LABORATORIO DI CHIMICA INORGANICA



Potenza, 17 dicembre 2025

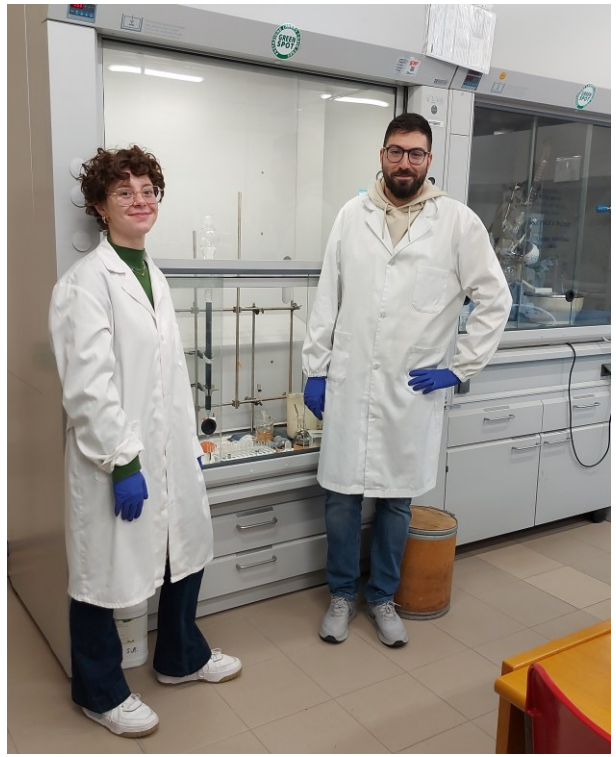
LABORATORIO DI CHIMICA INORGANICA

Edificio 3B – 3° piano

Responsabile Scientifico

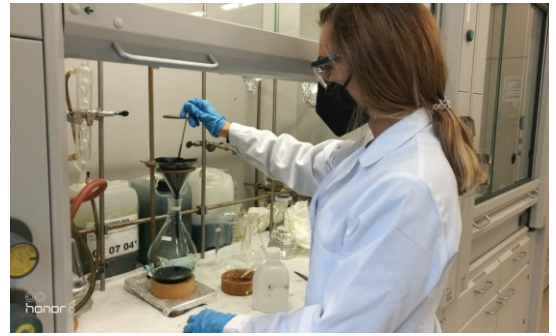
Prof.ssa

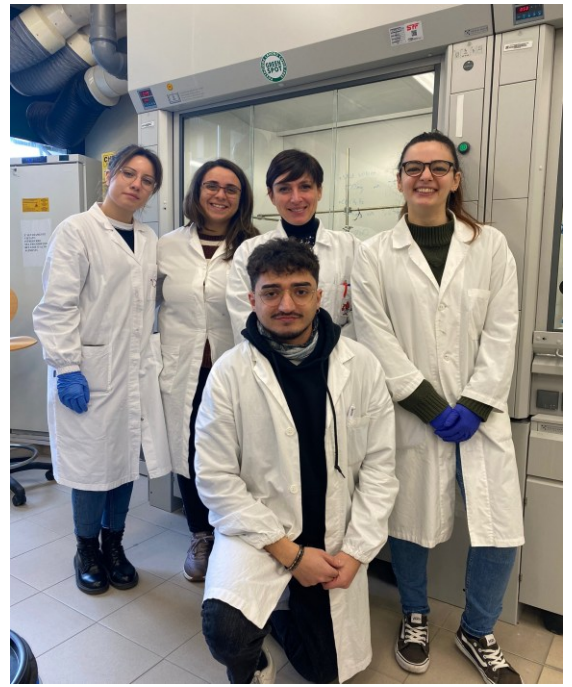
SANDRA BELVISO





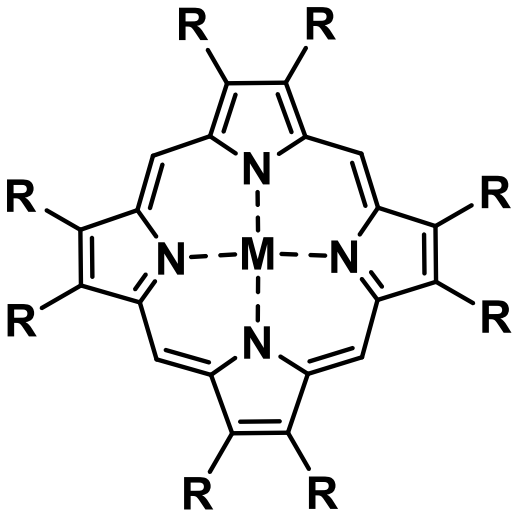




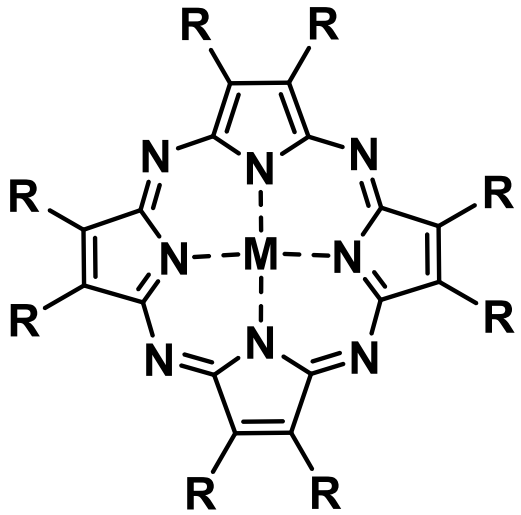


Potenza, 17 dicembre 2025

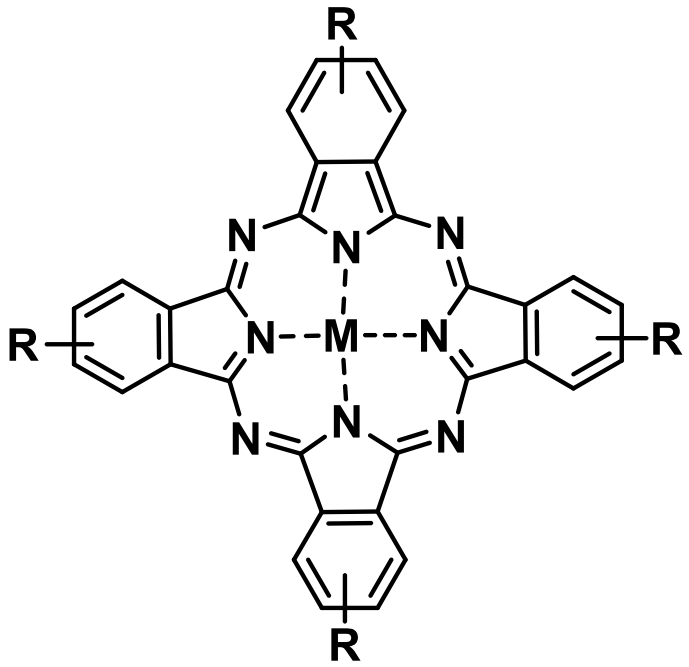
Macrocicli Tetrapirrolici



Porfirine



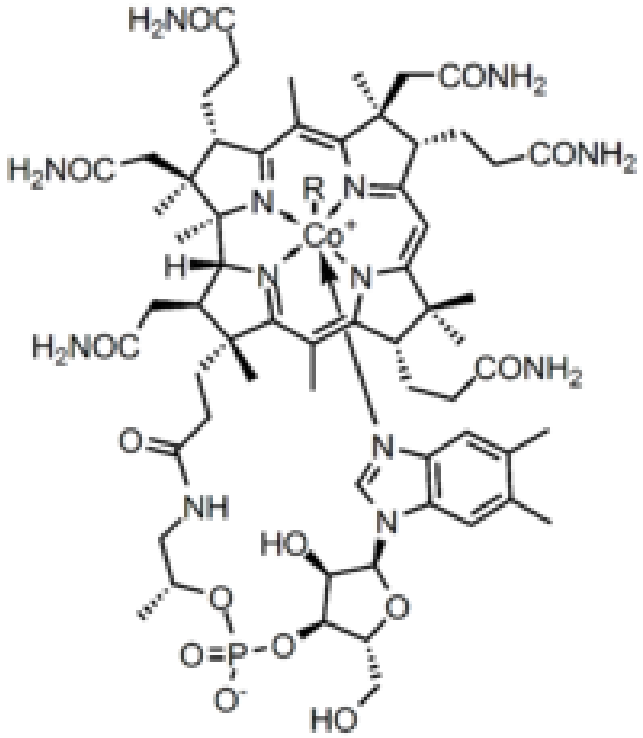
Porfirazine (Tetraazaporfirine)



Ftalocianine

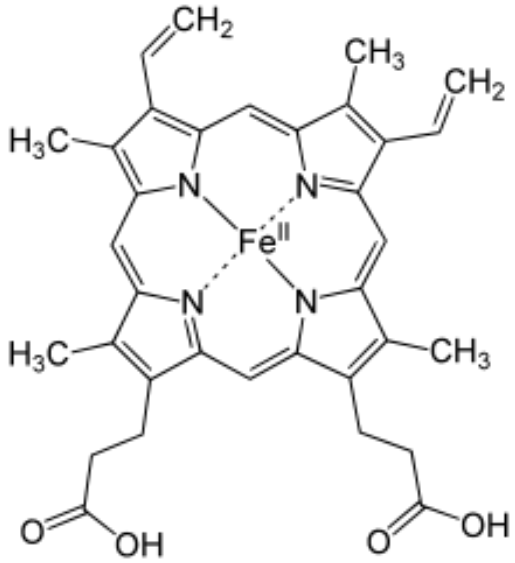
M = H_2, Metallo

Macrocicli tetrapirrolici di importanza biologica



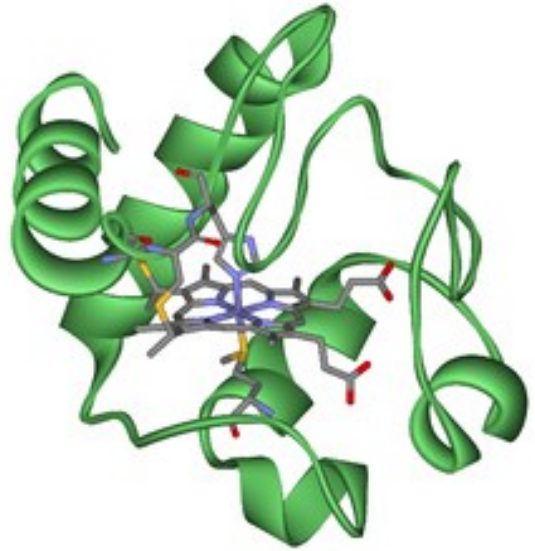
R = 5'-deoxyadenosyl, Me, OH, CN

Vitamina B12



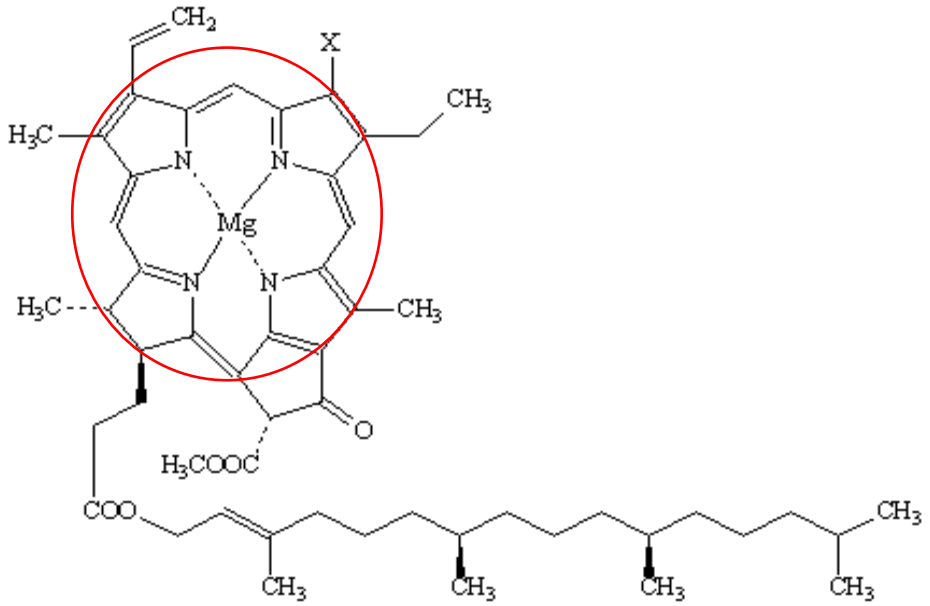
Eme

(Fe-Protoporfirina IX)

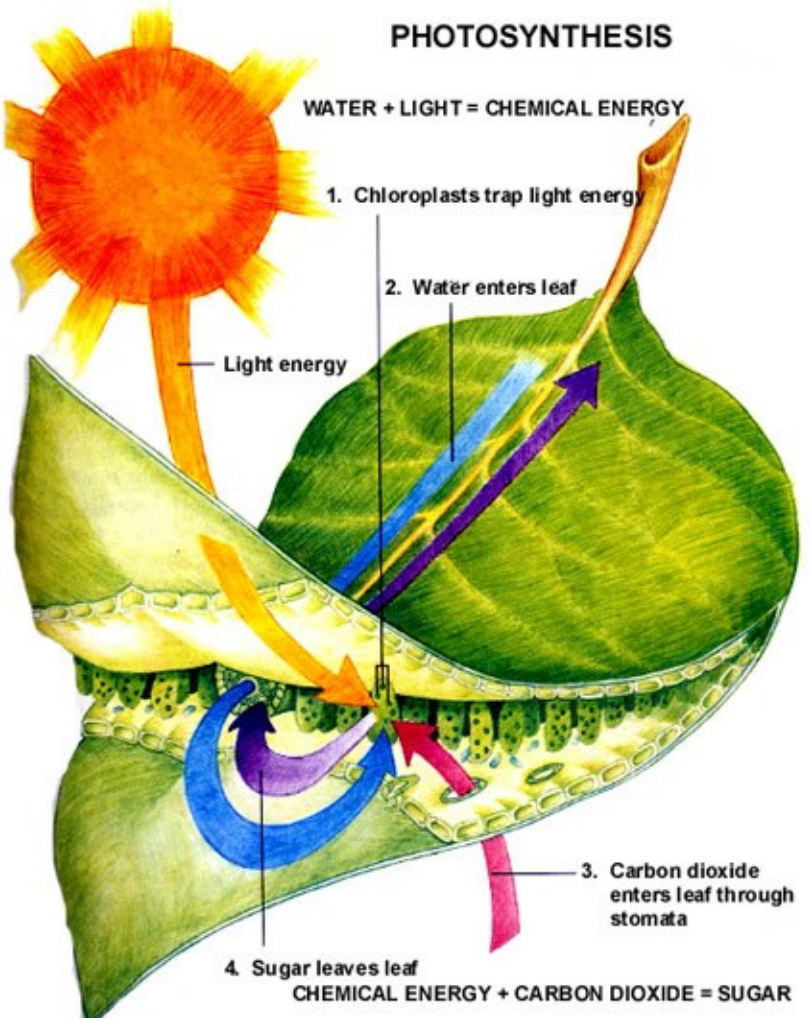


Citocromo C

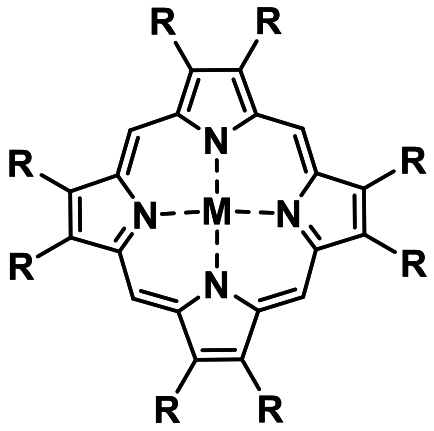
Macrocicli tetrapirrolici nella Fotosintesi



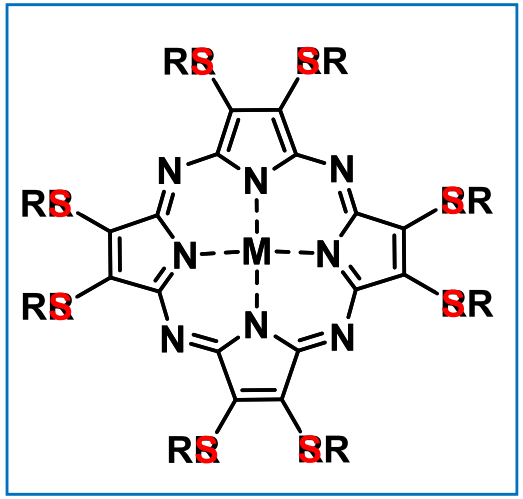
Clorofilla: un'*antenna solare*



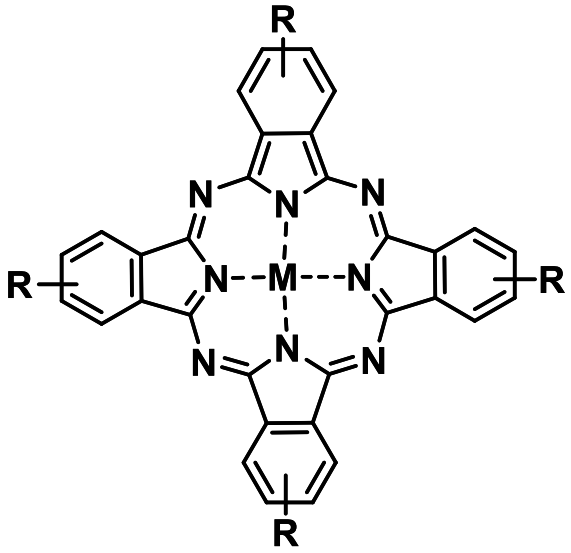
Tio-Porfirazine



Porfirine



Tio-Porfirazine



Ftalocianine

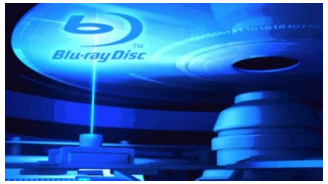
- **Peculiari proprietà spettroscopiche, elettrochimiche e di interazione intermolecolare**
- **Facile modulabilità strutturale**

Tio-porfirazine nella scienza dei materiali

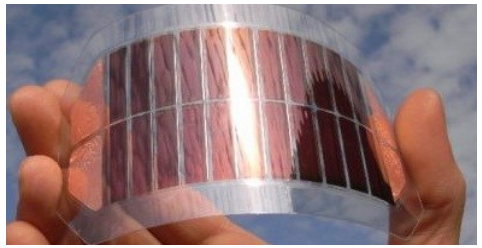
- **Cristalli Liquidi (LC)**



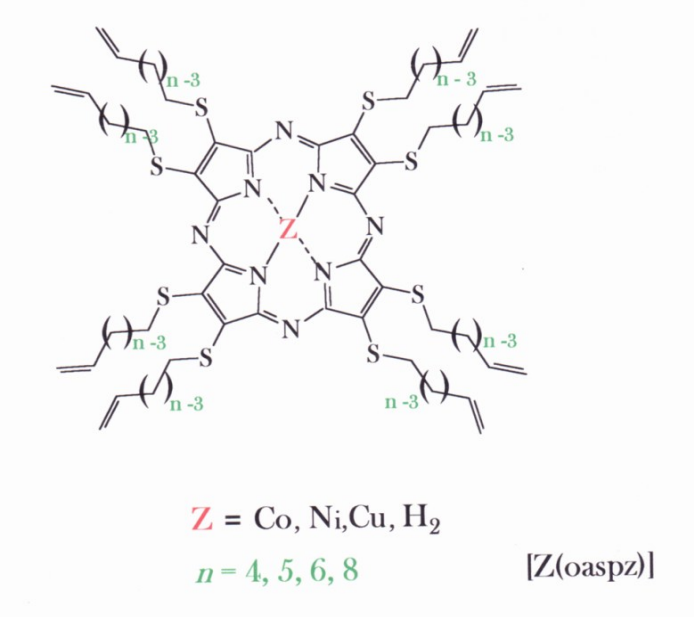
- **Ottica non lineare (NLO)**

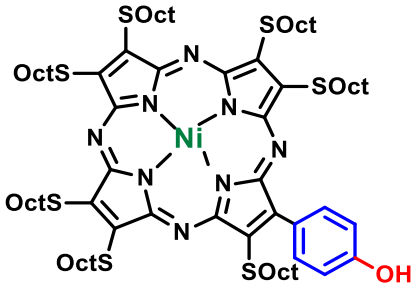


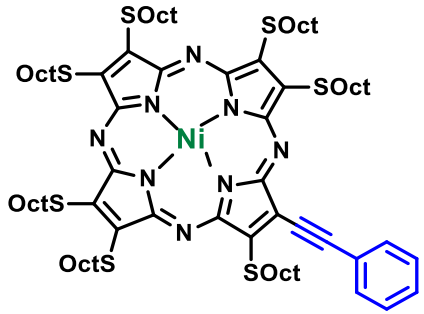
- **Fotovoltaico Organico (OPV)**

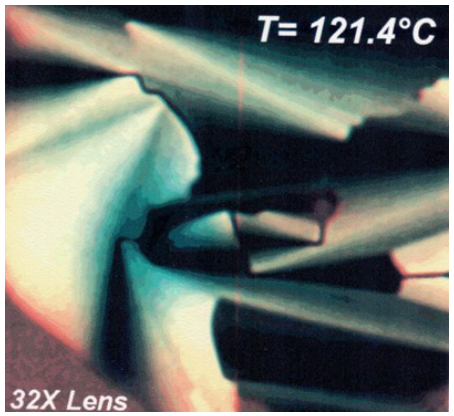


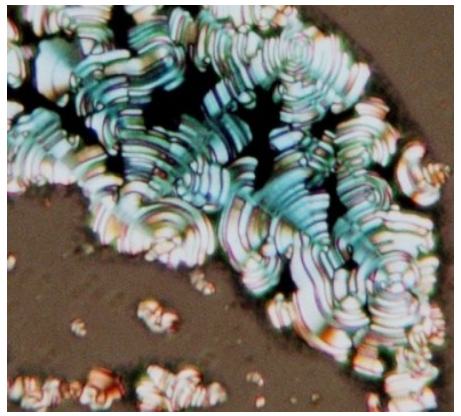
Tio-porfirazine Liquido-Cristalline

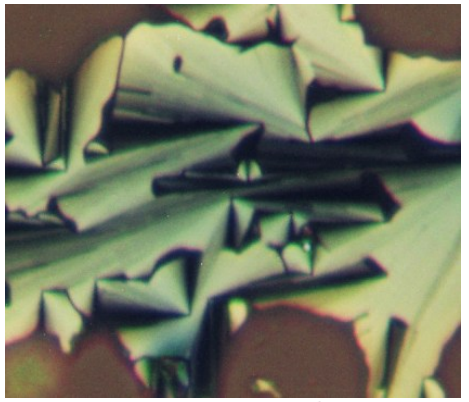


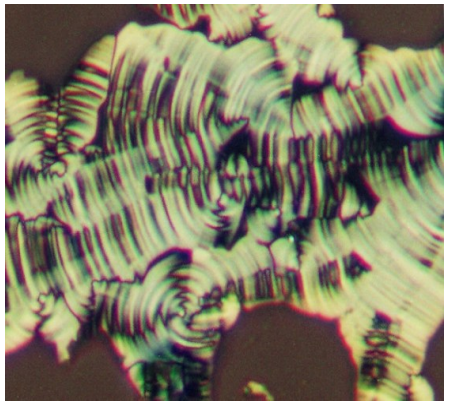


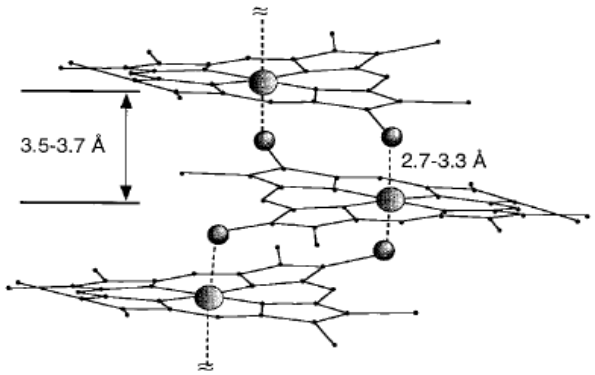




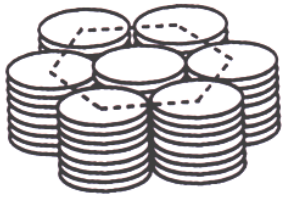








Col_h



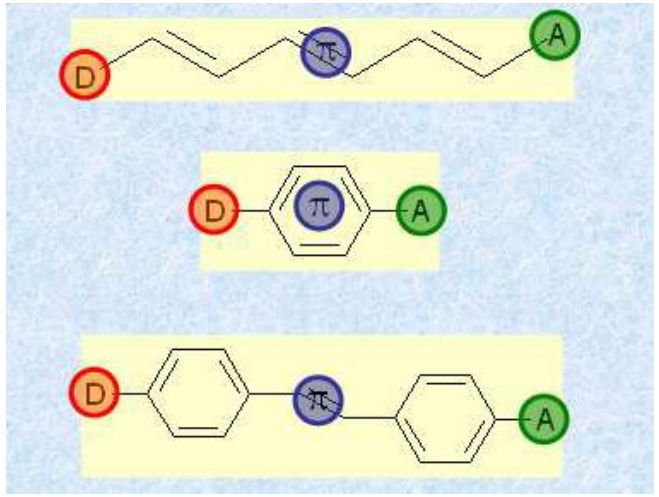
Col_r



S. Belviso *et al.*, *J. Mater. Chem.* **2000**, 10, 297.
S. Belviso *et al.*, *Dalton Trans.*, **2015**, 44, 2191.
S. Belviso *et al.*, *J. Porphyrins Phthalocyanines*, **2016**, *20, 223.*

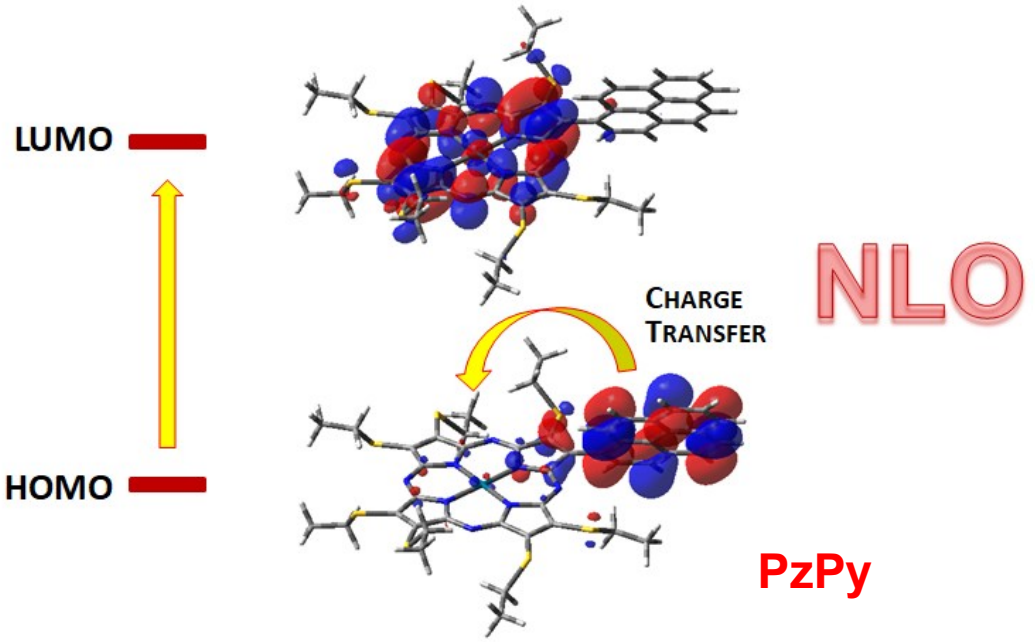
Ottica Non Lineare

Tipica struttura di sistemi "Push-Pull"



D = elettron-donatore
A = elettron-accettore

Tio-Porfirazine: Sistemi "Push-pull" non convenzionali



S. Belviso *et al.*, *Dalton Trans.*, **2015**, 44, 2191.

S. Belviso, *et al.*, *J. Phys. Chem. C* , **2019**, 123, 13074.

Tecnologie Fotovoltaiche



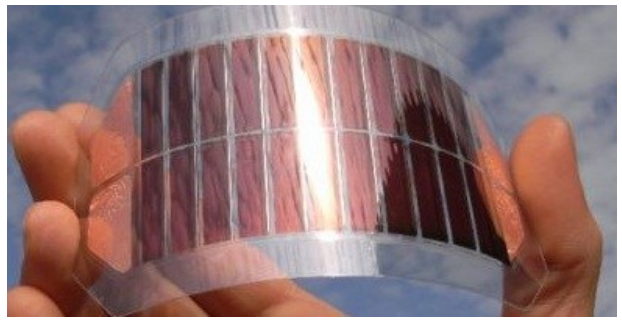
Celle Solari Inorganiche (silicio)

- **Efficienza alta (25%)**
- **Stabilità**
- **Costi alti**
- **Processo di produzione complesso**
- **Celle rigide e non trasparenti**
- **Smaltimento**



Celle Solari Organiche (molecolari)

- **Bassi costi di produzione**
- **Produzione a stampa ink-jet**
- **Pannelli leggeri, flessibili, grandi e trasparenti**
- **Integrazione architettonica**
- **Modulabilità delle proprietà**
- **Efficienza ancora inferiore a quelle al silicio**



A.Di Carlo, *et al.*, *La rivoluzione della plastica nel settore fotovoltaico*, Il nuovo saggiatore, **2010,** 26, 1.

Fotovoltaico Organico (OPV)

Heliatek – pannelli solari ultraflessibili per ogni profilo di superficie





“Alberi solari” al padiglione tedesco di EXPO 2015- Milano

Edificio ricoperto di Celle solari organiche Merck GmBh



Fotovoltaico Organico (OPV)

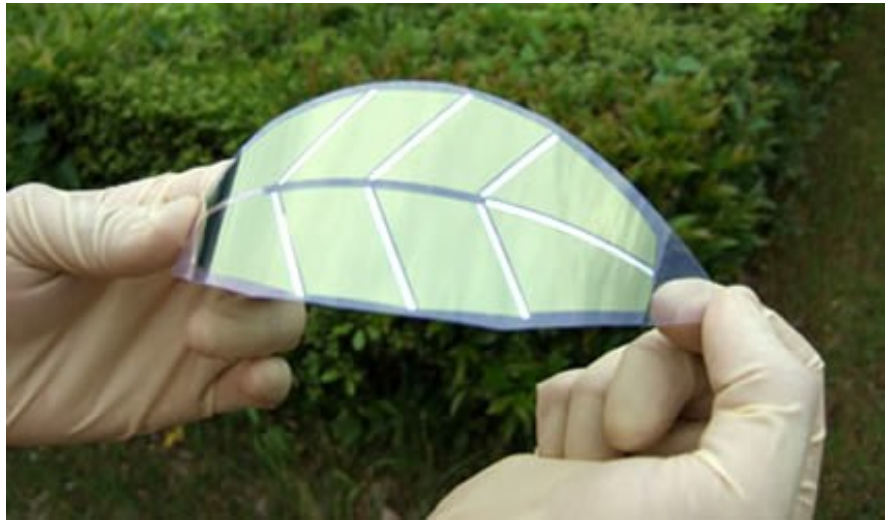


NEXT Energy Technologies sede di Santa Barbara: facciata fotovoltaica organica integrata in un edificio



Fotovoltaico Organico (OPV)





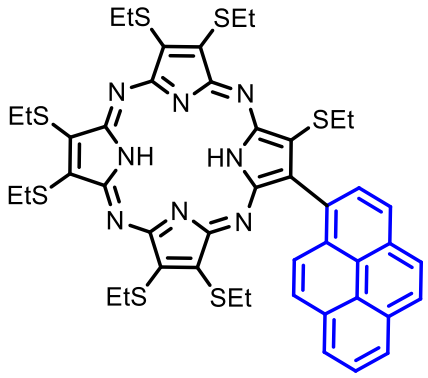
Pianta fotovoltaica, sviluppato dalla giapponese AIST www.genitron.com

Borsa fotovoltaica prodotta dall'azienda statunitense Konarka www.greenme.it

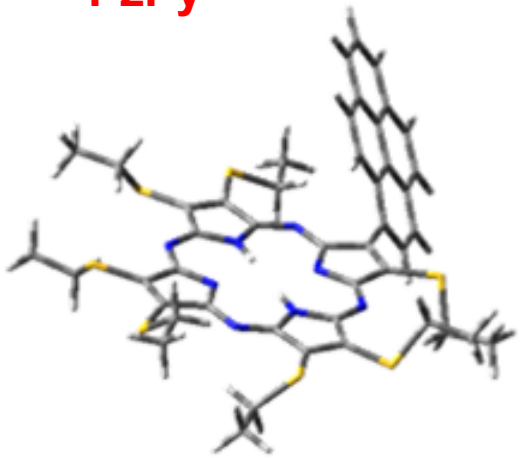


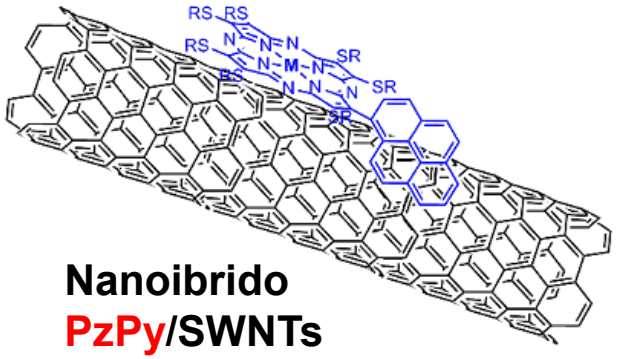
Tio-Porfirazine per OPV

Nanoibridi formati da porfirazine (DONATORI) con nanostrutture di carbonio (ACCETTORI)

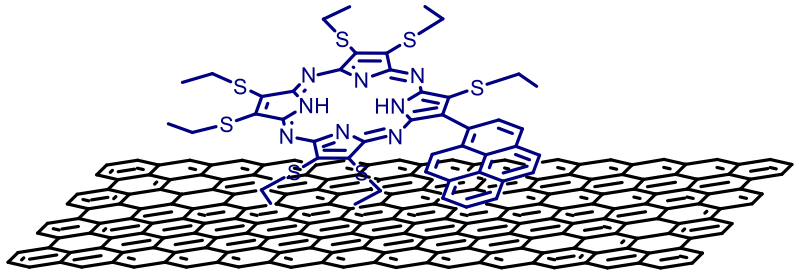


PzPy



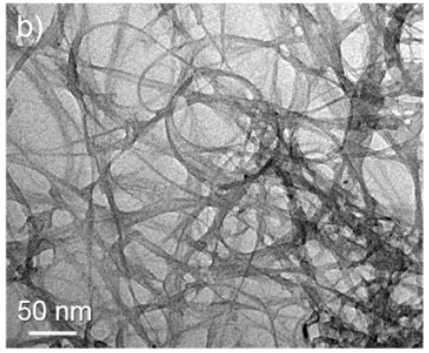


Nanoibrido PzPy/SWNTs

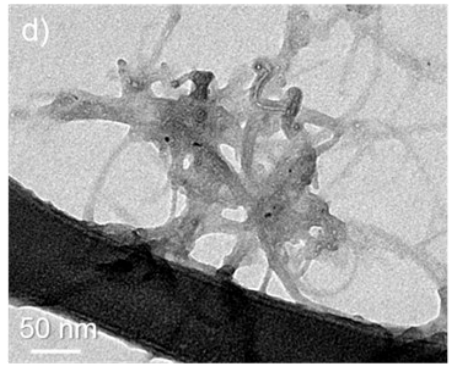


Nanoibrido PzPy/GNF

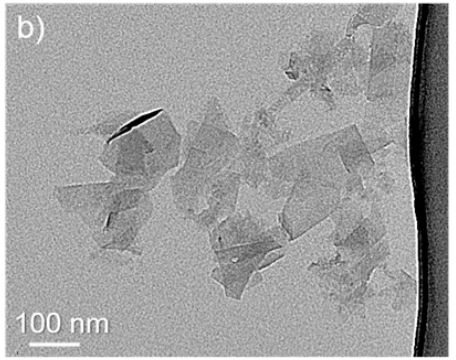
Microscopia elettronica TEM



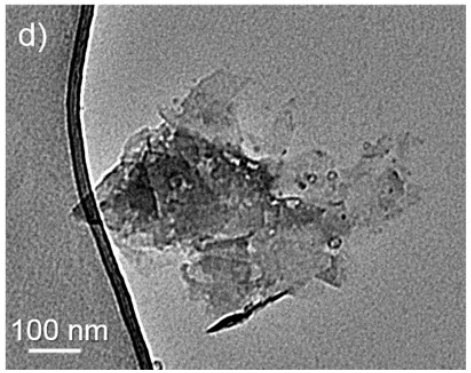
Nanotubi (SWNTs)



Nanoibridi PzPy/SWNTs



Nanofiocchi di grafene (GNF)

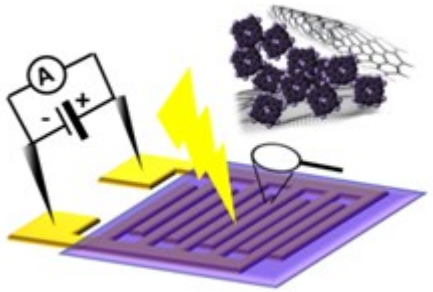


Nanoibridi PzPy/GNF

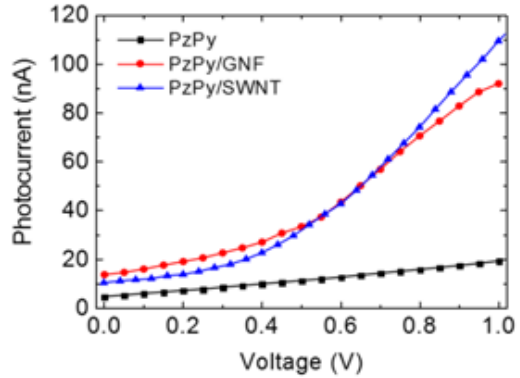
S. Belviso *et al.*, *Adv. Funct. Mater.*, **2018**, 28, 1705418.
S. Belviso *et al., J. Org. Chem.*, **2018,** 4029.

Tio-Porfirazine per OPV

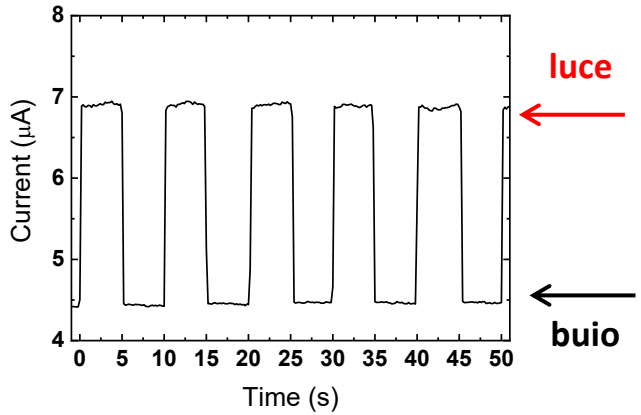
FOTOGENERAZIONE DI CORRENTE
da parte dei nanoibridi PzPy/SWNTs e PzPy/GNF



fotorilevamento:
nanoibridi depositati
su elettrodi d'oro
interdigitati



Fotocorrente in **PzPy** e nei **nanoibridi** con irradiamento **a 500 nm**.



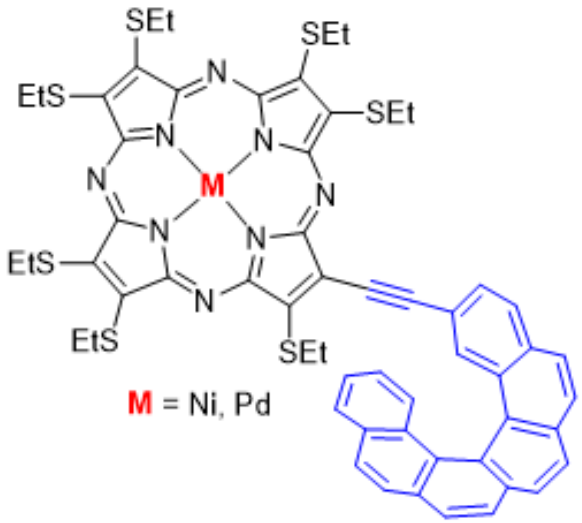
Cicli di luce/buio sui nanoibridi PzPy/GNF (1Sun)

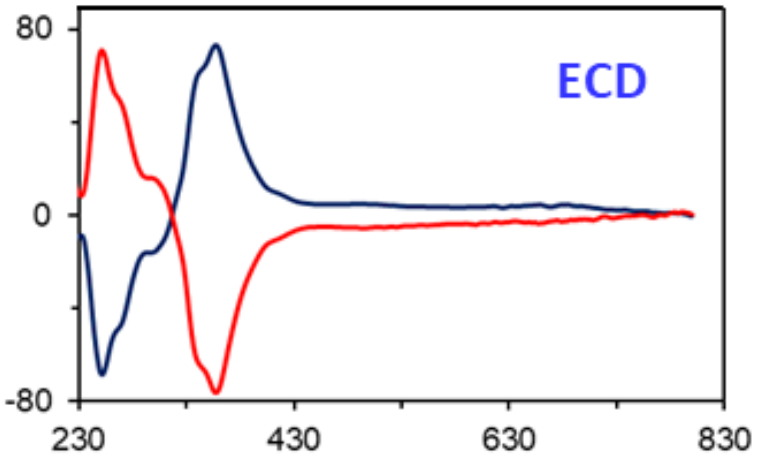
- ✓ **Gli ibridi PzPy/SWNT e Pz/GNF mostrano una fotogenerazione di corrente dieci volte superiore rispetto alla PzPy da sola**
- ✓ **Aumento/decadimento reversibile della corrente fotogenerata in risposta a diversi cicli di illuminazione on/off**
- ✓ **Stabilità alla corrente fotogenerata**

S. Belviso *et al.*, *Adv. Funct. Mater.*, **2018**, 28, 1705418.

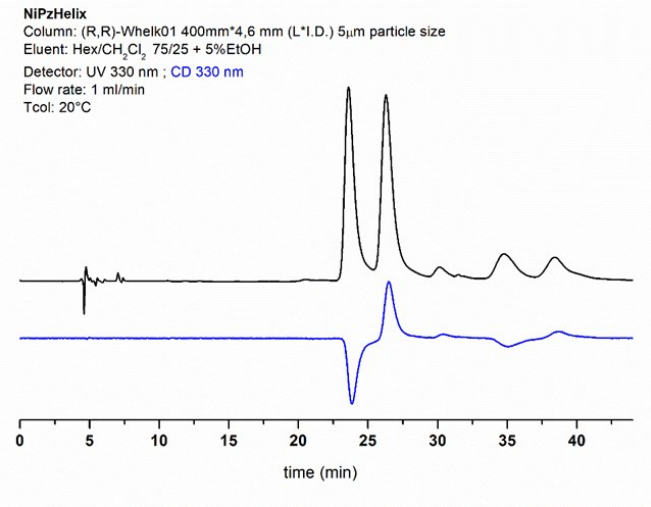
Tio-porfirazine Chirali per OPV





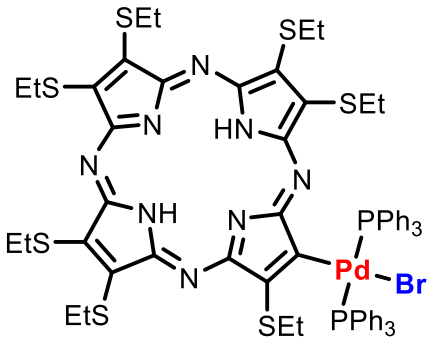


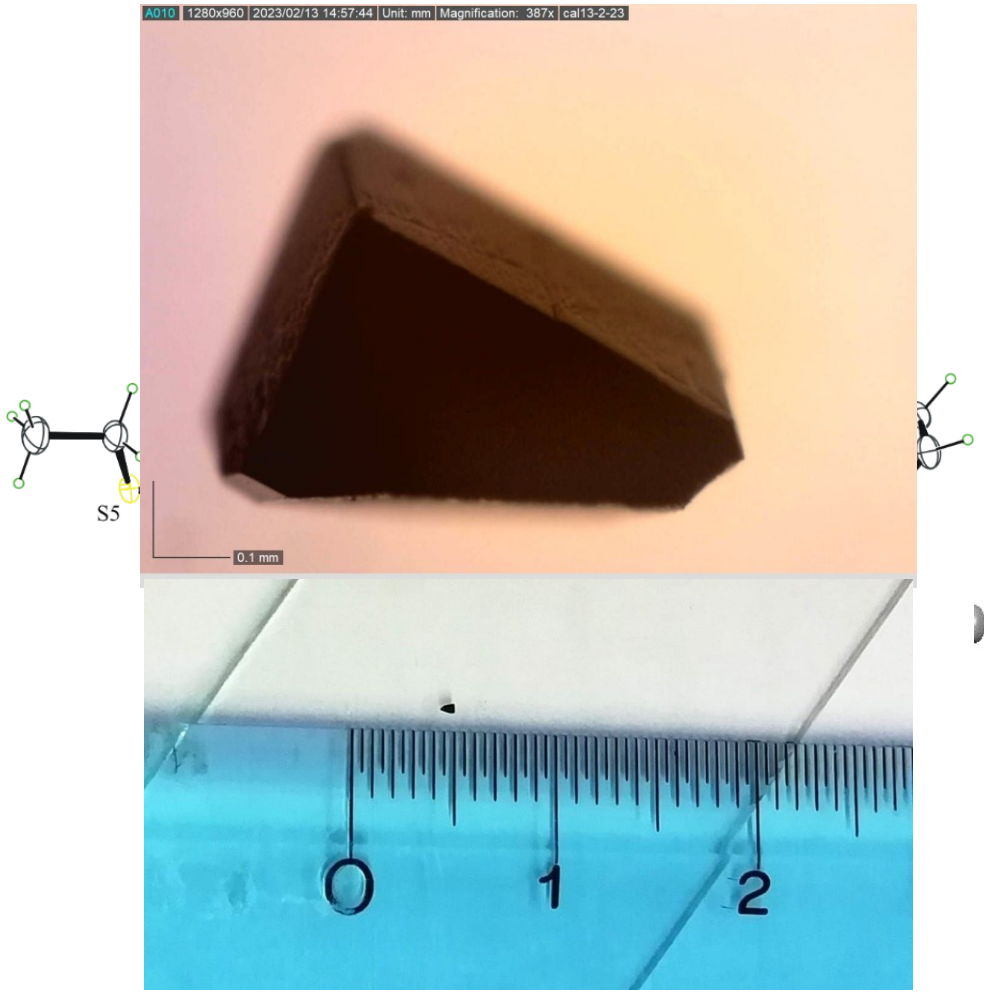
Primo esempio di porfirazina funzionalizzata con elicene

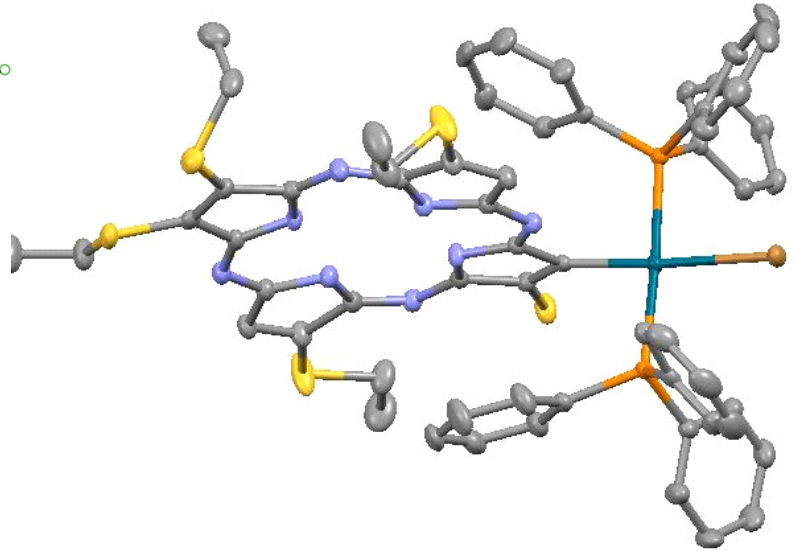


S. Belviso *et al*., *Dalton Trans*., **2022**, 51, 16453.

Tio-porfirazine per OPV



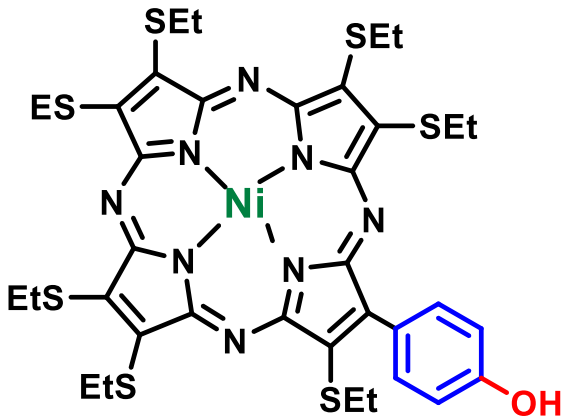




Celle Solari Organiche con Tio-porfirazine



CELLA SOLARE ORGANICA
DI TIPO DSSC



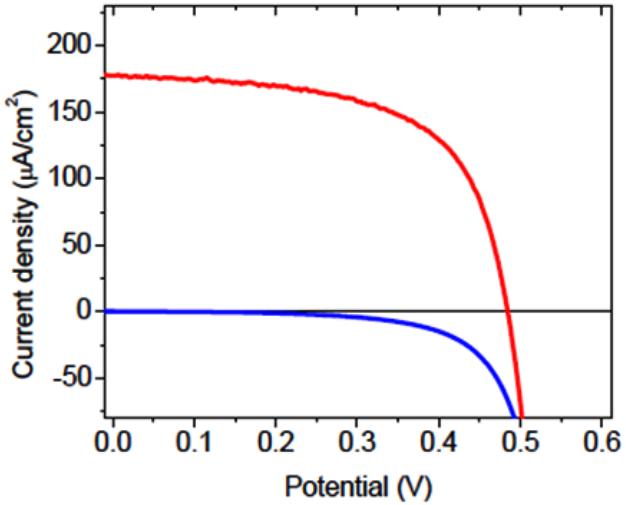


Figure S21. JV characteristics of TiO_2-DSSC with dye **2** under simulated one sun illumination (AM1.5G, P_{in} = 100 mW/cm^2) and active area of 0.159 cm^2.

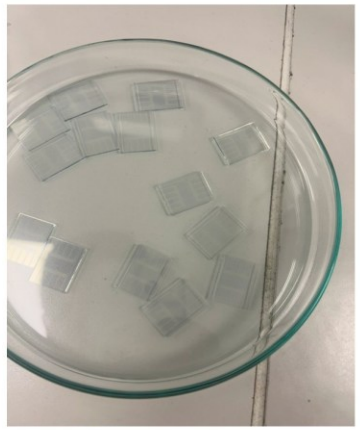
UNIVERSITÀ
DEGLI STUDI
DI MILANO

S. Belviso, *et al.*, *J. Phys. Chem. C* , **2019**, 123, 13074.

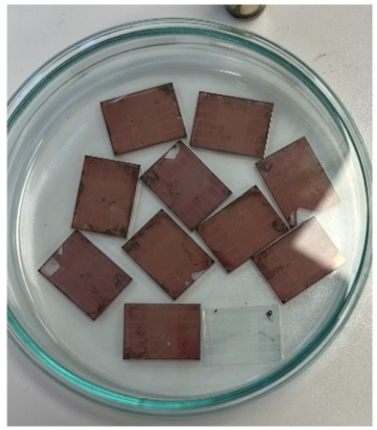
Potenza, 17 dicembre 2025

Celle Solari Organiche con Tio-porfirazine

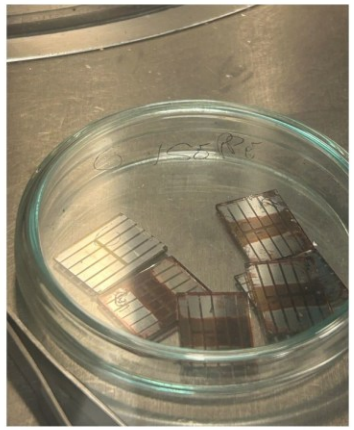
PROCESSO DI COSTRUZIONE DI UNA CELLA SOLARE ORGANICA DI TIPO BHJ



Substrato vetro - ITO (Indio Stagno Ossido)



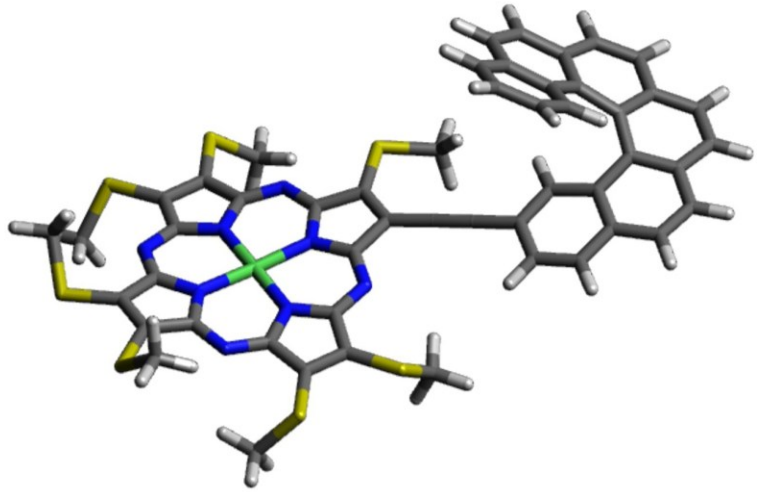
Substrato dopo deposizione del film attivo per spin coating



Cella completa dopo termo evaporazione di Ossido di molibdeno e argento come elettrodo



Cella Solare Organica BHJ



Esempio di **porfirazina** sintetizzata utilizzata come **antenna/donatore** della nella cella solare con **PCBM** come **accettore**

Finanziato dall'Unione europea NextGenerationEU · MUR · Italiadomani PIANO NAZIONALE DI RIPRESA E RESILIENZA

tech4you

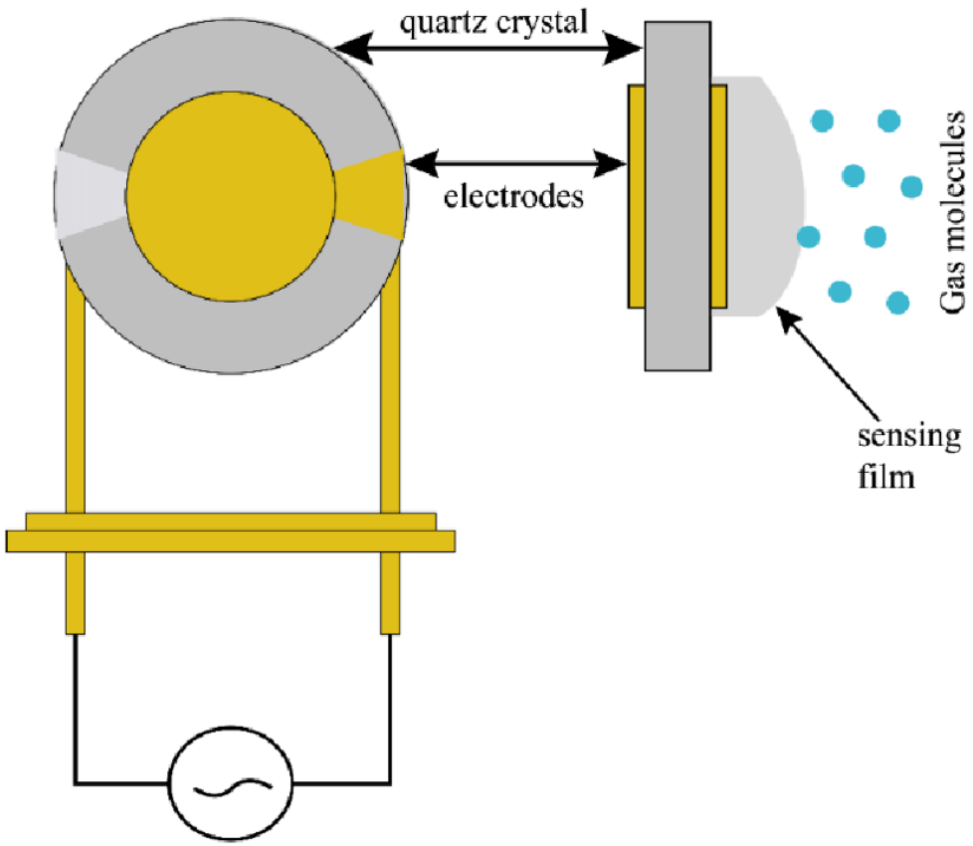
Tech4You - Technologies for climate change adaptation and quality of life improvement
Project grant n.ECS_0000009

Hellenic Mediterranean University

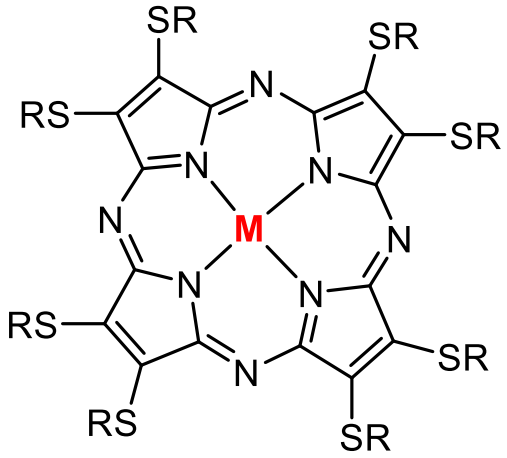
G. Larotonda, S. Belviso *et al.*, *manoscritto in preparazione*, **2025**

Potenza, 17 dicembre 2025

Tio-porfirazine come sensori chimici di sostanze volatili



Microbilancia di quarzo



M = H_2, metallo

LABORATORIO DI CHIMICA INORGANICA

Argomenti per la Tesi di Laurea

Progettazione, **Sintesi** e **Studio delle proprietà** di **composti tetrapirrolici** per la realizzazione di **materiali innovativi** da impiegare:

- nei settori dell'**optoelettronica**
- nei settori della **produzione di energia**
- nel campo della **sensoristica**
- in campo **ambientale**

Tesi di Laurea: Attività

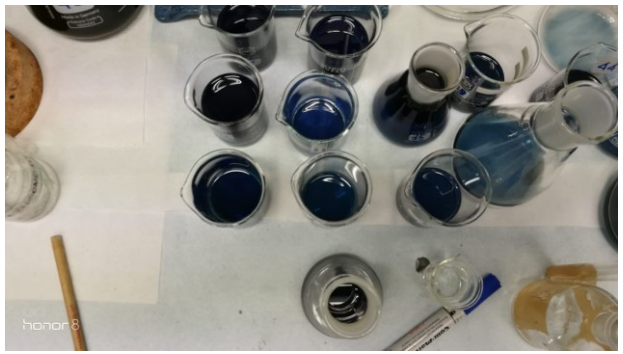


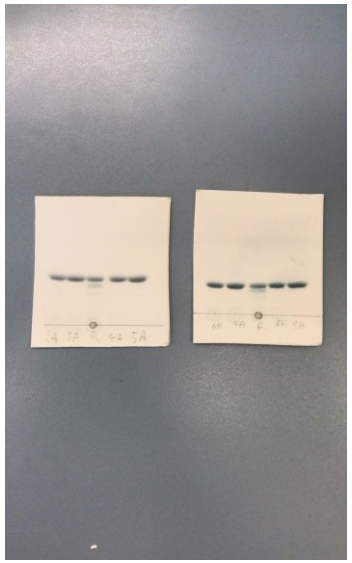


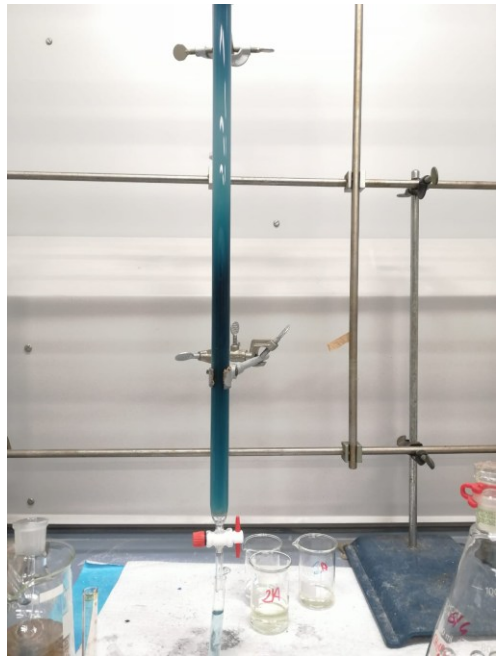




- **Ideazione** ed **esecuzione** di procedure di **sintesi chimica** di **nuovi macrocicli tetrapirrolici** e dei loro **complessi** di metalli di transizione
- **Purificazione** ed isolamento di composti puri



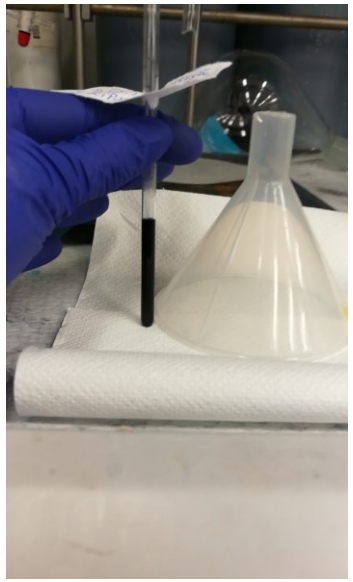




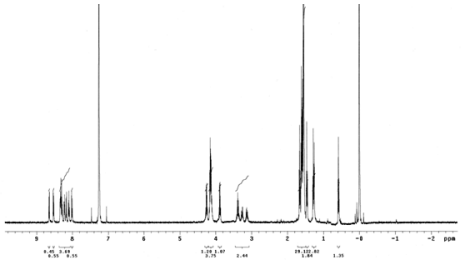
Potenza, 17 dicembre 2025

Tesi di Laurea: Attività

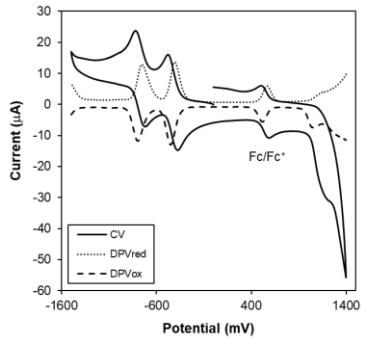


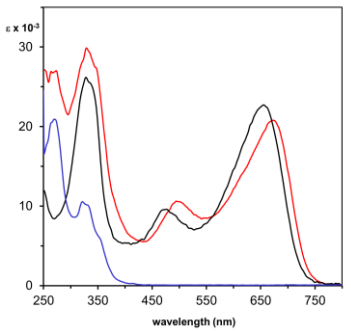


- **Caratterizzazione spettroscopica** (NMR, UV-Vis, FTIR) di nuovi composti



- **Studio** delle **proprietà** di nuovi composti:
  - Spettroscopia in assorbimento ed emissione
  - Voltammetria ciclica (CV) e pulsata (DPV)
  - Indagini in luce polarizzata





- **Studio** della **reattività** di nuovi composti:
  - Prove di catalisi
  - Prove di interazione e rilevamento di analiti
  - Implementazione di dispositivi

