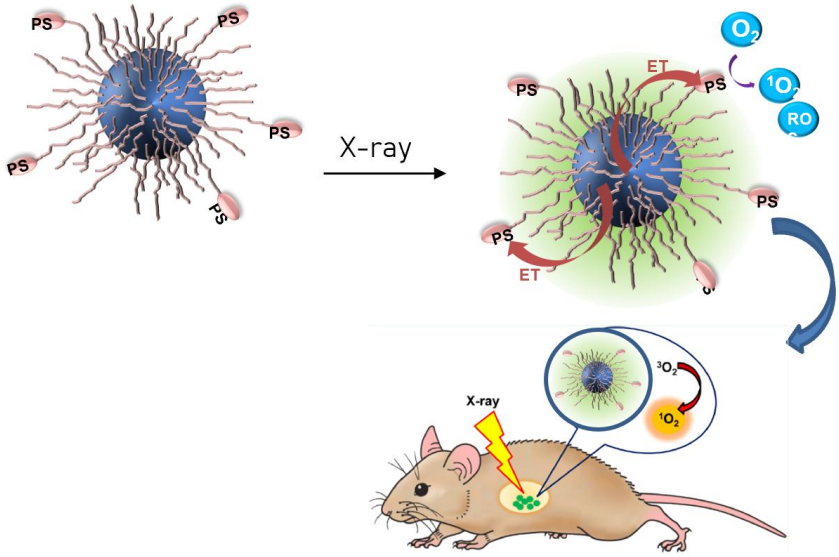

***Figure* 1**: Schematic illustration of the operating mechanism of specific nanoprobes.

Acknowledgements

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Ultrathin Light Emitting Electrochemical Cells From Photo and Redox Active Molecular Layers

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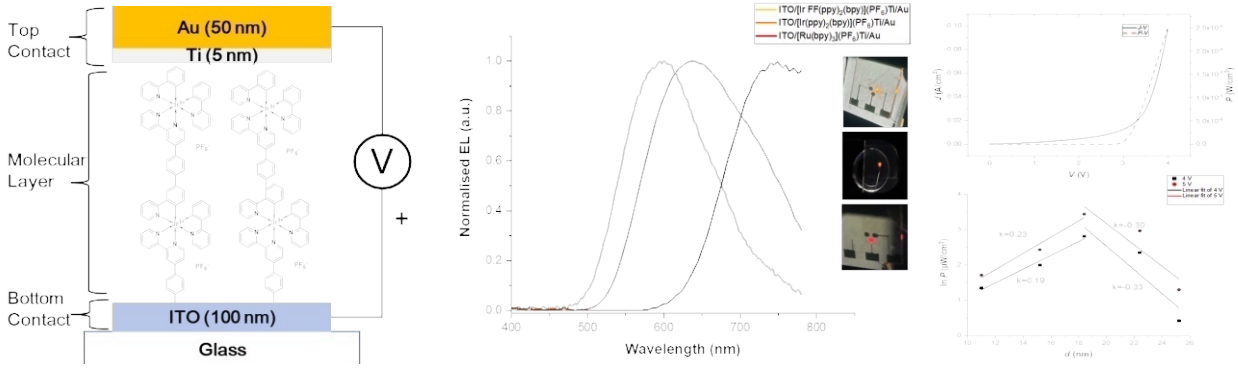
Molecular electronics (ME) is a scientific domain, aiming at developing devices for information technologies. The initial motivation of ME was to mimic conventional silicon-based electronic devices with molecules, which was also driven by the dream of extending Moore's law beyond the current miniaturization limits of complementary metal oxide semiconductor (CMOS) technology.[1] Molecular junctions (MJs) are the key building blocks of ME, which could be created at the single molecule level or in large area systems. Compared to single molecular, the large-area molecular junctions (via self-assembly, Langmuir–Blodgett, or other methods) allows the massive fabrication of high-quality and reproducible MJs, they are much more appealing for industrial processes. The large-area MJs incorporating Ru(bpy)3 has already shown light emission in eC/Ru(by3)/e-C with semi-transparent electrode.[2,3] In this talk, the fabrication of the devices will be made on ITO, which could be made by lithography and wet etching, making it possible to generate 500 , 1000 or 3000µm wide and fully transparent electrodes which are used for electrochemical grafting. They would be used in the development of ultrathin layers (thickness between 10 and 30 nm) and ITO_{100}/ Molecular multilayer /Ti_5/Au_{50} molecular junctions. Transport properties and light emission was investigated in these ultrathin solid-state MJs, A threshold of 2.7 V was evidenced to trigger light emission and is coherent with a mechanism based of redox events occurring within the junction showing that these MJs can be seen as the thinnest light emitting electrochemical cell developed. [4,5]



Acknowledgements

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ULTRAFAST DYNAMICS OF RELAXATION IN WELL-DISPERSED & SIZE-CONTROLLED NANOGRAPHENES

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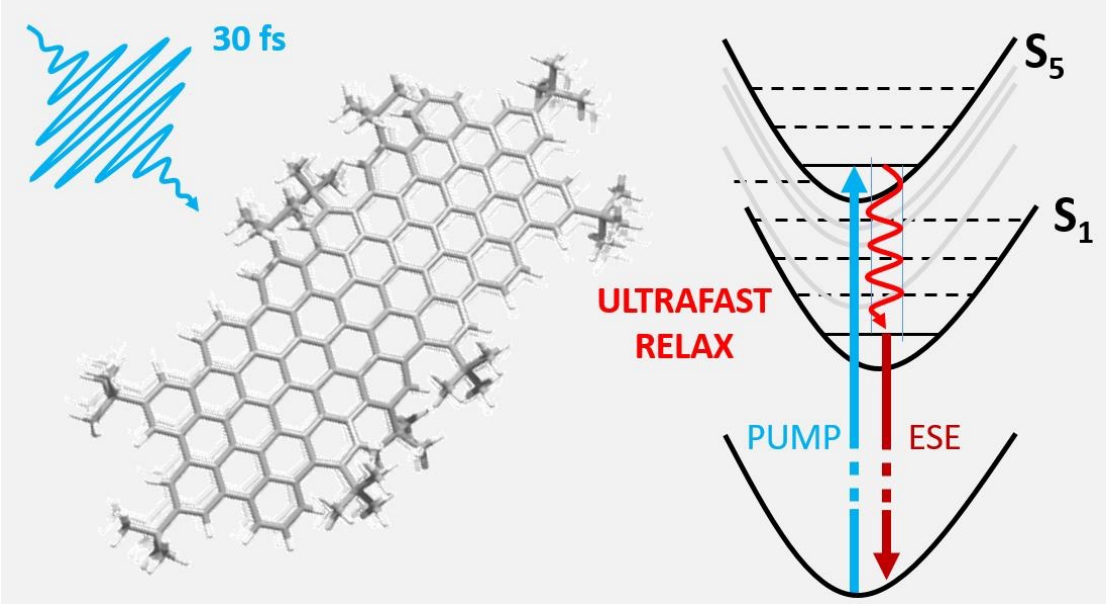
Recent chemical synthesis development through bottom-up approaches have led to **nanographenes** with exceptionally well-controlled size, shape and dispersion.[1] Among them, rectangular graphene nanoflakes (G-NFs) have provided tunable emission (energy and radiative rate) depending on their lateral sizes, combined with a **photoluminescence (PL) quantum yield close to 1**.[2] Here we use **transient absorption** (TA) of 40 fs temporal resolution to probe the **internal conversion and vibrational relaxation** in rectangular G-NFs composed of exactly 96, 114 and 132 conjugated carbons. The strongly limited aggregation allows a clear observation and identification of the discrete ground state bleaching (GSB) and excited state emission (ESE) signals. We selectively excite the different samples at optically active electronic transitions and vibrational replica. Thought the appearance of ESE signal at the energy of the steady-state PL peaks, the dynamics of relaxation were unveiled. The resulting electronic relaxation times range from 130 fs to 180 fs and are **limited by the vibrational relaxation step**.[3]



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Luminescent flexible Metal-Organic Frameworks for shock detection

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The detection of mechanical shocks has significant practical applications, for example in the aviation sector, where ensuring the structural integrity of the aircraft remains a major safety concern. To this end, it is necessary to develop materials whose properties (such as colour) can be switched under pressure and which can be formulated, for example as paints.

Coordination compounds such as luminescent complexes are solids whose properties can be switched under the effect of external pressure. However, their dense crystalline structures make them particularly sensitive to pressures above 1 kbar, due to their low compressibility (on average around 1% by volume per kbar). [1] Furthermore, this switching is often reversible, making the detection of shocks impossible. In contrast, some Metal-Organic Frameworks (MOFs) can exhibit significant flexibility, associated with a volume change of up to 50% under 1 kbar of pressure. Furthermore, this phase transition can be controlled by the adsorption of gases or vapours within the pores and may, in some cases, be irreversible.[2] Moreover, the structure of these solids can be modulated (nature of the metal, ligand functionalisation, crystal size) to control the conditions (T, P, other stimuli) under which the phase transition occurs. These materials therefore appear to be ideal for shock detection. However, the structural changes observed under pressure are not associated with any easily detectable change in physical properties.

In this contribution, I will demonstrate that we can combine the properties of these two classes of compounds through the formation of switchable porous coordination nanocrystals obtained by inserting luminescent species into the pores of highly porous and flexible MOFs. On such solids, the application of a hydrostatic pressure induce a non reversible structural change associated with a red shift of their luminescence spectrum, evidencing their potential for optical shock sensing.

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When research-based teaching labs reveal near-unity multistep energy transfer in common orange STABILO®

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In 2020–21, as part of a research-based laboratory course for third-year bachelor students (L3),[1] one project on STABILO highlighters revealed an unexpected phenomenon of excitation energy transfer (EET). Guided by curiosity and the desire to understand it more deeply, researchers from different fields collaborated to show that a common commercial orange highlighter ink achieves both direct and multistep EET with near-unity efficiency—94.4%—one of the highest reported in the literature (Figure 1A).[2] This outstanding performance arises from a stable dispersion of dye-loaded polymer nanoparticles, about 134 nm in size, and the dispersions can also serve as an efficient water-ethanol sensor, based on their different behavior in water and ethanol (Figure 1B), with almost no EET observed in ethanol (0.3%).

This communication will detail the genesis of this discovery and how steady-state and time-resolved spectroscopy, microscopy, and HPLC were used to characterize these unique properties. It will also highlight how innovation can emerge from everyday materials. It will also highlight how everyday materials can lead to innovation by providing a low-cost, readily available system suitable for a wide range of applications.

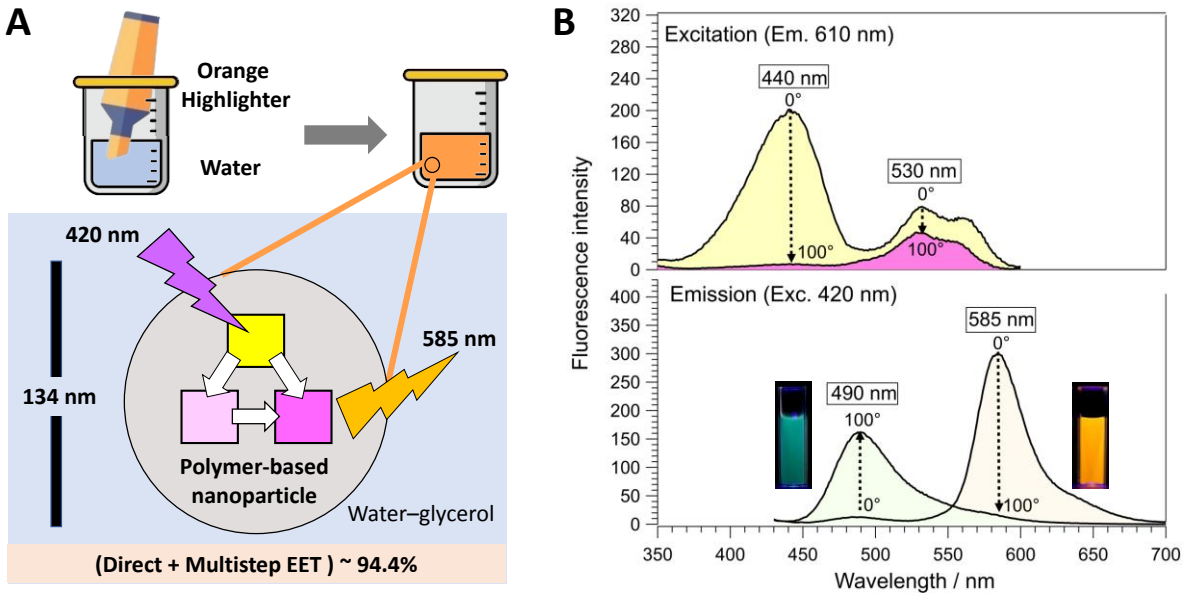

Figure 1: (A) Schematic representation of the emission behaviour correlating with the observed EET efficiency for orange highlighter in water. (B) Emission spectra (λ_{exc} = 420 nm) and excitation spectra (λ_{em} = 610 nm) of orange highlighter in water (0°) and ethanol (100°).

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Synergistic effect of nano-assemblies of photosensitizers and magnetic nanoparticles for cancer phototherapy

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The aim of the project is to study the synergistic effect of photosensitizers and iron oxide nanoparticles (IONPs) gathered in nano-assemblies[1] for a dual cancer phototherapy approach under near infra-red (NIR) irradiation (typically at 808 nm). Indeed, it is possible to treat tumors by exciting photosensitizers with a laser, which induces the production of singlet oxygen and reactive oxygen species that are cytotoxic. The use of two-photon excitable photosensitizers in NIR region allows a deeper penetration in the tissues.[2,3] Simultaneously, this same NIR laser radiation induces a local heating mediated by the IONPs. This photothermal mechanism leads to a selective toxicity towards tumor cells, which are more sensitive to temperature than the healthy ones.[4]

The study focuses on porphyrin and phthalocyanine photosensitizers carrying carboxyl functions which should increase the cohesion of the nano-assemblies by coordinating the IONPs. The nano-assemblies are prepared by flash nano-precipitation in a confined impinging jet (CIJ) mixer. Their cores are composed of photosensitizers and IONPs and surrounded by a stabilizing polymer. Nano-assemblies were prepared and their stability and physicochemical properties are studied.

Acknowledgements

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Singlet fission: From Solution to Nanoparticles and Thin Films

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Singlet fission (SF) is an ultrafast, spin-allowed process that generates two triplet excitons by absorbing a single photon.[1] This process has gained significant interest due to its potential to surpass the Shockley-Queisser limit for solar energy conversion and enhance the efficiency of photovoltaic devices.[2] Hence, SF has been extensively studied in solid-state systems, which is practical for device fabrication. However, in thin films, understanding the fundamental physics underlying the process is complicated due to various solid-state effects, such as structural disorder and strong intermolecular coupling. On the other hand, solution state studies provide a clear mechanistic view in a relatively simple molecular environment. [3]

In this work, we investigate singlet fission in a novel rylene derivative molecule across different environments: solution, nanoparticles, and thin films. Using steady-state and time-resolved spectroscopic techniques, we compare the excited-state dynamics in these three environments to elucidate the mechanism of singlet fission. Our results show that singlet fission is not observed in solution but emerges in nanoparticles and thin films, highlighting the crucial role of intermolecular interactions and molecular packing in enabling the SF process. This comparative approach could provide insights to optimize rylene-based materials for efficient singlet fission and future light-harvesting applications.

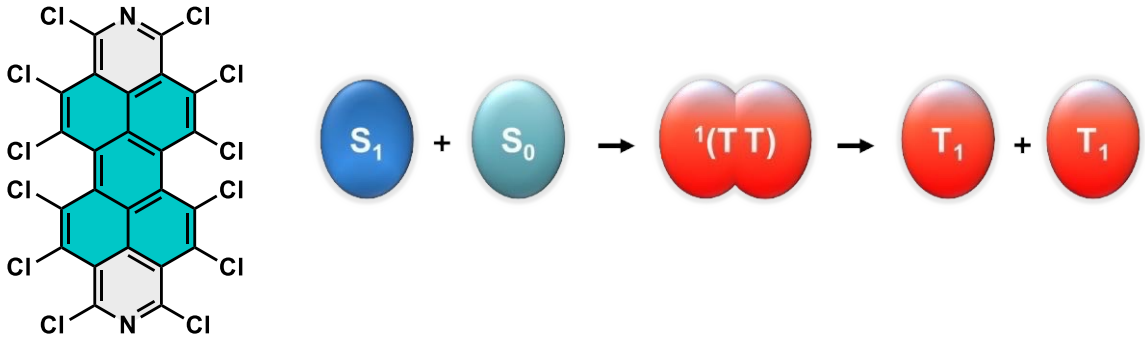

Figure : (Left) Molecular structure of rylene derivative. (Right) Schematic representation of singlet fission

Acknowledgements

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Precise control of energy release in a photo-electroswitchable ionic couple

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The chemists' contribution to the quest for clean and renewable energy is a molecular-level approach based on photoswitches, which are photoisomerised from a stable to a metastable form, lying at higher energy. *De facto*, such isomerization converts light into chemical energy, which is then stored and released - spontaneously or catalytically - in form of heat when the back isomerization occurs.[1] One of the current issues is that a fast and on-demand discharge requires a catalyst, preventing from the repeatability of the cycle and deepening the gap from practical applications.[2]

We have recently reported an ionic pair involving a photoswitchable azobenzene-type cation and an electroswitchable polyoxometalate anion. Azobenzenes undergo *E*-*Z* photoconversion, while the *Z*-to-*E* isomerization occurs spontaneously or upon proton-catalysis.[3] We therefore endowed the azobenzene with an ammonium moiety close to the central azo bond to promote self-catalysis. The counteranion is a molecular metal oxide with a redox-tuneable basic character. As such, by simple external redox inputs we were able to switch on/off the catalysis, and, thus, to control the energy discharge.

These results highlight the high potential of polyoxometalates as triggers in molecular-level energy storage, as they allow the coexistence of the photoswitch and of its catalyst in the same medium, whose interaction can be activated on demand by external inputs, and guarantees the repeatability of the cycle. Moreover, thanks to the versatility of polyoxometalates in being integrated on solid surfaces, this study makes a leap forward towards the implementation in devices, and pave the way for future applications.

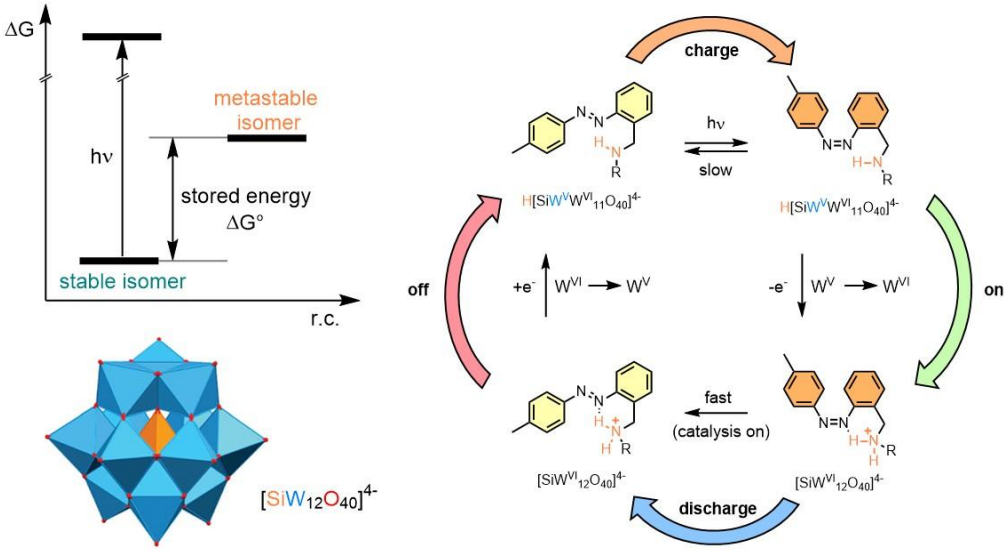

Figure: Top left: energetic diagram of the molecular-level energy storage; bottom left: structure of a Keggin-type polyoxometalate $[SiW_{12}O_{40}]^{4-}$; right: charge and discharge cycle of the photo-electro-switchable ionic couple.

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Increased Efficiency of DUV Photolithography of Chitosan bioresist with new water-soluble PAGs

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Microchip production constitutes a very important industry, however, current fabrication processes use chemicals that pose health risks and are environmental hazards during disposal. Bio-sourced polymers have been studied to aid in the transition to eco-friendlier processes. The polysaccharide chitosan has shown promise as a water-soluble photoresist in photolithography at 193 nm (Deep UV), already behaving as a positive tone resist *via* chain scission of its glycosidic bonds.[1] A commercial photoacid generator (**PAG 0**) was tested to enhance this effect;[2] however, its sensitivity is still lower than industrial standards. Two new fluorine-free water-soluble PAGs conceptually inspired by commercially available sulfonium salts were synthesized and incorporated in the chitosan resist platform significantly improving the sensitivity of the resulting films in DUV photolithography by reducing the dose-to-clear value and demonstrating the possibility for photomask patterning.

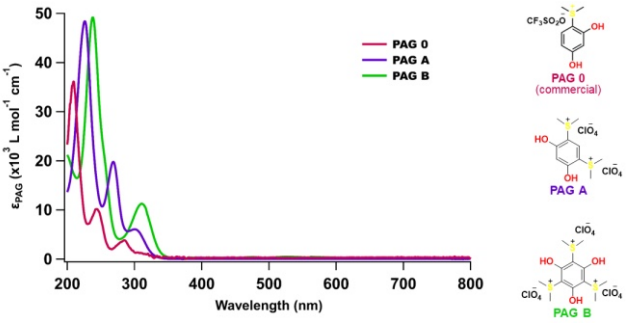

Figure 1. Absorbance spectra graph of molar extinction coefficient of photoacid generators **PAG 0**, **PAG A** and **PAG B** (0.0015% wt/wt) in water.

Acknowledgements

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Cathodoluminescence spectroscopy analyses of defects trapping in InGaN/GaN nanowire heterointerfaces

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Crystallographic point defects in InGaN/GaN planar structures limit quantum efficiency and hinder efficient red emission, mainly due to to strain-induced limitations in In incorporation. This strain makes the incorporation of high concentration of In in the InGaN lattice extremely difficult and is the driving force for the compositional pulling effect in InGaN [1]. Similar compositional inhomogeneities and interfacial defects have been observed in our recent investigations in molecular beam epitaxially (MBE) grown InGaN/GaN nanowire multi-quantum well (MQW) structures using cathodoluminescence spectroscopy (CL). In addition to compositional gradients along the MQW structure and non-radiative recombination centers limiting emission efficiency, undesirable radiative recombination has been observed in CL that is spatially localized at InGaN/GaN heterointerface.

In the present contribution, we investigate epitaxial strategies to both mitigate the compositional pulling effect for achieving In-rich InGaN insertions and at the same time to reduce the point defects in the InGaN/GaN superlattice grown by plasma-assisted MBE. Two approaches are explored: (i) insertion of an InGaN buffer with low In content between the GaN NW base and the InGaN/GaN NW superlattice, separated by a very thin GaN barrier, and (ii) the use of InGaN sacrificial layers between the GaN NW base and MQW structure with the same In composition as the QW separated by a thick GaN insertion. The influence of the InGaN buffer and InGaN sacrificial layer growth conditions on defect trapping and optical properties has been investigated with high resolution CL spectroscopy at room temperature and at 10 K. The hyperspectral mapping of the heterostructures along the NW axis is also investigated. The insertion of InGaN buffer and sacrificial sections have been found to suppress the undesirable defect related emissions further modifying the emissive behavior of NW MQW. In addition, the compositional gradient along the MQWs is effectively reduced leading to improved emission characteristics.

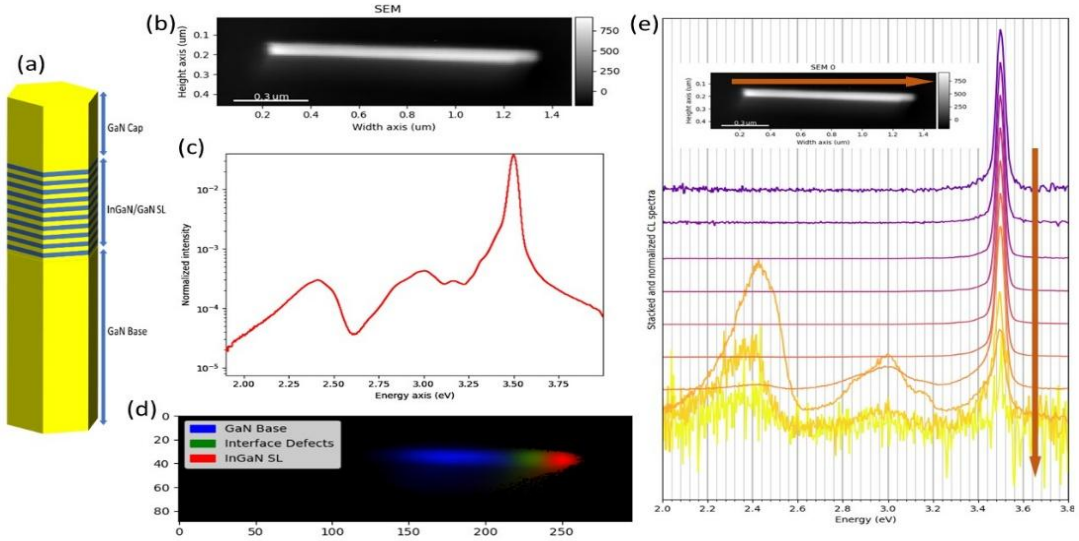

Figure 1. a) Schematic of the NW structure. (b) SEM of the NW. (c) Average CL spectrum recorded from the NW. (d) Spatial mapping along the length of the NW. (e) Line scan and corresponding luminescence spectra along the length of the NW.

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PRODUCTION OF H_2O_2 BY PHOTOREDUCED POLYOXOMETALATES BY ACTIVATION OF MOLECULAR OXYGEN

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The activation of small molecules is a key strategy for developing sustainable chemical processes for energy storage and the production of valuable chemicals. Many of these transformations involve multi-electron and multi-proton transfers steps, which often present challenges related to efficiency, selectivity, and reaction control. Polyoxometalates (POMs), a class of molecular metal oxide clusters, are promising candidates for such reactions due to their remarkable redox properties, great structural diversity and ability to reversibly store multiple electrons.[1,2] In their reduced forms, POMs can act as electron reservoirs capable of transferring electrons to small molecules such as molecular oxygen.

This work focuses on understanding the parameters governing the efficiency of POM photoreduction under UV irradiation, including their composition, electronic structure, redox potentials, and excited-state dynamics, using the decatungstate as a benchmark system.[3] These properties are investigated through UV-Vis-NIR absorption spectroscopy, infrared spectroscopy (IR), nuclear magnetic resonance (NMR), cyclic voltammetry (CV) and transient absorption spectroscopy (TAS) in collaboration with ISMO-Université Paris-Saclay.

The proposed strategy consists of coupling two processes: (i) the photochemical reduction of POMs under light irradiation in the presence of a sacrificial electron donor, followed by (ii) the transfer of the stored electrons to molecular oxygen to produce in situ hydrogen peroxide (H_2O_2). In addition, the reactivity of the generated H_2O_2 with the POM is investigated, as well as its application in epoxidation reactions.[4]

Acknowledgements

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Heterogenized NIR-Photocatalysts via Van-der-Waals Interactions Application to Photooxidations

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Keywords: Green chemistry, indocyanines, heterogeneous catalysis, photooxidations, NIR light.

Near infrared light (NIR) activation has recently been demonstrated as a useful tool in photochemistry and is becoming particularly attractive from a green chemistry standpoint. NIR light is lower in energy and more selective, which enables the use of more optimized light sources. Additionally, NIR light is less scattered than blue light in turbid reaction media (containing for example solid supported photocatalyst) which will improve light penetration[1]. However, an important drawback of NIR photocatalysis is the poor stability of the corresponding photocatalysts.

Our team discovered that immobilization of homogeneous photocatalysts can substantially improve their reactivity and stability[2]. The combination of supported photocatalyst and near infrared light (NIR) activation can therefore be particularly attractive from a green chemistry standpoint. In addition, the heterogenization of homogeneous photocatalysts on solid particles enables easier separation through filtration. The immobilization of NIR photocatalysts could therefore be an alternative solution to the current stability drawbacks.

In the present study, we developed a procedure for the heterogenization of indocyanines via van der Waals interactions with hydrophobic silica particles. The synthetic utility of these heterogeneous photocatalysts has been demonstrated in the context of singlet oxygen mediated photooxidations. The performances and recycling are studied in green solvent mixtures. The immobilized indocyanines gratifyingly appear to be more reactive and more stable than their homogeneous counterparts. This demonstrates that it is possible to enhance the performance of relatively unstable NIR photocatalysts using heterogeneous system. To the best of our knowledge, this is also a rare example of catalyst heterogenization by van der Waals interactions.

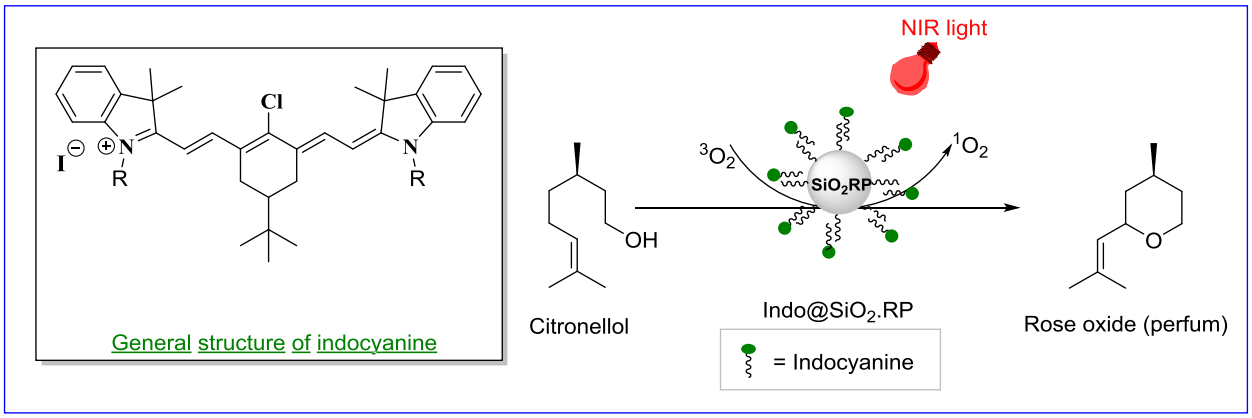

Fig1: Heterogenized NIR-photocatalysis with immobilized indocyanine

Acknowledgements

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Polymerization of bispyridylbutadiyne on surface evidenced by STM and application in photocatalysis

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PDPB belongs to the family of poly(diacetylenes), which are one of the interesting research targets among π-conjugated polymers, having fascinating physicochemical properties with tailorable pendant side groups and terminal functionalities. Scanning tunneling microscope (STM) is a powerful technique to investigate topographic as well as electronic properties on functional organic molecules down to sub-molecular level. BPBPy molecules, with a length of approximately 1.2 nm (as shown in Figure 1), self-assemble into highly ordered 2D nanostructures at the 1-heptanoic acid/HOPG interface under dark conditions. These nanostructures form differently oriented domains characterized by supramolecular stripes with a close-packed arrangement. High-resolution STM imaging shows a zig-zag organization stabilized by intermolecular N···H-N hydrogen bonds and weak van der Waals interactions with the HOPG substrate. Upon UV irradiation (365 nm) for varying durations, significant morphological transformations occur. After 15 minutes of exposure, the self-assembled patterns evolve into 1D polymeric wires with lengths ranging from tens to hundreds of nanometers (as shown in Figure 2). High-resolution STM images reveal sub-molecular details, including the cis orientation of pyridine moieties extending outward from the main axes. These findings demonstrate the potential of BPBPy molecules for photo-induced surface patterns. These observations demonstrate on-surface polymerization reaction at a sub-molecular level.

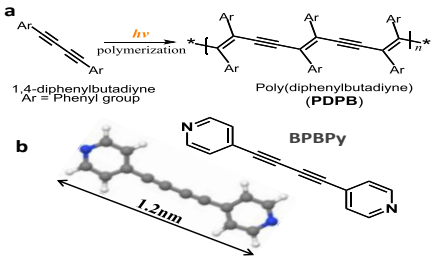

Figure 1 Molecular structure of BPBPy monomer and PDPB polymer

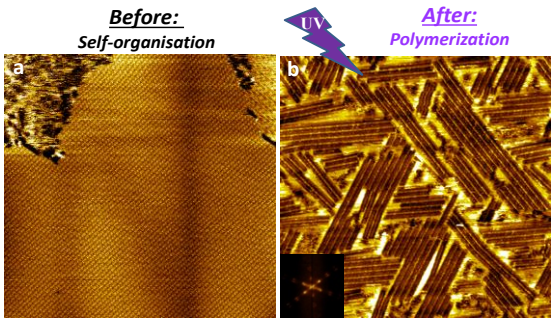

Figure 2 Molecular structure of BPBPy monomer and PDPB polymer

Acknowledgements

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Thermoresponsive nanostructures induced by radiolysis for applications in (photo-)catalysis

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Metallic nanostructures are small objects composed of metal (commonly gold, silver, platinum, and palladium) with at least one dimension ranging from one to a few hundred nanometers. These nanoparticles have been known to serve diverse purposes in various domains such as sensing, catalysis, bioimaging, and medicine. Their versatility stems from their unique properties, different from the bulk metals and related to their shape, size, composition, structure, and assembly.

Environmentally friendly synthesis methods and effective stabilization agents are essential for fabricating MNPs with controlled sizes and shapes. Among the available methods, radiolytic synthesis based on irradiation by ionizing radiation is powerful; no chemical reactants are needed as the reducing species (solvated electrons, radicals) are generated from the solvent [1]. This study explores the radiolytic synthesis method (gamma radiation), along with the use of a thermosensitive polymer, Poly(N-isopropylacrylamide) (PNIPAM), and its monomer, N-isopropylacrylamide (NIPAM), for the stabilization of gold nanoparticles (AuNPs) in aqueous solutions and for the formation of hybrid thermoresponsive nanostructures [2].

The radiolytic reduction of gold metallic salts in the presence of PNIPAM or NIPAM in aqueous solution leads to the formation of small, spherical AuNPs with an average size of about 5 nm and high stability at room temperature (Figure 1a). Thermal analysis reveals enhanced thermal responsiveness for PNIPAM-AuNPs, an effect not observed for NIPAM-AuNPs. Both AuNPs demonstrate excellent catalytic activity in the reduction of 4-nitrophenol (4-NP) in the presence of sodium borohydride and show efficient plasmonic photocatalytic activity in the visible-light-driven degradation of 4-nitrothiophenol (4-NTP) (Figure 1b). The AuNPs remain stable throughout the processes, indicating that these catalysts are highly reusable.

However, to facilitate their use, the synthesized PNIPAM-AuNPs have been embedded in PNIPAM-based polymer resin to design photo-thermoresponsive hydrogels via additive manufacturing (3D printing) (Figure 1c). Preliminary results show that the nanocomposite hydrogels exhibit reversible thermoresponsive behavior driven by the photothermal effect of the embedded AuNPs, and efficient (photo-)catalytic activity for the reduction of 4NP by $NaBH_4$ and degradation of 4NTP under plasmonic excitation, respectively. These findings support the potential applications of such nanocomposites for environmental remediation, such as water depollution.

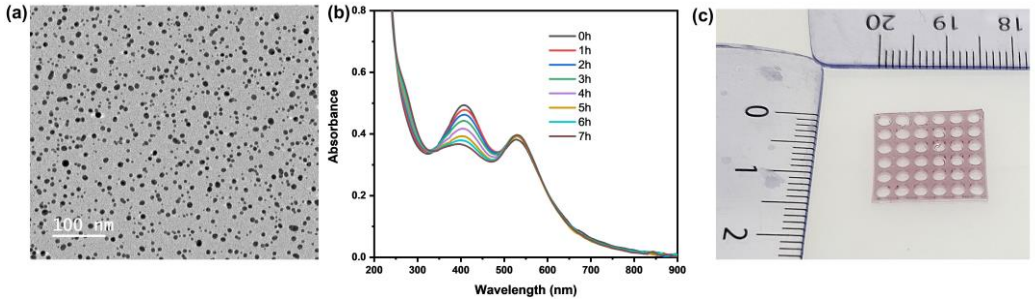

Figure 1: (a) TEM micrograph of PNIPAM-AuNPs synthesized by radiolysis, (b) absorption spectra monitoring the photocatalytic degradation of 4-NTP by plasmon excitation of NIPAM-AuNPs, (c) 3D printed nanocomposite hydrogel

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POSTER PRESENTATIONS

Poster#1	Zafar Wajahat	Composite photocatalysts based on prussian blue analogs (PBAs) and TiO_2 for green hydrogen generation
Poster#2	Niederst Léo	Collaborative homo- and hetero-FRET processes in singlet-singlet photosensitization probed by photopolymerization
Poster#3	Augusto Carmen	InGaN Nanowires for Photocalytic Solar Hydrogen Production
Poster#4	El Idrissi Hiba	GaN Nanowires for Green Photocatalytic Hydrogen Generation
Poster#5	Grill Justin	Modelling the nonlinear optical properties of functionalized CdTe quantum dots using an end to end DFT/ML framework
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Poster#12	Karam Elie	Plasmon-Assisted Condensation of Sol-Gel Based Materials
Poster#13	Alam Md Faiz	Nickel-Copper Bimetallic MOFs Photocatalysts for Efficient Photocatalytic Green Hydrogen Generation
Poster#14	Sheikh Abdur Rehman	Hybrid POM /Cyanine Dyads for Efficient NIR Driven Photochemical Trifluoromethylation of Alkenes
Poster#15	Kaddour Maissara	Antimicrobial Activity of Gold Nanoparticles under Light Irradiation
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Poster#22	Silswal Akshay	Toward Sustainable CO_2 Management through Light-Responsive Photoacid System
Poster#23	Battaglia Filippo Piero	Novel Heptazine-core Molecular Materials for Delayed Fluorescence
Poster#24	Xie Mingkuan	UiO-66-NH2-Based Composites for Efficient Photocatalytic Hydrogen Production
Poster#25	Masum Abdullah Al	Cl-doped Polypyrrole for Photocatalytic Green Hydrogen Peroxide Production
Poster#26	Dos Santos Adeline	Hybrid particles for the physical treatment of thrombotic diseases
Poster#27	Brazzi Claire	MOF-Based Quantum dots Composites with Photothermal and Photodynamic Effects against Drug-resistant Bacteria
Poster#28	Bui Bich Phuong	Light-induced Ultrafast Charge Transfer of NiO/P1 Architecture
Poster#29	Bastide Mathieu	Two step process to functionalize gold nanoparticles with photo-active molecules though plasmon-induced grafting
Poster#30	Bastide Mathieu	Plasmon-induced thermo-polymerization of PETA in presence of various initiators
Poster#31	Rachid Mohamad	Innovative molecular materials combining optical and luminescent monitoring of the thermal experience of their environment

Composite photocatalysts based on prussian blue analogs (PBAs) and TiO_2 for green hydrogen generation

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The depletion of fossil fuels and escalating environmental concerns have intensified the search for sustainable energy alternatives [1,2]. In particular, green hydrogen, produced using renewable energy sources without carbon emissions, has attracted significant attention as a sustainable alternative to fossil fuels. Photocatalysis has emerged as a key strategy for sustainable hydrogen evolution, providing a renewable method to meet global energy demands. Prussian Blue Analogues (PBAs) represent a versatile family of coordination polymers known for their tunable porosity, structural flexibility, and efficient charge-transfer properties, making them attractive candidates for photocatalytic applications. Due to their tunable porosity and efficient charge transfer properties. In this work, we synthesized CuFe PBA/TiO_2 composite designed for enhanced photocatalytic hydrogen evolution. The photocatalytic performance was evaluated under UV-vis light using water-methanol system, where methanol served as effective hole scavenger. By integrating the redox-active sites of PBAs with the semiconducting properties of TiO_2, we achieved a composite that demonstrates synergistic architecture boosting hydrogen generation rates compared to pristine TiO_2. Preliminary results (Fig.1(a)) indicate that coupling a small amount of PBA with TiO_2 significantly boosts the photocatalytic activity, achieving a hydrogen production rate of approximately 3.7 mmol/g/h. These findings highlight the potential of PBA-based composites as cost-effective platforms for renewable energy productions. Further characterizations are being done to understand synergistic mechanisms and charge-carrier dynamics of the composite.

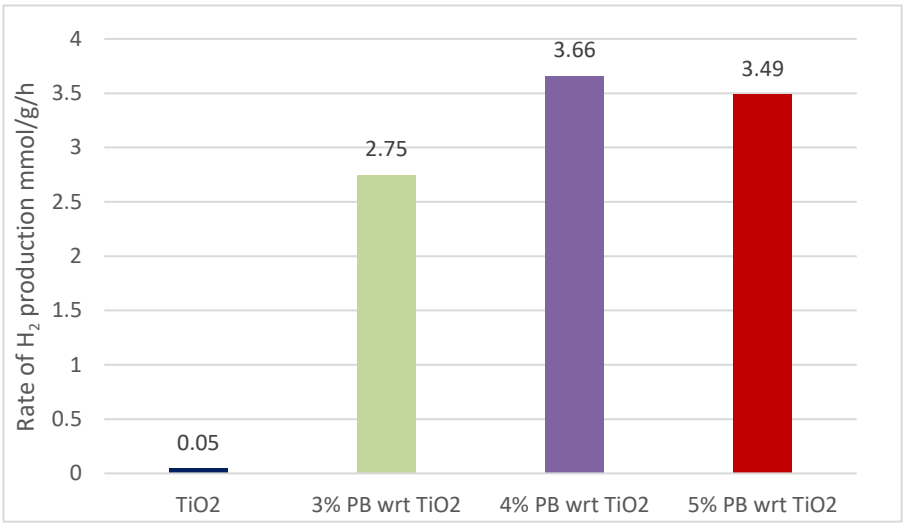

Figure 1(a) Graph comparing H_2 production rate of PBAs-TiO_2 composites with different mass ratios

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Collaborative homo- and hetero-FRET processes in singlet-singlet photosensitization probed by photopolymerization

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Phosphine oxides are pivotal compounds in the UV-curing domain, presenting benchmark performances although having moderate absorption properties. Enhancement of the absorption efficiency by these compounds is thus a key challenge. In this work, we present the possibility of Förster resonance energy transfer (FRET) from an optical brightener to phosphine oxide, allowing to significantly increase the rate of excitation of the latter, and thus achieved high photopolymerization rates. This phenomenon was demonstrated under common LED wavelength (365 nm) at low light intensity (1 mW/cm^2). Comprehensive photophysical and kinetic studies demonstrated that the photosensitization is enabled by a hetero-FRET between the fluorophore (donor) and the photoinitiator (acceptor). When the donor concentration is significant, considerable modulation of the energy transfer efficiency is observed, arising from energy migration among donors (homo-FRET). The collaborative donor-donor and donor-acceptor mechanism was evidenced by implementation of a refined model, shown to reproduce experimental photopolymerization data. This study allows to evidence the beneficial effect of homo-FRET on the global efficiency of donor-acceptor energy transfer, from the standpoint of the acceptor which signal is amplified by photopolymerization. These coupled energy transfer processes pave the way for rational design of systems efficiently collecting UV irradiation.

InGaN Nanowires for Photocatalytic Solar Hydrogen Production

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Despite significant advances in renewable energy, clean hydrogen production remains largely dependent on fossil fuel reforming, contributing substantially to global CO_2 emissions [1].
Solar-driven hydrogen production via photocatalytic water splitting offers a promising bias-free route toward carbon-neutral energy [1]. Among candidate semiconductors, GaN has long been recognized for its chemical stability, wide bandgap (3.4 eV), and favourable conduction band alignment with the water reduction potential. By incorporating indium, the resulting InGaN alloys extend light absorption across the visible spectrum through a continuously tuneable bandgap (0.7–3.4 eV), while maintaining favourable alignment with water redox potentials and enabling simultaneous H_2 and O_2 evolution [2]. However, long-term stability remains a key challenge, as InGaN surfaces are prone to photocorrosion, oxidation, and indium dissolution under aqueous illumination.
This work proposes a surface-engineering strategy based on controlled GaN capping layer deposition onto InGaN nanowires to improve durability while preserving charge transport [3]. A thin GaN overlayer is expected to act as a corrosion barrier and passivate surface defects, though excessive thickness may limit carrier extraction. InGaN nanowires are grown on p-type Si (111) by plasma-assisted molecular beam epitaxy, with GaN layers of varying thickness deposited in situ to ensure conformal coverage and abrupt heterointerfaces.
Structural and optical properties are characterized by scanning electron microscopy and photoluminescence spectroscopy. Photoelectrochemical measurements and bias-free H_2 evolution experiments under solar-simulated irradiation are used to evaluate the activity and stability of the photocatalysts. H_2 is quantified by micro gas chromatography see figure 1 c). This systematic study aims to establish correlations between GaN capping thickness, and long-term photocatalytic performance, providing design guidelines for durable III–V nanostructured photocatalysts.

Keywords: InGaN nanowires; photocatalysis; hydrogen evolution
Supervisors: Dr. Hynd Remita, Dr. Maria Tchernycheva

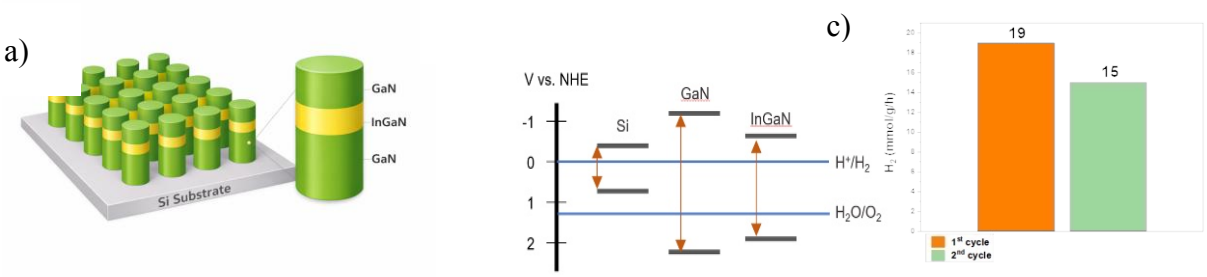

Figure 1: a) Illustration of the InGaN nanowires and capping; b) Schematic diagram of the band positions of the photocatalysts relative to the NHE potential; c) Hydrogen production during two photocatalytic Cycles

Acknowledgements

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GaN Nanowires for Green Photocatalytic Hydrogen Generation

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Hydrogen is considered a key energy carrier for sustainable energy systems, and photocatalytic water splitting offers a promising route for solar-driven hydrogen production. Among the various hydrogen production routes, the photocatalytic hydrogen evolution reaction (HER), based on semiconductor photocatalysts, represents a direct and promising approach for converting solar energy into chemical fuels.[1]

Among currently investigated photocatalysts, group III-nitride semiconductors such as GaN exhibit a wide and tunable bandgap (GaN $\approx$ 3.4 eV) and provide suitable band-edge position for hydrogen evolution: The conduction band lies at a more negative potential than the H^+/H_2 redox level, allowing photogenerated electrons to reduce protons into H_2, while the valence band lies at a more positive potential than the O_2/H_2O redox potential, enabling photogenerated holes to oxidize water.[2]

In this work, GaN nanowires were synthesized via epitaxial growth to precisely control their structural parameters. A systematic morphological optimization revealed that the photocatalytic performance strongly depends on nanowire diameter, height and density. An optimal diameter of approximately 20 nm significantly enhanced hydrogen evolution rate. This can be attributed to increased specific surface area and shortened radial charge transport distance, leading to more efficient separation of photogenerated electron–hole pairs and reduced bulk recombination.

The nanowire height was also identified as a critical parameter. The optimal value for photocatalytic hydrogen generation was found to be around 1 μm. Shorter nanowires provide insufficient active surface area and limited light absorption, whereas excessively long nanowires increase carrier recombination probability due to extended axial transport pathways and may further restrict mass transfer. A height of about 1 μm provides a balance between efficient light absorption, adequate active surface area, and effective charge collection. Nanowires should not be too dense. High-density arrays cause light scattering and shadowing, which reduce photon penetration. They also limit mass transport, hindering water diffusion to active sites and hydrogen bubble release. Optimized low-density arrays improve light absorption and reactant/product diffusion, enhancing photocatalytic efficiency. Under these optimized conditions ($\approx$20 nm diameter, controlled low density, and ~1 μm height), the nanowires were functionalized with Pt nanoparticles induced by radiolysis, which act as cocatalysts to decrease the charge carriers' recombination and enhance the photocatalytic activity.

Finally, functionalization with non-noble metal cocatalysts such as Ni–Fe nanoparticles further improved the photocatalytic performance, reaching hydrogen evolution rates of 29.3 mmol g^{-1} h^{-1}.

Acknowledgements The authors gratefully acknowledge the Institute of Sustainable Energy and the ANR CMA HTASE project for financial support of this research.

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Modelling the nonlinear optical properties of functionalized CdTe quantum dots using an end-to-end DFT/ML framework

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CdTe quantum dots (QDs) are promising materials for photovoltaics, optoelectronics, and biomedicine, with optical properties tunable through size, structure, and surface ligands [1, 2]. In this context, Sum Frequency Generation (SFG) spectroscopy [2] appears as a key tool for understanding QD-ligand interactions at the interface, since these interactions largely govern the stability and optoelectronic response of the nanocrystal. However, SFG theoretical modelling relies on the computation of the second-order susceptibility tensor along molecular dynamics (MD) trajectories, which is already computationally prohibitive at the density function theory (DFT) level for relatively small systems. This project aims to overcome the current limitations by developing machine-learning (ML) force fields, trained on DFT data, to enable molecular dynamics simulations and SFG spectroscopy calculations of large, experimentally relevant functionalized CdTe QDs (d > 3 nm) at tractable computational cost. Deep neural networks (DNNs) architectures have already been employed for simulating the electronic structure of semiconducting nanoparticles, demonstrating remarkable accuracy and efficiency. However, while recent work has successfully applied these methods to simulate SFG spectra at aqueous and air interfaces [3], yielding enlightening insights, this methodology has not yet been extended to the QD-ligands interface. Our current dataset includes a diverse set of passivated structures, generated following experimental motivations through an automated procedure. The trained DNN model accurately reproduces atomic forces from DFT calculations, achieving a root-mean-square error of 0.07 eV/Å. This level of performance enables stable machine-learning molecular dynamics (MLMD) simulations over tens of picoseconds and demonstrates transferability to structures larger than those included in the training set. Beyond force prediction, dedicated DNN models are being trained to predict dipole moments and polarizability tensors, two key quantities for computing SFG spectra. The latter are evaluated using the modern theory of polarization, formulated within the DFT framework and exploiting the periodicity and condensed phase nature of the nanocrystral through the computation of Wannier charge centers. These quantities will be subsequently used to derive the susceptibility via Fourier transform of the cross-correlation between the dipole moment and polarizability along MLMD trajectories. Once complete, this DNN framework should enable a fast and reliable way to predict experimental SFG intensities for the QDs which are functionalized and studied in our laboratory.

Acknowledgements

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Luminescent nanoparticles as bright nanotools for biosensing & bioimaging

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The in situ and real-time detection of analytes in complex biological media demands robust, sensitive, and stable biosensors capable of signal amplification. Fluorescent nanoparticles (NPs) are promising candidates, offering exceptional brightness and photostability compared to traditional dyes.[1] These luminescent NPs fall into two main categories: intrinsically luminescent NPs, such as Quantum Dots (QDs), and doped NPs, which encapsulate dyes (e.g., lanthanides or organic fluorophores) within a matrix. For imaging and sensing applications, these NPs aim to achieve excellent brightness, enhanced photostability, and strong colloidal stability in water, outperforming conventional organic dyes. Classical FRET (Förster resonance energy transfer) nanosensors typically involve a donor NP conjugated with bioreceptors that bind to a ligand labeled with an acceptor dye. However, most current luminescent nanoparticles are designed with core–shell or core–crown–shell architectures, which do not always ensure optimal FRET efficiency[2]. In these systems, the spatial distribution of fluorophores within the nanoparticle is often poorly controlled, and the donor–acceptor distance remains suboptimal, limiting both energy transfer efficiency and detection sensitivity.

In this poster, strategies to overcome these limitations will be presented, focusing on the development of compact and highly emissive polymer-based nanoparticles in which the spatial distribution of fluorescent dyes is precisely controlled during the polymerization. This approach enables enhanced optical performance and improved FRET efficiency. The resulting nanoparticles are then surface-functionalized with biologically relevant ligands (e.g., biotin, oligonucleotides) to yield specific and efficient biosensing platforms. Furthermore, the design of anisotropic, fluorescent nanoparticles with potentially biodegradable cores[3] will be presented, opening new perspectives for the development of biocompatible and sustainable nanoprobes for biosensing and bioimaging.

Acknowledgements

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Fluorescence Microscopy Investigation of Light-Triggered Self-Assembly of a Molecular Gelator

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Low-molecular-weight gelators (LMWGs) have demonstrated their versatility as building blocks of self-assembled physical gels.[1] Research has also increasingly focused on controlling hierarchical assembly and developing multi-component systems using LMWGs.[2] While traditionally temperature and pH have been employed to trigger self-assembly,[1] our focus lies in utilizing light to achieve spatio-temporal control of the process. Our group has developed a supramolecular system in which a light-sensitive pro-gelator **dkDDOA** undergoes photoconversion into an organogelator **DDOA** (see Figure a). The photoreaction triggers a hierarchical organization into fluorescent nanofibers and anisotropic microstructures under laser irradiation.[3] In the present work, we explore the mechanisms of the photoconversion and fiber formation via quantitative photochemistry and fluorescence microscopy. The irradiation powers and wavelengths of excitation light play a critical role, since they determine the kinetics and the relative involvement of the precursor and the photoproduct in the nucleation and growth processes. As a result, the density of nucleation and the morphologies of the fibers are affected. In perspective, this study will offer a novel control and a better understanding of the mechanisms involved in the self-assembly of multi-component soft materials.

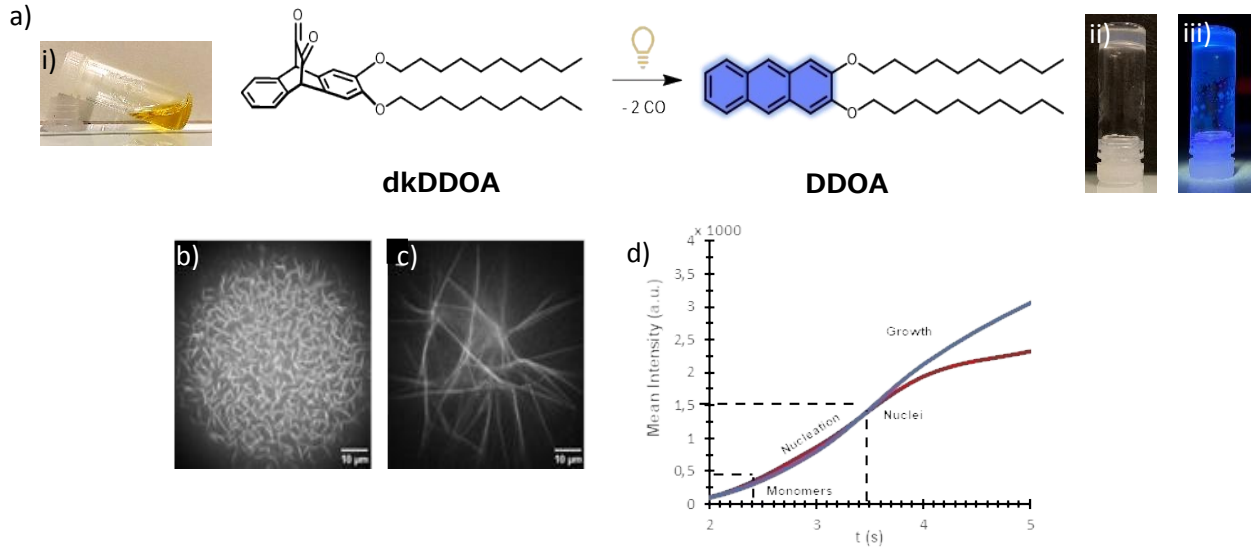

Figure. a) Scheme of the photoreaction converting dkDDOA into DDOA. Irradiation (at 490 ± 23 nm) of the precursor solution: i), 3 mM dkDDOA in dry DMSO yields the ii) DDOA gel (photo under room light; iii) Photo of the same gel under UV illumination, showing blue fluorescence. Fluorescence microscopy images (spectral range of detection: 400-1000 nm) of photoinduced DDOA fibers obtained with wide-field irradiation at (b) 365 nm, and (c) 490 nm, from a 3 mM solution of dkDDOA in dry DMSO. d) Emission intensities obtained from two different regions of a sample surface as a function of irradiation time. (blue curve) region in which a fiber becomes visible at the end; (red curve) region without visible fibers.

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VERSATILE MODIFICATIONS IN THE CAVITY OF IMOGOLITE

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Imogolite is an aluminosilicate nanotube naturally formed in volcanic soils with the chemical composition of $(HO)_3Al_2O_3Si(OH)$ and an internal diameter of around 2nm[1]. It is possible to synthesize and totally replace the internal hydroxyl groups by methyl ones, and therefore obtain a Janus compound (Imo-CH_3) with a hydrophobic cavity and a hydrophilic external surface[2]. The internal surface can be further tuned by partially replacing the silicon precursor (leading to Imo-CH_3) with an "exotic" silane bearing new functional groups (R = -C_3H_6SH, -$C_3H_6NH_2$, Phenyl, etc.), at different substitution rates, leading to a structure of type $(HO)_3Al_2O_3Si(CH_3)_{1-x}(R)_x$, (Figure 1a), with *x* on the order of a few percent. Small Angle X-ray Scattering experiments enable to demonstrate that the dual functionalization does not change the diameter of the nanotube. However, it modifies its polarity as identified by the strong modification of color after contact with a solvatochromic dye (Nile Red), encapsulated in the cavity (Figure 1b – f).
In this poster, we will explore the properties of the functionalized imogolites, where -CH_3 groups are predominant present, while functional groups (-C_3H_6SH written as -SH) and (-$C_3H_6NH_2$ written as -NH_2) are introduced up to a few percent (imogolites are therefore labelled as Imo-SH and Imo-NH_2 for the functionalized with their corresponding group). Our observations reveal that Imo-SH induces a bathochromic shift in the UV-Vis absorbance spectrum, whereas Imo-NH_2 exhibits a hypsochromic shift compared to Imo-CH_3 (Figure 1). For the first time, we successfully achieved a triple functionalization (with -CH_3, -SH and -NH_2 groups) and demonstrated that the effect of the -SH group predominates (Figure 1f). A phenyl-functionalized imogolite is also obtained for which the strong UV absorbance of the phenyl group allows to quantify their substitution rate.

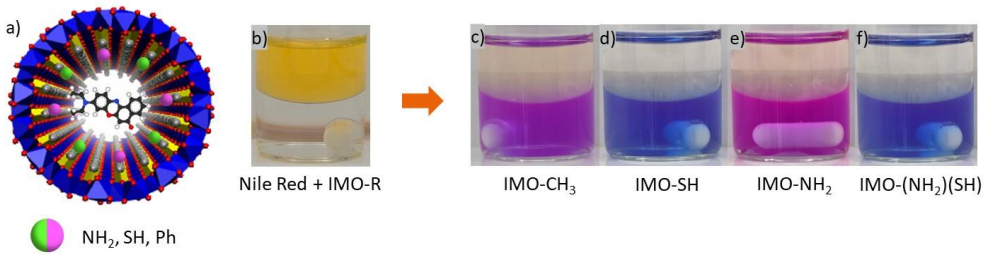

Figure1 : Figure showing (a) Nile Red molecule adsorbed within the functionalized imogolite cavity (Al octahedra in blue, Si tetrahedra in yellow, O in red, C in grey; H are omitted), and (b – e) the evolution of a Nile Red/dodecane solution in contact with the 5% aqueous phase of functionalized imogolites before agitation (b) and after 5 days of agitation (c – e).

Acknowledgements

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Microwave plasma-assisted N_2 fixation to NO_x over $La_{0.65}Sr_{0.35}MnO_3$

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We recently reported on the application of microwave (MW) heating in N_2 fixation over perovskites.[1,2] The possibility to form NO_x from air represents a promising alternative to the current industrial route that involves N_2 reduction with H_2 to form NH_3 (Haber-Bosch process) followed by NH_3 oxidation (Ostwald process). The NO_x concentration obtained suggested reaction temperatures around 2300 °C. Hot spots with temperature in excess of 1800 °C were measured using a thermal camera (Optris® PI 1 M, enabling temperature maps of 382 × 288 pixels up to 1800 °C) once the plasma was formed (Fig. 1A and 1B). The present work aimed at better defining the nature and temperature of the MW plasma formed in contact with the perovskite in the presence of N_2 and O_2.
The $La_{0.65}Sr_{0.35}MnO_3$ was purchased from Merck. The research MW assembly and analytical methods are described in details elsewhere.[2] An Avantes Varius Optical Emission Spectrometer (OES) and the SPECAIR software were used to determine the nature and temperature of the plasma formed under N_2 and O_2. A temperature of 2900 ± 150 °C was determined through the fitting of the dinitrogen second positive system (Fig. 1C), consistent with the high proportion of NO_x measured. The perovskite MW absorption properties, the nature of the plasma and the quartz reactor thermal stability will be discussed.

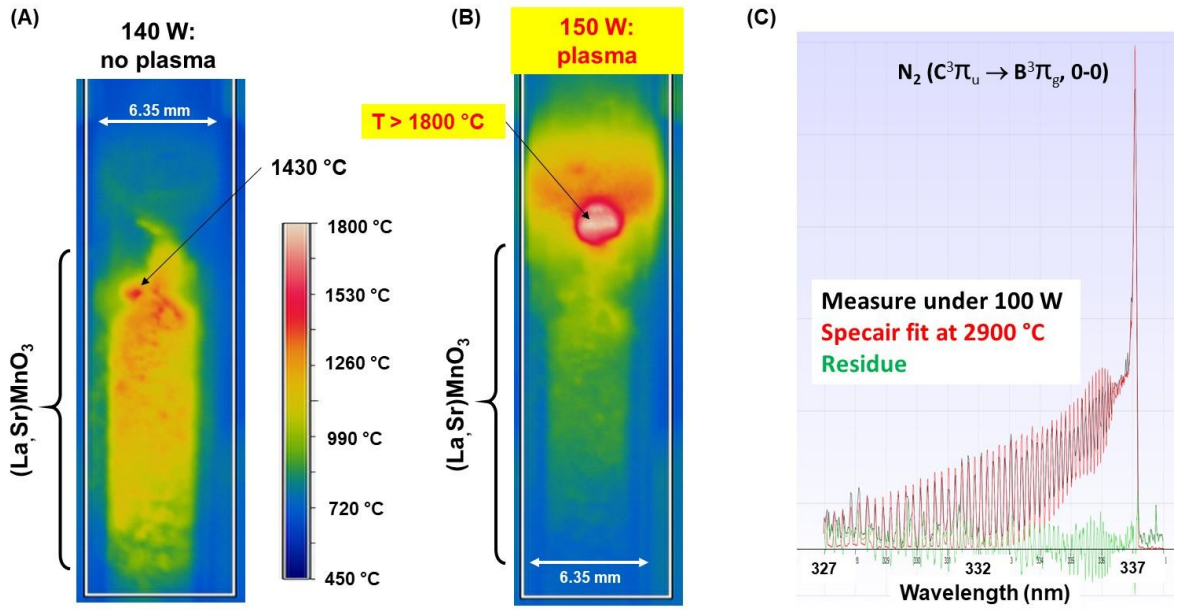

Figure 1: Thermal imaging of $La_{0.65}Sr_{0.35}MnO_3$ placed in a quartz reactor (A) under 140 W of microwave irradiation just before plasma ignition and (B) at 150 W during the plasma episode. Feed: 5% O_2 /N_2, 50 mL/min, P = 1 atm. (C) (Black line) OES spectrum measured during a plasma episode under 100 W of MW power over $La_{0.65}Sr_{0.35}MnO_3$, (red line) fitted OES spectrum using SPECAIR and (green line) difference between the measured and fitted spectra.

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Controlled Magnetron Sputtering of Gold Nanoparticles for Multimodal SERS–AFM substrate

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ABSTRACT :

Raman spectroscopy is widely used to analyze biological specimens because it yields detailed molecular information without the need for external labels. However, the intrinsic weakness of the Raman signal has motivated the development of surface-enhanced Raman spectroscopy (SERS) platforms, in which metallic surfaces supporting plasmon resonances dramatically amplify the detected intensity. In parallel, there is growing interest in multimodal characterization strategies that can better capture the complexity of biological systems by combining complementary techniques.In this context, we introduce a gold-based SERS substrate that is fully compatible with atomic force microscopy (AFM) and optimized for excitation at 785 nm, a wavelength chosen to suppress autofluorescence from biological materials. By systematically examining the parameters of the deposition process (magnetron sputtering), we found that increasing the pressure in the sputtering chamber leads to a higher areal density of nanoparticles (NP), while the mean lateral size of the NP can be adjusted by varying the deposition current and total deposited thickness, with the current exerting the stronger influence.With the deposition conditions optimized, we obtained nanoparticles with an average lateral diameter of 22 ± 2 nm, a size range that promotes strong plasmonic interactions between neighboring particles and consequently the generation of highly efficient SERS hot spots. At the same time, the particles maintain a relatively constant height of around 4 nm, resulting in a surface that is sufficiently smooth for high-quality AFM imaging of nanometer-scale biological features. Collectively, these findings establish a robust foundation for an efficient SERS platform that can be integrated into future multi-technique workflows for biological analysis.

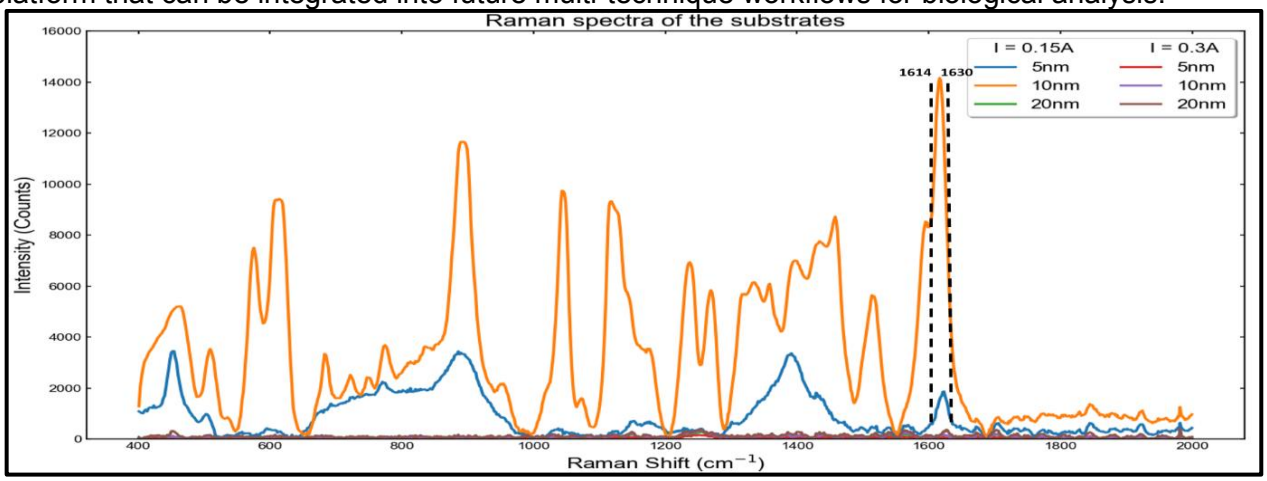

*Figure : Raman spectra of MB (10^{-5} M) recorded on substrates deposited at **32 mTorr** using different currents (0.15 A and 0.3 A) and varying nominal thicknesses (5, 10, and 20 nm)*

Acknowledgements:

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Solvation Effect on Photoelectron Circular Dichroism of Chiral Molecules

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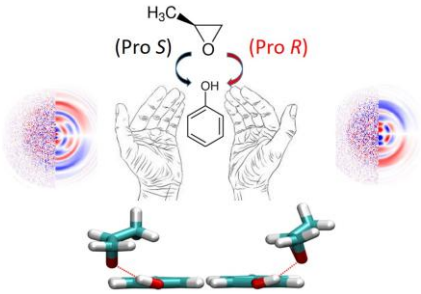
Photoelectron circular dichroism (PECD) is defined as a forward-backward asymmetry in the angular distribution of the photoelectrons emitted by a chiral molecule photo-ionized by circularly polarized light (CPL).

We recently developed a PECD scheme based on a two-photon ionization process, which allows obtaining the PECD of each conformer of a chiral molecule separately.[1] This experiment was applied to flexible molecules and their weakly bound complexes in the gas phase. We observed for example the effect of step-wise hydration on the PECD of 1-phenyl-2-ethanol.

We extended these experiments to the study of induced chirality on an achiral molecule interacting with a chiral environment.[2] Ionizing the non-chiral phenol chromophore within a hydrogen-bonded complex with a chiral molecule, methyloxirane, results in the appearance of a PECD signal for the ionization of the phenol highest occupied orbital (HOMO). This induced PECD is related to a chiral deformation of the HOMO. This system shows different conformers, which exhibit different PECD, in relation to their structure determined by IR spectroscopy, and symmetry. These results show that PECD can be used as a tool for differentiating the two electron lone pair of a prochiral oxygen.



Scheme of the interaction between phenol and the two lone pairs of (S) methyloxirane (top) resulting in two stable complexes (bottom) with photoelectron circular dichroism of opposite signs (left and right). The electrons excess is shown in blue, and the defect in red. The light propagation direction is from bottom to top.

Acknowledgements. This work was supported by the ANR DICHROSOL, Grant No. ANR-23-CE29-0006 and by state funding from the ANR under the France 2030 program, with reference ANR-23-EXLU-0004, PEPR LUMA TORNADO.

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Kinetic control of DASA photoswitches via acid triggering

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Negative photochromic molecules differ from the more widespread positive photochromic derivatives by their ability to absorb visible light in their open form A, to produce a colourless compound in their closed form B. A recently developed family of such photochromic molecules, the Donor Acceptor Stenhouse Adducts (DASA) [1], are of particular interest due to their fast photoreactions, thermal back reactions, and straightforward synthesis.

In this work, we characterize the kinetic behaviour of a DASA compound under various environmental conditions using steady-state and time-resolved spectroscopic techniques. We explore the possibility to influence the B→A thermal back reaction by varying the solvent nature and by adding acids. Specifically, we examine the acceleration of the ring opening reaction kinetics with sub-stoichiometric amounts of acid. By comparing the reaction rates, we observe an acceleration factor of up to 40 between the different media, enabling precise, reversible control of the switching reaction. Our experimental work is complemented by theoretical calculations at the DFT level.

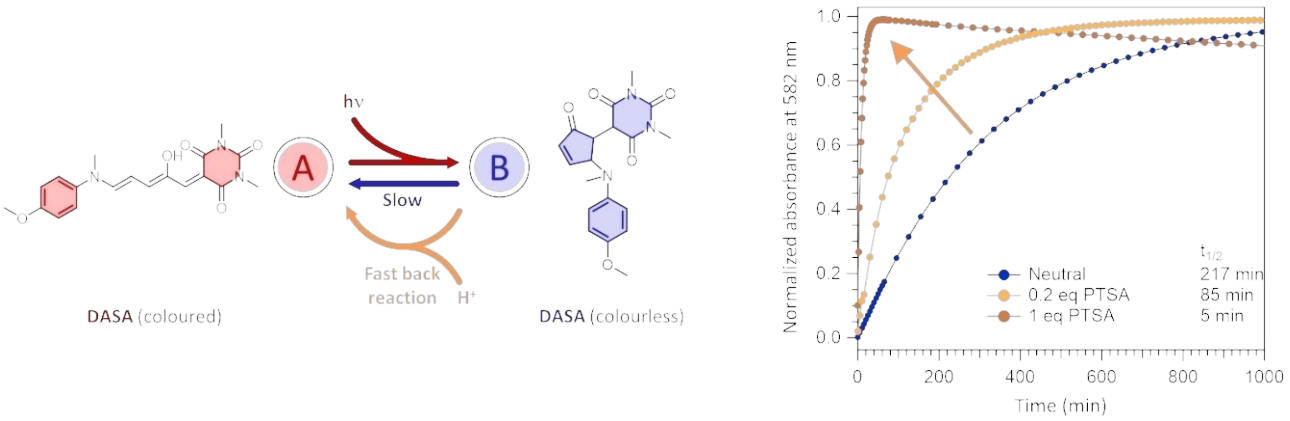

Figure: *(Left)* Principle of negative photochromism showing the trigger of DASA back reaction by the addition of protons. *(Right)* Kinetic absorption profiles of the B→A reaction with different amounts of acid.

Acknowledgements

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Plasmon-Assisted Condensation of Sol-Gel Based Materials

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This project explores an innovative approach combining sol–gel chemistry and the plasmonic resonance of noble metal nanoparticles to prepare hybrid Au/TiO_2 nanostructures [1]. TiO_2 is selected for its excellent mechanical properties, biocompatibility, chemical stability, and photocatalytic activity. Coupling TiO_2 with plasmonic nanoparticles broadens the range of potential applications arising from the interactions between metallic nanostructures and semiconducting materials.
The main objective of this work is to investigate the formation of titanium dioxide (TiO_2) layers around colloidal gold nanoparticles, with a particular focus on the plasmonic properties of gold nanotriangles (AuNTs). These anisotropic nanoparticles exhibit unique plasmonic behavior, with strong electromagnetic field enhancements localized at specific vertices depending on the polarization of the incident light.
We demonstrate an unprecedented control over the localized nanofabrication of TiO_2 nanostructures. By tuning the polarization direction of the incident light, spatial control over TiO_2 formation can be achieved. In particular, TiO_2 growth can be selectively induced at the vertices of the nanotriangles, as illustrated in Figure 1.
The hybrid nanoparticles were characterized by transmission electron microscopy (TEM). Possible mechanisms responsible for the localized formation of TiO_2 will be discussed, including near-field enhancement, generation of excited charge carriers, and local photothermal effects, each of which may selectively trigger specific chemical reactions [3].

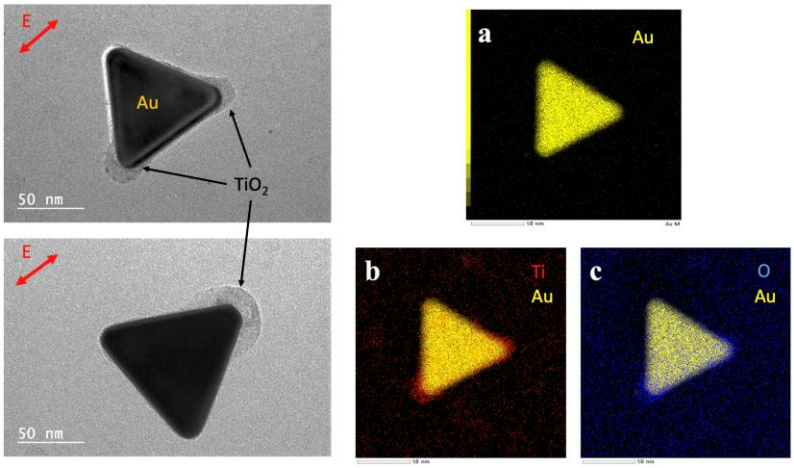

Figure 1 : TEM images of two AuNT@TiO_2 hybrid structures along with EDX cartography analysis of (a) Au, (b) Au and Ti overlay, and (c) Au and O overlay.

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Nickel-Copper Bimetallic MOFs Photocatalysts for Efficient Photocatalytic Green Hydrogen Generation

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As the world seeks sustainable energy alternatives to mitigate carbon emissions and climate change, hydrogen stands out as a clean, high-density energy carrier (LHV~122 kJ/g). Photocatalytic water splitting offers a solar-driven, eco-friendly route for green hydrogen production; however conventional photocatalysts suffer from high recombination rates and poor visible-light efficiency. Metal-Organic Frameworks (MOFs) have emerged as promising materials for photocatalytic hydrogen production due to their high surface area, tunable properties, and structural flexibility.

Recent studies have demonstrated the strong potential of Ni-based MOFs for photocatalytic hydrogen generation. For example, Liu *et al. [1]* reported a TBAPy-based Ni-MOF nanobelts system capable of efficient photocatalytic water splitting under visible light, highlighting the role of coordinated Ni catalytic centres and π-conjugated ligands in promoting charge separation and hydrogen evolution. Similarly, copper-based MOFs, such as HKUST-1 and its derivatives, have also shown promising photocatalytic performance due to their accessible Cu active sites and favourable electron-transfer properties.[2] Inspired by these advances, combining multiple metal centres within a single MOF framework has emerged as an effective strategy to further enhance photocatalytic activity by promoting synergistic electronic interactions and improving charge separation. In this context, we designed a bimetallic Ni/Cu TBAPy MOF to integrate the catalytic advantages of both Ni and Cu sites for enhanced photocatalytic hydrogen evolution.

To explore the synergistic effect between the two metals, a series of Ni/Cu bimetallic MOFs with different weight ratios were synthesised and evaluated. Among these, the Ni/Cu (3:1) weight ratio composition reached the best performance, achieving a hydrogen evolution rate of approximately 6.00 mmol g^{-1} h^{-1} without the use of any cocatalyst (Fig1). This enhancement highlights the beneficial synergistic interaction between Ni and Cu centres, which improves charge separation and photocatalytic efficiency for hydrogen generation.

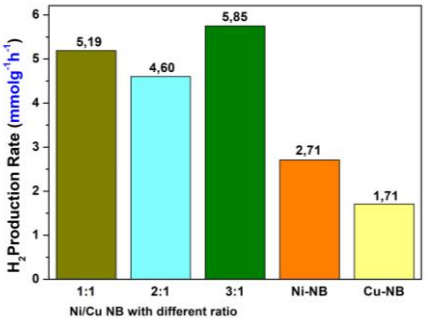

Figure 1: Graph comparing hydrogen production rate of Bimetallic MOFs with different w/w ratios.

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Hybrid POM /Cyanine Dyads for Efficient NIR-Driven Photochemical Trifluoromethylation of Alkenes

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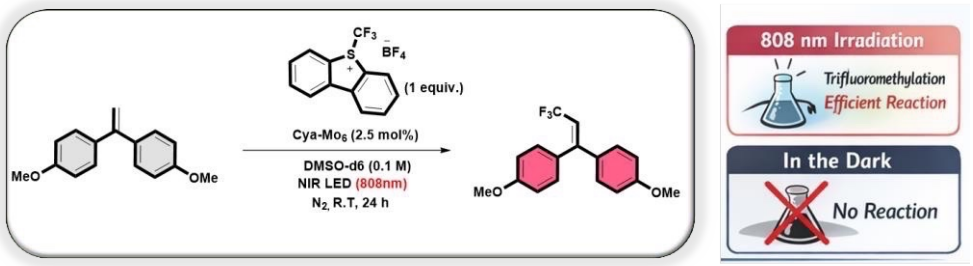
Photocatalysis, which employs light as a renewable energy source to drive chemical transformations, is widely recognized as a sustainable alternative to thermally driven processes. Traditionally, photocatalytic systems involving organic substrates have predominantly utilized UV light, as most of these molecules absorb only within this spectral window.[1] However, UV light poses challenges due to its high energy, which can induce side reactions and lead to by-product formation. Over the last decades, significant advancements have been made in photocatalysis in the visible-light range. Nevertheless, visible light can exhibit limited penetration into reaction media, hindering scalability, especially in large-scale processes or photopolymerization.[2] In response to these limitations, there has been a growing focus on the use of near-infrared (NIR) light for photocatalysis. NIR light offers deeper penetration, milder reaction conditions, and biocompatibility, making it particularly suitable for organic synthesis and biological applications. However, the development of effective NIR-responsive photocatalysts for organic transformations remains underexplored. Recent studies have investigated cyanine-based dyes and organometallic complexes as NIR catalysts, demonstrating significant efficiency and selectivity. Nevertheless, these systems can still face challenges, such as instability, complex preparation, and scalability limitations, which limit their widespread application.[3]

To address these challenges, we developed NIR-photocatalytic systems combining cyanine and polyoxometalates (POMs). These hybrids can be easily synthesized via ionic self-assembly and have been characterized via numerous techniques, including single-crystal X-ray diffraction. Their efficient photocatalytic trifluoromethylation of alkenes under 808 nm irradiation is presented, evidencing that they far exceed the performance of purely organic cyanine catalysts.



General schematic representation of Trifluoromethylation of alkenes by POM/cyanine photocatalysts

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Antimicrobial Activity of Gold Nanoparticles under Light Irradiation

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Antimicrobial resistance (AMR) represents one of the most critical threats to global public health, as recognized by the World Health Organization[1]. Bacteria evade conventional antibiotic treatments through multiple resistance mechanisms, including the formation of biofilms, which significantly reduce therapeutic efficacy[2]. In response to this challenge, we propose an innovative approach based on the functionalization of gold nanoparticles (GNPs) to enable specific interactions with a model bacterium, *Escherichia coli*. GNPs possess remarkable optical properties arising from surface plasmon excitation, which can be harnessed to induce localized heating and generate reactive oxygen species (ROS)[3]. These features form the basis of two complementary light-driven antibacterial strategies: photothermal therapy (PTT) and photodynamic therapy (PDT)[3]. We aim to evaluate, compare and quantify the antibacterial efficiency of both approaches against E. coli in planktonic form as well as within biofilms. Bacteriological assays and fluorescence imaging will be employed to assess bacterial viability and quantify cell death, as well as FCS to assign bacteria to gold particles interactions.

Acknowledgements

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Microscale Force Sensors in Microfluidic Chips based on Polydiacetylenes Mechanofluorochromism

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Mechanofluorochromism is a property held by molecules or molecular materials whose fluorescence changes when submitted to a mechanical force. Polydiacetylenes (PDA) form a family of polymers exhibiting such an intriguing behavior.[1] When formed in the solid-state by polymerization under UV light, PDA appear in their blue form, which is not fluorescent. This stable blue-PDA can then undergo an irreversible phase transition to the red-PDA, becoming weakly fluorescent. Multiple factors can trigger it such as heat or the application of a mechanical force. The latter is thought as an interesting property in the design of reliable force sensors. The weak mechanofluorochromism of PDA can be enhanced by the addition of a tetrazine fluorophore in the backbone of the diacetylene (DA).[2] Indeed, the emission spectrum of tetrazine overlaps with the absorption spectrum of the blue-PDA, quenching its bright fluorescence by FRET after photopolymerization. Afterwards, when the PDA switches to its red-form, the absorption spectrum blue-shifts and the tetrazine fluorescence is released.

We synthesized a new fluorescent DA designed to allow a covalent grafting inside microfluidic chips. After photopolymerization, the resulting PDA provides a new function to the microfluidic channel walls, which now behave as real force sensors, in which biological organisms such as microalgae are flushed to trigger the OFF-ON fluorescence switch by applying a shearing force when constricted (**Figure**).[3] This enhanced fluorescence is linked to the force applied on the microalgae and studied to understand the influence of forces on membrane permeability.

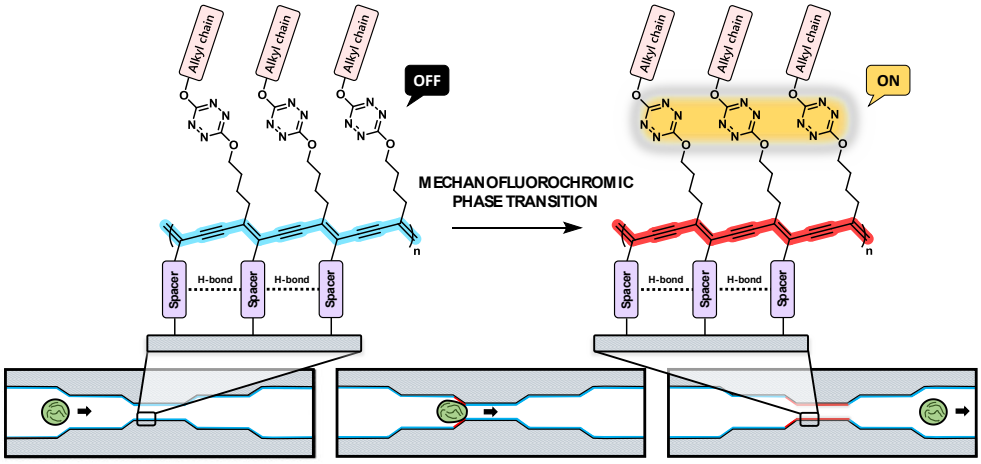

Figure: Mechanofluorochromic transition undergone by PDA when submitted to a mechanical force exerted by microalgae.

Acknowledgements. This work has been supported by ANR Chromic (ANR-24-CE06-7222) and 2IM Paris-Saclay action.

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Inspired by Nature, Driven by Charge: Electrostatics in Artificial Photosynthesis of CO_2

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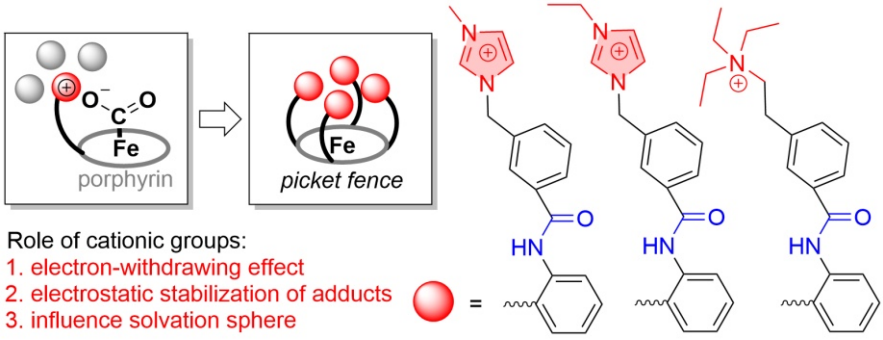
Breaking the linear scaling barrier in carbon dioxide reduction reaction (CO2RR) remains a central challenge: boosting turnover frequency typically comes at the cost of higher overpotential. Nature, however, offers a blueprint. Enzymes such as carbon monoxide dehydrogenase seamlessly integrate multiple second coordination sphere interactions within a confined active site to orchestrate substrate binding, proton transfer, and charge stabilization with remarkable efficiency. Hydrogen-bond donors promote CO2 capture and activation [1], while strategically positioned cationic residues stabilize anionic intermediates and reshape the local electric field [2-3].

Inspired by this strategy, we interrogate how electrostatic second-sphere effects can be deliberately tuned under photocatalytic conditions, where catalytic reactivity must align with the thermodynamics of the photoreductant. We report a multifunctional picket-fence iron porphyrin that combines a proximal amide with four cationic pendants, delivering a pronounced enhancement in CO production relative to the parent scaffold. Strikingly, subtle variation of the cationic substituent, from methyl-imidazolium to ethyl-imidazolium and ultimately to ethyl ammonium, leads to marked differences in CO2RR performance, revealing an unexpected sensitivity to second-sphere structure. Through a synergistic suite of in situ spectroscopy, laser flash photolysis, and spectroelectrochemistry, we uncover how fine-tuning electrostatics reprograms catalytic energetics under photocatalytic turnover.



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Plasmon-induced photopolymerization followed by spectroscopic and electronic microscopy

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Plasmonic effects enhance the electromagnetic field around gold nanoparticles, enabling photopolymerization at the nanoscale. In this work, we aim to understand photopolymerization in the near field.

We combine two complementary approaches. First, a spectroscopic method based on thermally dewetted gold nanoparticles is used to monitor shifts in the localized surface plasmon resonance (LSPR) during photopolymerization using UV–Vis spectroscopy. Second, a microscopic approach allows direct observation of polymer growth at the surface of a single nanoparticle with a nanometer resolution by Transmission Electronic Microscopy (TEM).

The spectroscopy results show a clear LSPR shift, reflecting changes in the local refractive index as polymerization proceeds. Simultaneously, microscopy reveals polymerization occurring at the surface of individual nanoparticles. We investigated the differences linked to the acrylate monomers used in free radical polymerization. These findings highlight the key role of plasmonic near-fields in driving photopolymerization. This work opens new opportunities for fabricating polymer structures with nanoscale precision and allows the investigation of (photo)polymerization at nanoscale.

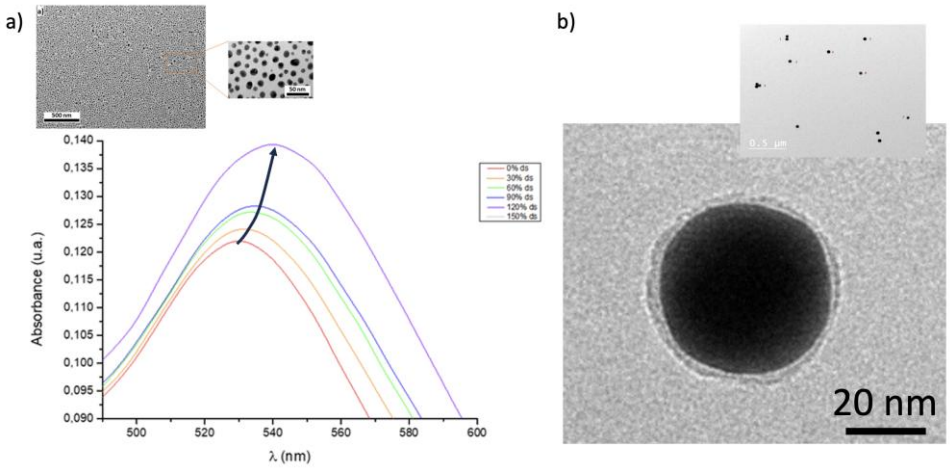

Figure: a) Spectroscopic following of the near-field photopolymerization and b) TEM approach showing a single nanoparticle surrounded by a polymer layer

Acknowledgements

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Towards a Molecular Understanding of Copper Resistance: Photoinduced Electron Transfer Studies in the Green Cupredoxin CopI

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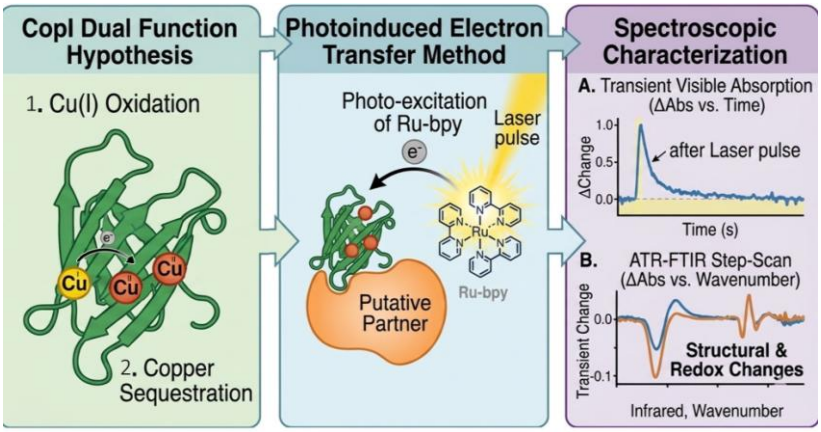
Bacteria can be exposed to toxic concentrations of copper, especially in environments where copper is used as an antimicrobial agent. To survive, they have evolved complex detoxification mechanisms. One of them involves the expression of periplasmic proteins capable of binding or transporting excess copper ions [1].
Among these, CopI, has recently been identified as a key component of the bacterial copper resistance system of the photosynthetic purple bacterium *Rubrivivax gelatinosus* [1]. It has been characterized as a green Cu-type cupredoxin capable of binding up to three Cu(II) ions [2]. The presence of multiple copper-binding sites suggests that CopI may have an unprecedented dual function, combining Cu(I) oxidation and copper sequestration [3].
Here, we investigate this redox-based process using a combination of spectroscopic techniques, including time-resolved visible and FTIR spectroscopies. To characterize electron transfer (ET) within CopI and between CopI and its putative partners, we employ nanosecond transient absorption spectroscopy and ATR-FTIR techniques. Electron flow is initiated using photoredox-active Ru polypyridine complex, which has proven effective as photo-initiator in ET studies of proteins lacking intrinsic photoactive cofactors.



Acknowledgements

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Development of Original Photochemical Process to Synthetize Metal Nanoparticles

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Bismuth (Bi) has attracted considerable attention due to its low toxicity, biocompatibility, intrinsic physicochemical properties, and low cost. This heavy metal also exhibits several advantages in various fields when used in nanoparticle form, such as in catalysis for nitro-group reduction, and as photocatalyst to enhance photocatalytic activity owing to its plasmonic band and its high electronic density.[1,2] Moreover, Bi nanoparticles are of growing interest as contrast agents for imaging and as therapeutic agents for cancer treatment or antibacterial applications.[3,4]

These considerations highlight the need to develop new synthetic processes aligned with the principles of green nanomaterials. [5,6] Photochemistry represents a promising energy source for producing nanomaterials under milder conditions that do not require high temperatures.[7] This activation offers better control over the nucleation and growth of nanoparticles when combined with continuous flow technology. The advantages of continuous flow are also evident in terms of reproducibility, the stability of the nano-objects, and the potential for scale-up. [8,9] These benefits are directly linked to the excellent mass and heat transfer generated by the flow process.

The aim of this study is to develop a new continuous-flow photochemical process to synthesize stable and monodisperse Bi NPs under mild and reproducible conditions. Preliminary experiments were conducted in a batch reactor under UVC irradiation using biocompatible reagents: citrate, D-glucose, and bismuth citrate as the precursor. This approach allowed us to optimize key parameters and obtain polydisperse nanoparticles ranging from 20 to 80 nm. To improve reaction control and, above all, reproducibility, a continuous-flow reactor was set up in the laboratory using PFA tubing placed under a UVC lamp. The concentration, residence time and reagents amounts were optimized. Initial results demonstrated the Bi NPs formation with well-controlled sizes, on the order of only a few nanometers.

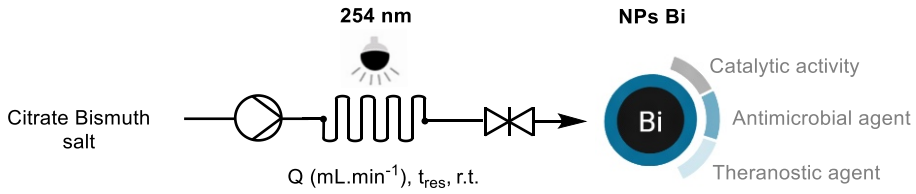

Figure 1 : *Photochemical flow to produce Bi NPs and their known applications in catalysis and in medicinal. fields.*

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HPA-Controlled Back-Isomerisation of Azobenzenes

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As global energy demand rises, the development of efficient energy storage systems has become as crucial as energy production itself. Photoswitchable molecules, such as azobenzenes, offer a promising approach to molecular energy storage. Their isomerisation process converts light into chemical energy, which can be stored and released, either spontaneously of catalytically, as thermal energy. However, a major limitation remains in the controlled release of the stored energy, that is, of the back-isomerisation.[1]

Acid-catalysis has been reported in the literature as a method to trigger the back-isomerisation of azobenzenes,[2] but it suffers from drawbacks such as poor cycle repeatability and requires external intervention. Heteropolyacids (HPAs) represent an attractive alternative, as their acidity depends on their redox state, thus the catalysis can be controlled *in situ* via redox stimuli.

This study investigates the influence of HPAs on the Z-E isomerisation of dimethylazobenzene (DMAB)[3] as a model system, as well as the elucidation of the catalytic activity upon electrochemical inputs.

Overall, this approach demonstrates the feasibility of controlled energy release via HPAs, and opens the way for the eventual design of repeatable and externally controllable molecular switching.

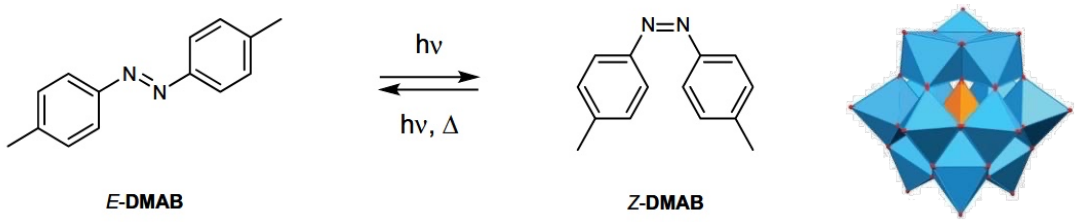

Figure: Left: E-Z Photoisomerisation of dimethylazobenzene (DMAB); Right: Structure of a Keggin-type polyoxometalate $H_4[SiW_{12}O_{40}]$

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Toward Sustainable CO_2 Management through Light-Responsive Photoacid System

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The accelerating impacts of climate change, driven by rising anthropogenic CO_2 levels, demand innovative and energy-efficient carbon management strategies.[1] Conventional capture technologies, such as carbon capture and storage and direct air capture, rely on thermal or pressure-swing processes that impose significant energy penalties during CO_2 release.[2] To address these limitations, we are developing a photochemically driven CO_2 release platform that operates under mild conditions using sunlight as the primary energy input.

Our approach integrates atmospheric CO_2 capture with on-demand, light-triggered release through photochemical desorption mediated by photoacid molecules, eliminating the requirement for high-temperature regeneration. The system employs spiropyran-based photoacid molecules that reversibly switch between protonated merocyanine and spiropyran forms upon visible light irradiation.[3] Light activation induces a pH drop via proton release, enabling CO_2 liberation from bicarbonate or carbamate species, while dark recovery regenerates the sorbent through pH restoration (Figure **1**). We aim to design and synthesize photoacids with tailored functionalization to enhance CO_2 release efficiency, photochemical stability, and cycling durability. Structure-property relationships derived from this work will guide molecular design and will inform integration of the photoacid-based CO_2 release system with a low-temperature electrolyzer for fully coupled capture, release, and electrochemical conversion of CO_2.

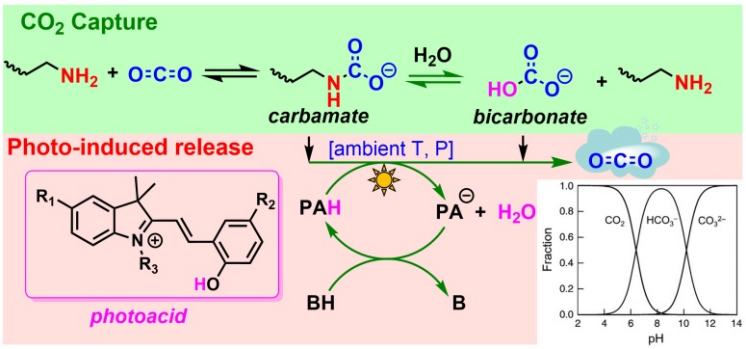

Figure 1: Overview of the integrated platform showing CO_2 capture and photochemical release.

Acknowledgements

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Novel Heptazine-core Molecular Materials for Delayed Fluorescence

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Organic Light-Emitting Diodes (OLEDs) represent a key technology in modern lighting and display applications. In such devices, the injection of electrical charges is converted into light thanks to organic emitters. In this context, Thermally Activated Delayed Fluorescence (TADF) has gained significant attention over the past decade as one of the most promising properties to improve the conversion yield of electrical energy into light.[1] TADF originates from a small energy gap between the lowest excited singlet and triplet states (ΔE_{ST}), which enables reverse intersystem crossing (rISC), a crucial parameter for organic emitters in OLEDs.

In this context, the present research investigates the functionalization of heptazine-based emitters. They consist in highly electron-withdrawing heterocyclic cores, with seven nitrogen atoms. In particular, we aim to functionalize heptazine core with strong electron-donating units through straightforward nucleophilic aromatic substitution (see Figure 1).[2]

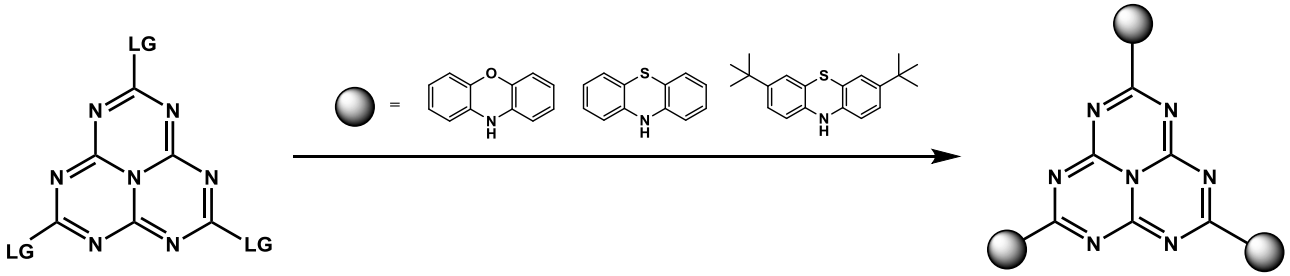

Figure 1: Scheme of the nucleophilic aromatic substitution for the synthesis of D-A TADF systems based on heptazines and antiaromatic species. LG: leaving group

This class of donor-acceptor systems exhibits pronounced charge-transfer behavior, one way to achieve efficient TADF. Notably, these heptazine derivatives show small ΔE_{ST} values, and may even display singlet-triplet gap inversion, potentially leading to a significant enhancement of TADF efficiency.

A first series of mono-, di-, and tri-substituted heptazine derivatives incorporating phenoxazine donors has been synthesized and characterized.[3] These compounds display photoluminescence in PMMA films, along with very small ΔE_{ST} values. For mono- and di-substituted derivatives, the first results suggest the presence of singlet-triplet inversion, although accurate quantification remains challenging due to methodological limitations.

These interesting results establish a promising platform for the design of novel OLED fluorophores. Current efforts focus on the replacement of phenoxazine with stronger electron-donating systems, such as phenothiazine (see **Erreur ! Source du renvoi introuvable.**). Another objective consists in functionalizing the heptazine core with one or two electron-rich unit(s) and complete the substitution with solubilizing groups (*e.g.*, alkyl thiols) to improve the processability which remains an issue for applications.

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UiO-66-NH_2-Based Composites for Efficient Photocatalytic Hydrogen Production

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The conversion of solar energy into chemical energy is widely regarded as a sustainable and promising strategy to mitigate environmental issues and the energy crisis. From an economic and environmental point of view, photocatalytic hydrogen (H_2) production is one of the most promising techniques nowadays [1]. Conventional benchmark oxide photocatalysts, such as TiO_2 and related metal oxides, have been extensively studied due to their stability, low cost, and suitable band structures, although their limited visible-light absorption and rapid charge recombination still restrict their efficiency. In this regard, metal-organic frameworks (MOFs), a versatile class of porous hybrid crystallines solids with a huge chemical and structural diversity, have emerged as promising platforms for specific properties such as visible light response and its high thermal and chemical stability in some case, as well as the possibility to construct heterojunctions with various entities, among others [2]. For instance, UiO-66-NH_2 (UiO stands for University of Oslo) is an amino-functionalized microporous MOFs, where the amino groups can effectively improve the light harvesting (in the visible range) and which also provides active sites for post-synthetic modification [3]. On the other side, pure semiconductors materials, such as MoS_2 and CdS, possess high redox capabilities but suffer from the limited surface area and swift photo-charge recombination, which significantly limits their photocatalytic activity and results in the low product selectivity. Thus, designing excellent MOF-Semiconductor (MOF-SC) composites photocatalyst with excellent performances for H_2 production activity is very appealing and promising.

Thus, UiO-66-NH_2 and different semiconductors have been explored to identify optimal MOF-SC composites. In this presentation, the focus will be specifically on MoS_2/UiO-66-NH_2 and CdS/UiO-66-NH_2 composites (Figure 1). The latter are constructed from MoS_2 and CdS for their excellent photosensitivity, combined with UiO-66-NH_2 which serves as a good platform for forming heterojunctions. This combination is expected to effectively suppress the fast photo-charge recombination [4]. Furthermore, photo-depositions of Pt, Ru, Ir and Au at very low amounts (< 0.5 wt.%) will be proceeded on MoS_2/UiO-66-NH_2 and CdS/UiO-66-NH_2, respectively, in order to improve the photocatalytic H_2 production.

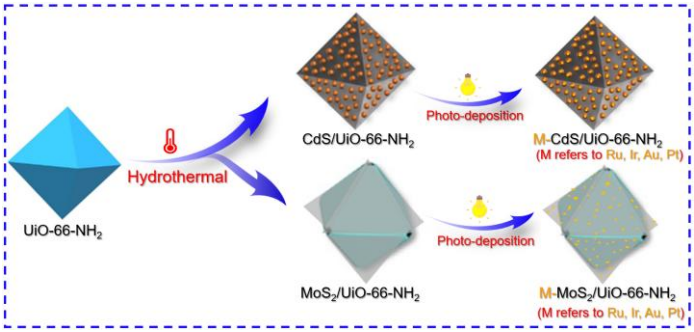

Figure 1: Schematic illustration of the preparation process of UiO-66-NH_2 based photocatalysts.

Acknowledgements

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Cl-doped Polypyrrole for photocatalytic green H_2O_2 production

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Hydrogen peroxide (H_2O_2) is a promising green oxidant for various industrial applications. However, its synthesis is primarily achieved through the environmentally costly anthraquinone process. Consequently, several alternative routes for eco-friendly H_2O_2 synthesis are under investigation. Photocatalytic H_2O_2 production via H_2O oxidation and O_2 reduction stands out as a sustainable option, as it generates no harmful byproducts [1].

Conjugated polymers, as organic semiconductor have emerged as one of promising candidates for photocatalytic H_2O_2 generation active under visible light in recent years[2]. Here, we report a facile one step synthesis of Cl-doped polypyrrole (Cl-PPy) conjugated polymer via γ-radiolysis for photocatalytic H_2O_2 production. We investigated the effect of Cl doping on H_2O_2 production and studied various parameters (pH, light source, influence of oxygen, etc.) affecting H_2O_2 yield. Several analytical and characterization techniques were employed to understand the behavior of the Cl-PPy photocatalyst and its role in H_2O_2 generation. We found that Cl-PPy is highly active for photocatalytic H_2O_2 formation (1.9 mM/h) from H_2O and O_2 without any sacrificial agent, under UV-Vis illumination. Its higher photocatalytic activity, ease of synthesis, and recyclability confirm its potential for sustainable photocatalytic H_2O_2 production.

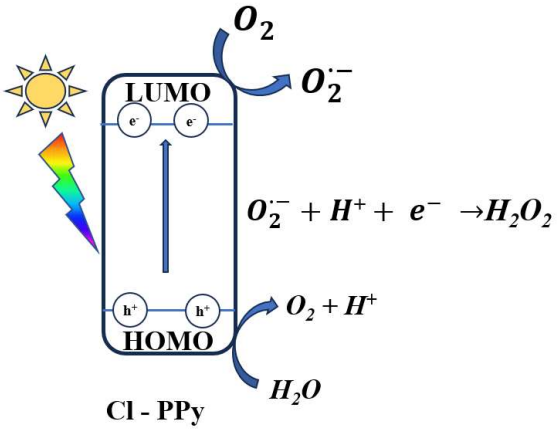

Figure : Mechanism of Photocatalytic H_2O_2 formation by Cl-PPy .

Acknowledgements

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Hybrid particles for the physical treatment of thrombotic diseases

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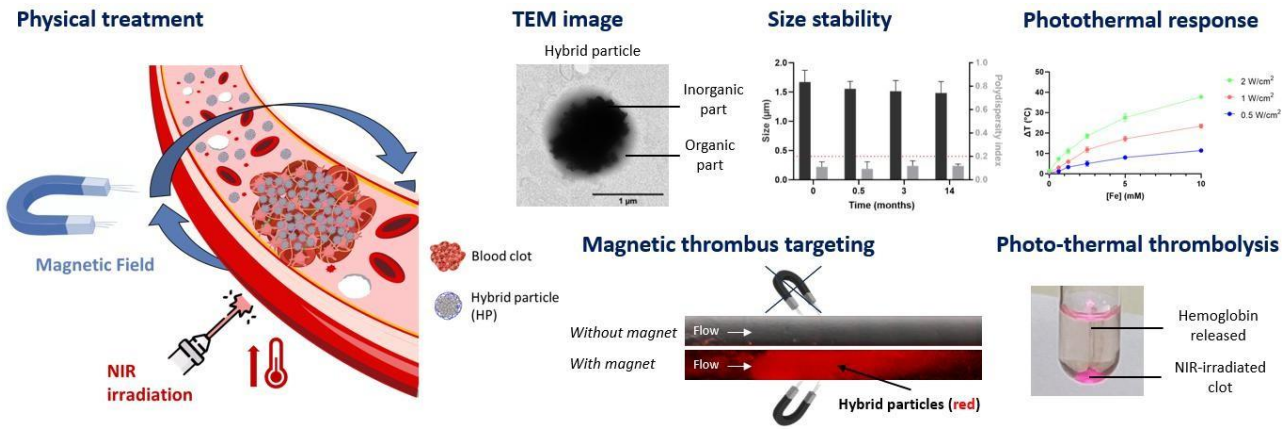
Thrombosis is responsible for most strokes and heart attacks, which are the two leading causes of death worldwide. Reperfusion is commonly performed with thrombolytics such as recombinant tissue plasminogen activator (rt-PA) but these present numerous limitations (severe adverse effects, few eligible patients, low recanalization rate). With the objective of designing a safer and efficient treatment, we designed hybrid particles for a targeted physical action on the thrombus. This non-pharmaceutical thrombolysis would be a combination of thermal and mechanical action, through light and magnetic stimulation, and would be targeted to the occluded vessel by an external permanent magnet. To achieve this strategy, we embedded iron oxide nanoparticles that have great photothermal and magnetic properties in polysaccharide microbeads that are stable and intravenously injectable (Patent – INSERM - 01/12/2023). We confirmed the hybrid structure by electronic microscopy and FT-IR spectroscopy. Through DLS and ELS, we studied the time stability in size and charge of these new microsystems and characterized them also in saline solution. Magnetization measurements and particle counting were performed to compute the magnetic moment of these hybrid particles. Also, their response to magnetic stimulation was verified. This was completed with photothermal tests to estimate their ability to increase temperature when irradiated by a near-infrared laser. In an in vitro flow model (platelet binding assay), these particles could be retained by a magnet while flowing in venous or arterial conditions, proving their ability to magnetically target the thrombus. Finally, the effect of different levels of hyperthermia was evaluated *in vitro* clots.



Graphical abstract

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MOF-Based Quantum dots Composites with Photothermal and Photodynamic Effects against Drug-resistant Bacteria

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Antimicrobial Resistance (AMR) in bacteria, driven by genetic mutations, biofilm formation, and horizontal gene transfer, poses a growing challenge under prolonged exposure to antibiotics and heavy metal ions [1]. Photodynamic (PDT) and photothermal(PTT) therapies have emerged as promising alternatives to conventional antibiotics, offering reduced risk of resistance development [2]. Metal–organic frameworks (MOFs) are emerging as versatile platforms for PDT/PTT due to their high surface area, tunable structures, and ability to incorporate photosensitizers or photothermal agents[3]. These features enable efficient reactive oxygen species generation and heat conversion, enhancing antibacterial phototherapy [3]. However, their limited near infrared(NIR) -light absorption and rapid charge recombination hinder practical applications, which is necessary for deep tissue penetration. To address these limitations, a MOF/Quantum Dots(QDs) heterojunction nanocomposite was designed to enhance charge separation and extend NIR-light response, promoting higher efficiency PDT and PTT for sterilization. The objective of PDT and PTT is to generate reactive oxygen species (ROS), which are highly oxidative molecules capable of interacting with bacterial biomolecules, thereby inducing cellular damage and effectively eliminating bacteria. Materials such as copper indium sulfide/zinc sulfide ($CuInS_2$/ZnS) and copper-deficient sulfides ($Cu_{2-x}S$) exhibit distinctive optical and electronic properties. Notably, they possess broad absorption spectra that can extend into the NIR region [3]. Furthermore, their tunable bandgap and effective surface passivation help suppress non-radiative recombination pathways, thereby enhancing photoconversion efficiency. These characteristics contribute to improved performance in both PDT and PTT [4]. The composite was synthesized and characterized by powder X-ray diffraction (pXRD) and scanning electron microscopy (SEM), confirming phase composition and morphology. NIR absorbance spectroscopy, Nitrogen adsorption–desorption (BET) analysis and inductively coupled plasma (ICP-MS) were conducted to assess structural changes, with ongoing analysis to evaluate QD incorporation within the MOF framework. Further studies, including photothermal behavior studies and reactive oxygen species (ROS) generation were investigated for the in-vitro PDT and PTT effect. This work aims to establish a heterostructure-engineered strategy to enhance the NR-induced antibacterial performance of MOF-based composites, with potential implications in antimicrobial therapy.

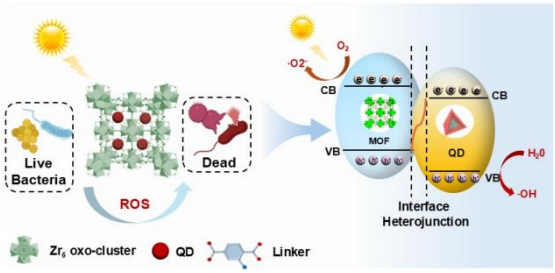

Fig 1 : Scheme of the photocatalytic effect of MOF/QDs composite for effective bacteria-killing under NIR-light irradiation

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Light-induced Ultrafast Charge Transfer of NiO/P1 Architecture

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Dye-sensitized p-type NiO is a key platform for solar energy conversion. In this work, we investigate the photodynamics of the benchmark dye P1 on a dry mesoporous NiO surface. Using broadband femtosecond spectroscopy, we demonstrate sub-picosecond hole injection into NiO and, crucially, decouple the intrinsic injection and recombination kinetics, enabling direct determination of the charge-separated state lifetime. Building on this controlled platform, we are going to extend our approach to more complex assemblies incorporating push–pull sensitizers. While these materials are understood in liquid solutions, their electronic behavior can change dramatically when immobilized on a solid surface. Understanding solid-state charge transfer dynamics is essential to maximize catalytic turnover and to enable the integration of these molecular systems into functional photoelectrochemical devices with enhanced efficiency for next-generation solar energy conversion.

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Two step process to functionalize gold nanoparticles with photo-active molecules though plasmon-induced grafting

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We report a plasmon-assisted strategy for the controlled grafting of photoactive molecules onto gold nanoparticles (AuNPs) assemblies using diazonium chemistry. While diazonium-based functionalization is a powerful tool for surface modification[1,2], initial attempts to directly graft DAE-based diazonium salts onto plasmonic nanoparticles resulted in limited grafting efficiency and non-uniform surface coverage. To overcome this limitation, we introduce a two-step approach based on an intermediate anchoring layer.
First, Oligo(bisthienylbenzene) is selectively grafted by plasmon-induced diazonium salt reduction within the interparticle gaps of non-connected AuNPs, forming a robust and uniform organic interface.
In a second step, a diarylethene (DAE)-based diazonium compound, exhibiting photochromic properties, is grafted onto the pre-functionalized substrate, enabling the formation of molecular junctions between nanoparticles.
The resulting structures are characterized by scanning electron microscopy (SEM) coupled with energy-dispersive X-ray spectroscopy (EDX), confirming both the spatial localization of the grafted layers and their chemical composition. The combination of plasmonic confinement and stepwise diazonium chemistry allows for controlled functionalization at the nanoscale, overcoming limitations of direct grafting strategies.
This approach provides a versatile route for integrating photoresponsive molecules into plasmonic architectures, opening perspectives for applications in molecular optoelectronics, nanoscale switching, and light-controlled functional surfaces.

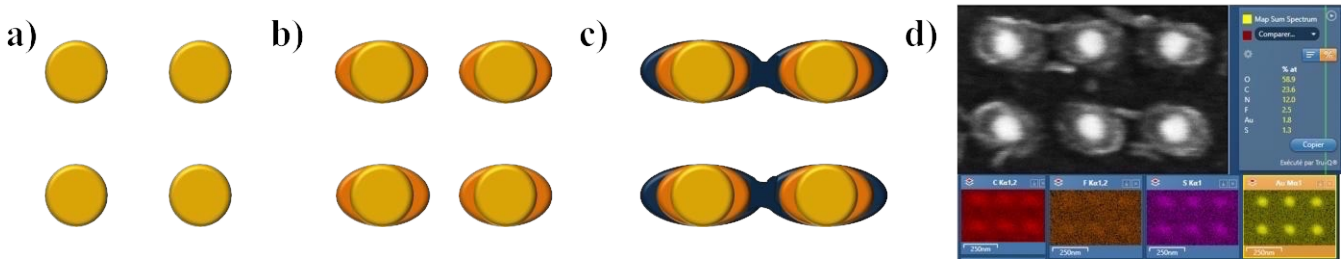

Figure 1: a) naked AuNPs b) AuNPs/BTB c) AuNPs/BTB/DAE d) SEM-EDX coupled imaging of the AuNPs/BTB/DAE junctions

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Plasmon-induced thermo-polymerization of PETA in presence of various initiators

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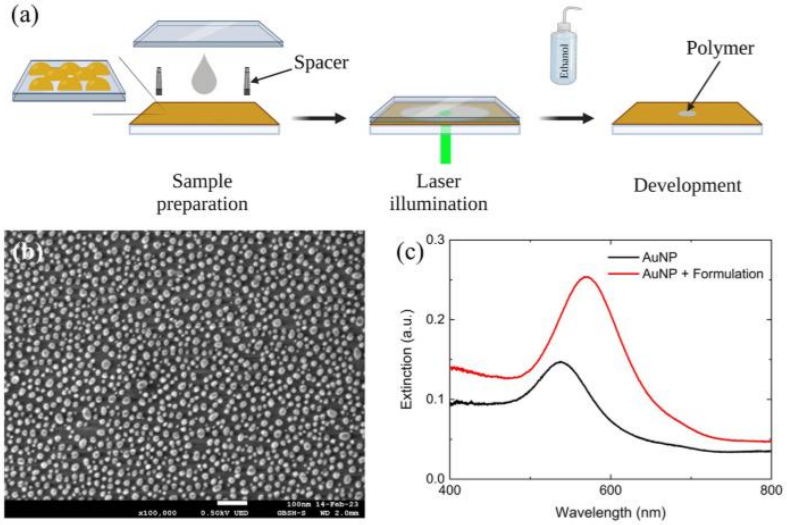
We have previously intoduce a novel thermopolymerization method utilizing gold nanoparticles (AuNPs) to determine the heat generated during plasmonic effects. 1,2 The system employs Pentaerythritol Triacrylate (PETA) as a monomer combined with a dialkoxyamine-based thermal initiator (DIAMS). Upon laser irradiation at 532 nm, the AuNPs generate heat that initiates the polymerization of PETA, enabling temperature mapping of the substrate.
The methodology involves depositing the thermopolymer formulation on a gold nanoparticle-coated substrate and exposing it to varying laser powers. Differential Scanning Calorimetry (DSC) and hot-plate tests confirm the polymerization threshold for each initiator. The thermopolymerization is visibly detectable as polymerized regions correlate with localized heating induced by AuNP irradiation. Importantly, the study validates the thermal pathway by excluding photopolymerization, owing to the transparency of the formulation in the irradiation spectrum.
This approach leverages collective heating effects from densely packed AuNPs, which amplify temperature distribution beyond individual nanoparticle scales. Experimental results demonstrate the precise control of polymer dot size and shape based on laser power and exposure duration. Moreover, this work highlights the self-sustaining nature of the exothermic polymerization reaction once initiated. This thermoplasmonic polymerization framework provides a rapid, marker-free method to probe heat generation in nano-thermoplasmonic applications. Its potential extends to fabricating metal-polymer nanocomposites and verifying temperature models in plasmonic systems.



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Innovative molecular materials combining optical and luminescent monitoring of the thermal experience of their environment

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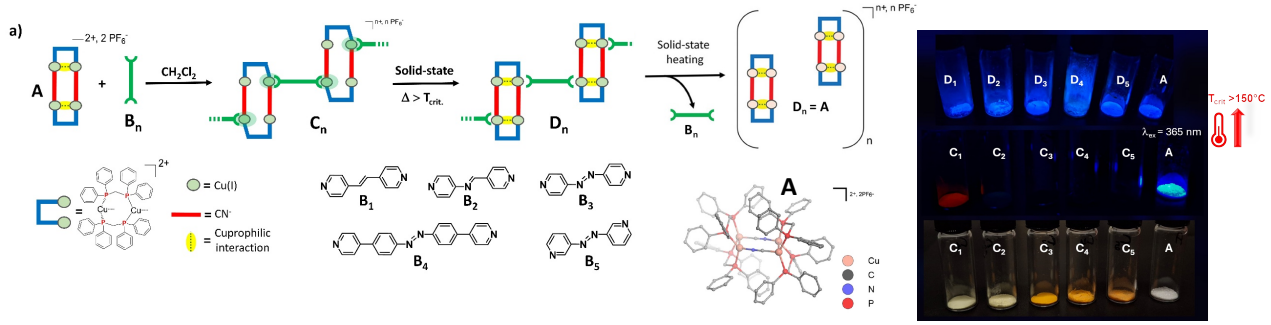
Growing attention is being directed toward molecular assemblies based on the Cu(I) ion as promising photoluminescent materials for lighting and stimuli-responsive sensing applications.[1] This interest arises from their diverse photophysical behaviors, as well as the remarkable flexibility of the coordination environment offered by Cu(I)-based derivatives. We recently reported a series of one-dimensional coordination polymers constructed from photoactive Cu_4 luminescent Cu(I) subunits[2] interconnected by N-capped ditopic linkers.[3] These materials exhibit original, irreversible yet non-destructive solid-state thermal transitions in their luminescence properties, offering attractive prospects for the design of innovative solid-state temperature sensors.

In the present contribution, we extend this approach to new systems capable of both real-time optical monitoring and a posteriori luminescent detection of threshold temperature crossing. Furthermore, the reversibility of these thermally induced transitions, enabling material reusability, will also be addressed.



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