

Dipartimento di Chimica

Università di Torino



Il Dipartimento oggi

Fondazione

Il nuovo Dipartimento è stato fondato nel **2012** a seguito della riorganizzazione del sistema universitario italiano.

Staff

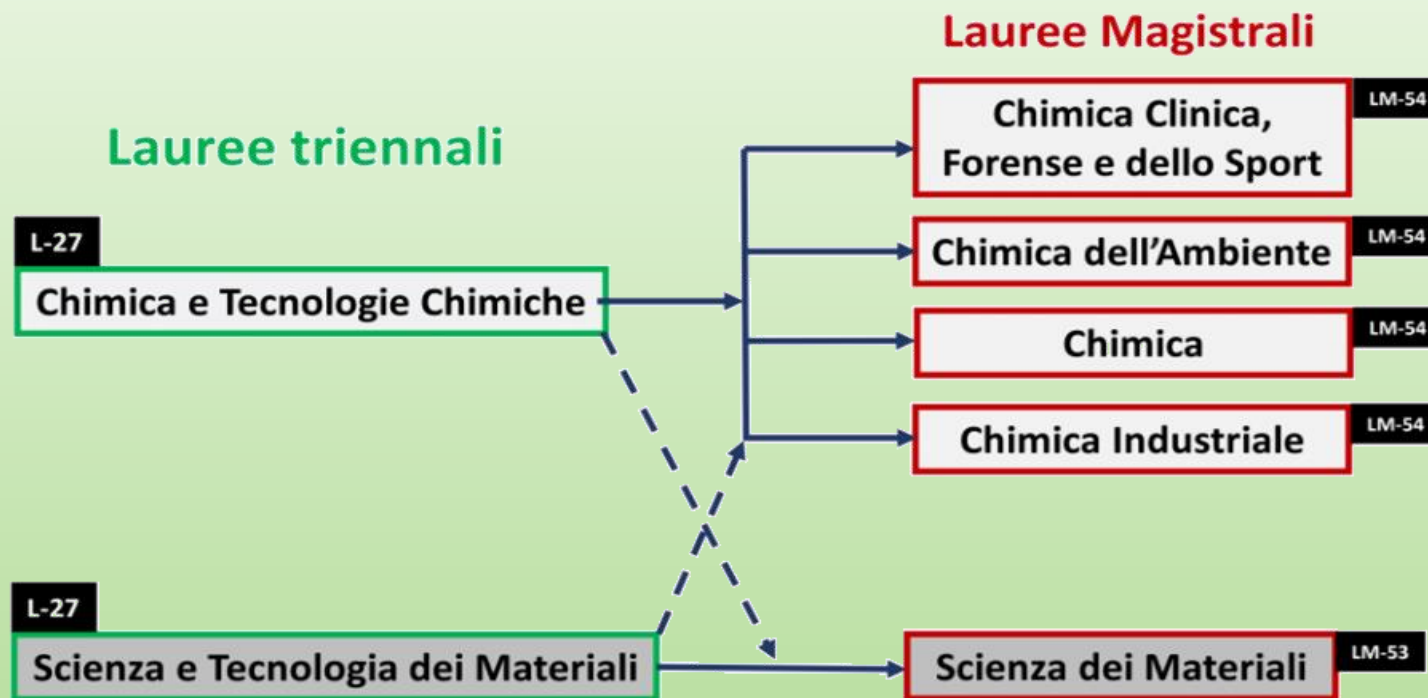
Nel Dipartimento lavorano circa **250** professori, ricercatori, tecnici e amministrativi. Gli studenti di Dottorato e i ricercatori Post-doc rappresentano circa la metà dello staff.

Studenti

Le attività di insegnamento del Dipartimento coinvolgono circa **2.000** studenti.



Offerta formativa del Dipartimento di Chimica (2018)

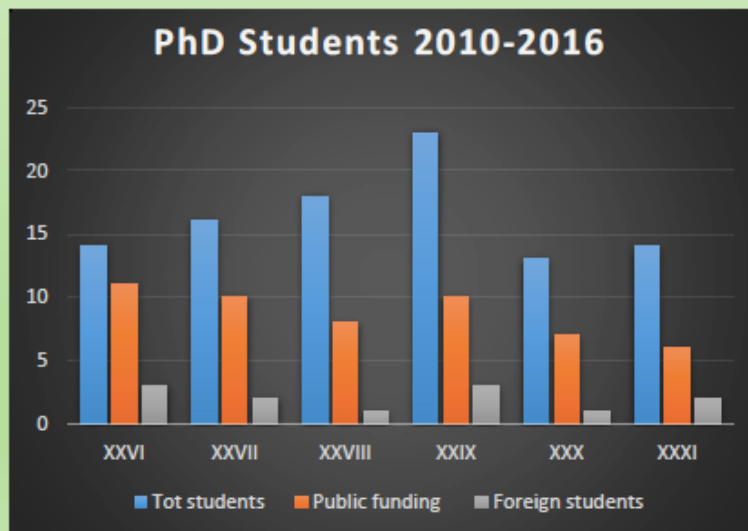


	Lezione	Esercitazioni in aula	Attività in laboratorio	Stage/Tirocinio/ Tesi
1 CFU	8 ore	12 ore	16 ore	25 ore

PhD Program in Chemical and Material Sciences

50 students currently enrolled over three cycles (Cycles XXIX-XXXI)

39 students graduated in the last three years. **31%** of these students is employed in industries either in Italy or abroad. **54%** is currently pursuing an academic career as post-doc researcher.

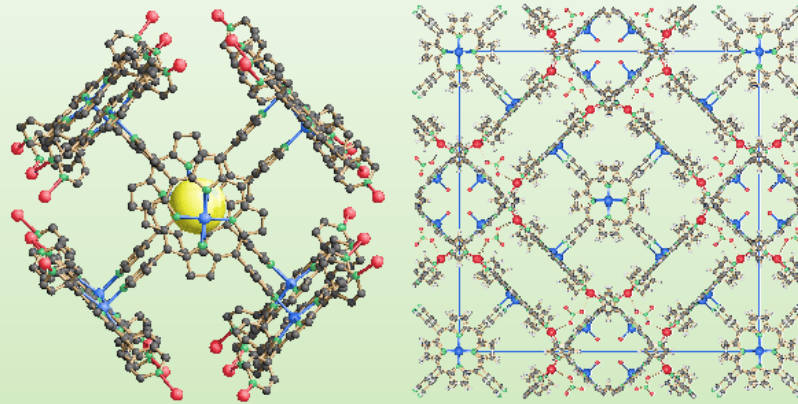


PhD program in Circular Economy

- Tra i primi Dottorati Industriali in Italia
- Unico programma di Dottorato in Italia in Circular Economy con un Collegio Docenti altamente interdisciplinare
- Il processo di transizione da una economia lineare all'Economia Circolare è un sistema complesso che deve essere analizzato sotto punti di vista diversi
- Collegio docenti composito facente capo a diverse aree disciplinari
 - Scienze Economiche**
 - Chimica**
 - Sociologia**
 - Informatica, Scienze Agrarie e Forestali**
- Dottorato Internazionale
- *Inserito in network internazionali di formazione (Marie Curie ITN)*
- Dottorato Intersettoriale
- *Coinvolgimento di imprese che svolgono R&S*



Attività di ricerca



Progettualità:

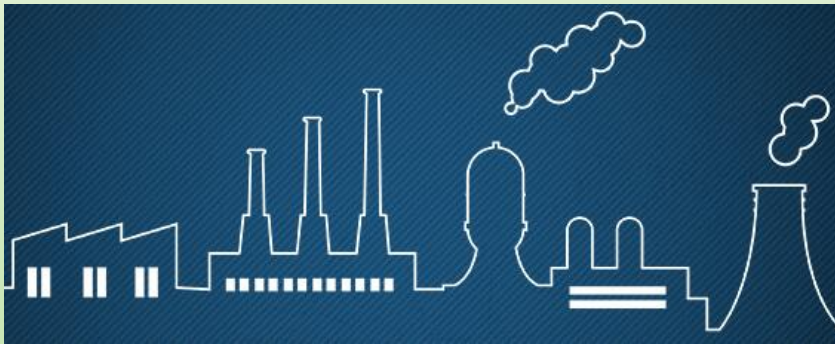
- **PROGETTI UE** → 20
- **ALTRI PROGETTI INTERNAZIONALI** → 6
- **PROGETTI NAZIONALI** → 80

Prodotti della ricerca:

- **NUOVA CONOSCENZA** → pubblicazioni scientifiche di alto livello
- **BREVETTI E LICENZE** → forte e crescente collegamento con PARTNER INDUSTRIALI internazionali e locali e partecipazione a HIGH-TECH OPEN LABS

Collaborazioni industriali

Finanziamento per la ricerca: il Dipartimento gestisce un budget totale di circa **8 milioni di euro all'anno** (2018). Le principali fonti di finanziamento sono: 1) settore privato 2) l'UE. La collaborazione con le industrie nel 2018 ha raggiunto un budget complessivo di circa **2.5 milioni di euro**.



3 Spin-off

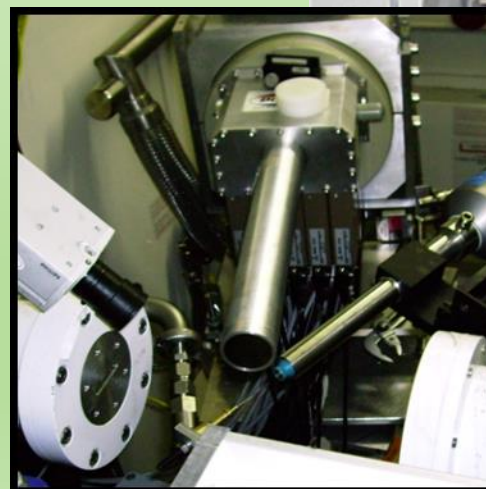
Più di 50 contratti attivi¹

**26 brevetti nel periodi 2010-2015
(4 brevetti all'anno in media)**

Strumentazione

Il Dipartimento di Chimica - insieme ai singoli gruppi di ricerca – possiede e gestisce **STRUMENTI PER DIVERSI MILIONI DI EURO**

- Strutture di sintesi
- Spettroscopie vibrazionali ed elettroniche
- **Spettroscopie a risonanza magnetica**
- Microscopio in trasmissione ad ultra-alta risoluzione
- **Microscopio a scansione (Bando INFRA-Pi RP)**
- Microscopi elettronici (microscopio in trasmissione ad ultra-alta risoluzione, microscopio a scansione)
- **Diffrazione di raggi X (Bando INFRA-Pi RP)**
- Cromatografie
- **Spettrometrie di massa**
- **Strutture computazionali**
- Laboratori didattici



Centri Interdipartimentali

- **NIS - Nanostructured Interfaces and Surfaces Center of Excellence**



- **The Scansetti Center – Interdepartmental Center for the Study of Asbestos and Other Toxic Particulates**

- **CRISDI - Interdepartmental Center of Diffractometric Crystallography**



- **C3S - Centro Di Competenza Sul Calcolo Scientifico**

- **ICxT - Centro Interdipartimentale di innovazione dell'Università di Torino**



Technological offer

For Cultural Heritage

For Life Sciences

For Agrochemical and Food



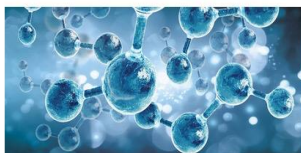
For Environment

For Energy

For Advanced Materials and
Nanomaterials

Research at Department of Chemistry

<https://www.chimica-ricerca.unito.it/index.php/en>



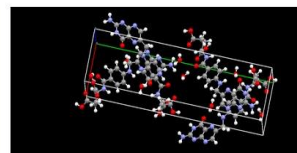
CHEMISTRY AND HEALTH

People's health and quality of life are the basis of an active and dynamic society. Knowledge of human metabolism, as well as development of new medicines, innovative...



ADVANCED MATERIALS

Our everyday life is strongly influenced by materials: transportation, recreation, clothing, health, food production, security. To discover, produce and characterise new materials...



COMPUTATIONAL CHEMISTRY

Using computational clusters and powerful programs, computational chemists can predict the motions, reactivity, aggregation and formation of complex molecules up to predict their...



CHEMISTRY AND ENVIRONMENT

Chemistry plays a central role not only in describing and understanding environmental processes, but also in allowing the achievement of a correct balance between human activities...



GREEN CHEMISTRY

Chemistry can and must provide knowledge and technologies for the sustainable management of resources and lifestyles. With a reversal of perspective, as a voracious consumer of raw...



CULTURAL HERITAGE

The study of the archaeological, historical and artistic heritage, as all the cross-disciplinary researches, generate a huge added value, both cultural and socio-economics. This is...



CHEMISTRY AND FOOD

Today food paradigmatically represents the complexity and interconnectedness of knowledges where themes such as health, education, culture and enhancing the excellence of local...



ENERGY

Clean, renewable, low cost and sustainable energy distribution to people all over the world is nowadays one of the most demanding challenges to mankind.



CHEMISTRY AND EDUCATION

Scientific skills are fundamental for the culture itself, the self-care, sight on issues of great social, environmental and ethical relevance for all scientists, stakeholders and...

Ambiente: Aria, Acqua, Suolo

Chimica Analitica Ambientale

- ✓ Analisi e monitoraggio ambientale
- ✓ Sviluppo di metodiche analitiche per la determinazione di specie in matrici anche complesse
- ✓ processi nell'ambiente

- ✓ Riduzione foto-elettrocatalitica di CO₂ e produzione fotocatalitica di H₂
- ✓ Produzione di composti ad alto valore aggiunto mediante processi *green*
- ✓ Produzione di materiali innovativi per l'accumulo di energia (es. LiBs)

Tecnologie Green e energia

Tecnologie innovative per l'abbattimento di inquinanti (H₂O, aria, suolo)

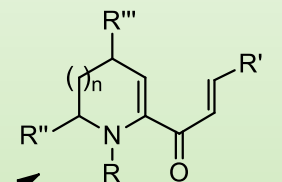
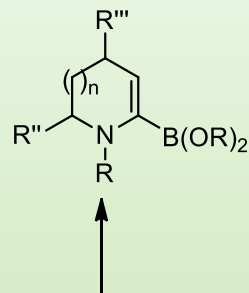
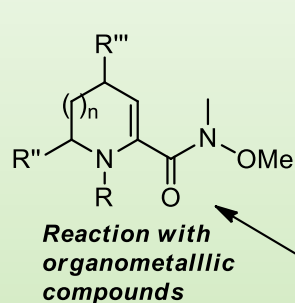
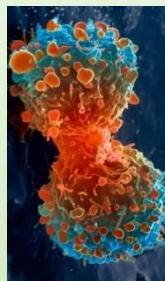
- ✓ AOPs (fotocatalisi eterogenea su ossidi semiconduttori, sonochimica, processi Fenton/foto-Fenton...)
- ✓ Materiali avanzati per DENOx
- ✓ studi meccanicistici
- ✓ applicazioni in contesti reali
- ✓ sviluppo prototipi

- ✓ Progettazione e realizzazione di prototipi di misura
- ✓ Consulenza per realizzazione di nuovi processi chimico tecnologici
- ✓ problemi normativi

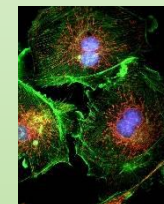
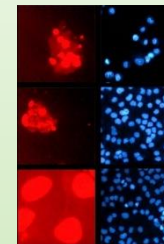
Ricerca applicata e industriale

Synthesis vs. Green Chemistry

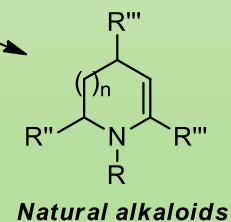
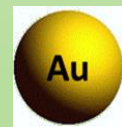
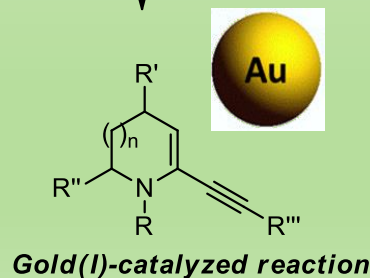
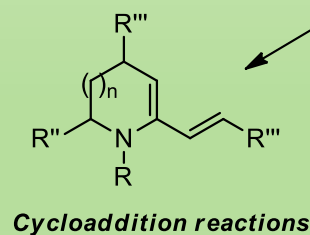
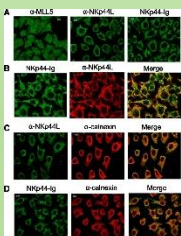
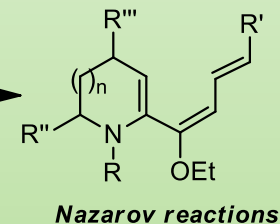
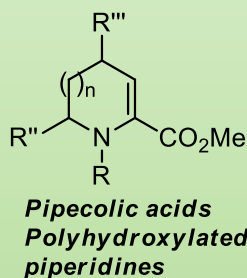
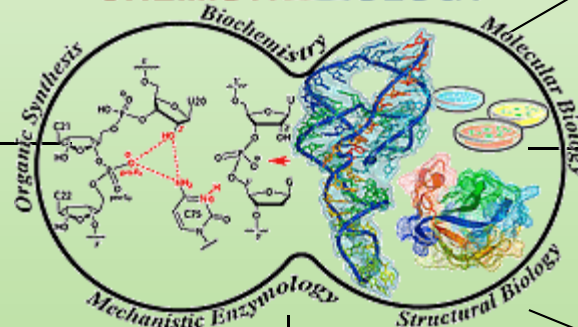
Anticancer agents



Biomarkers

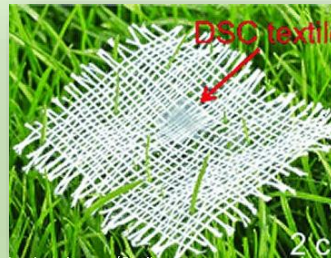
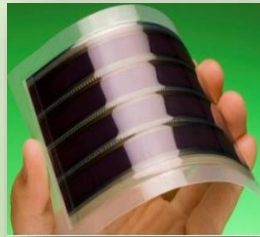
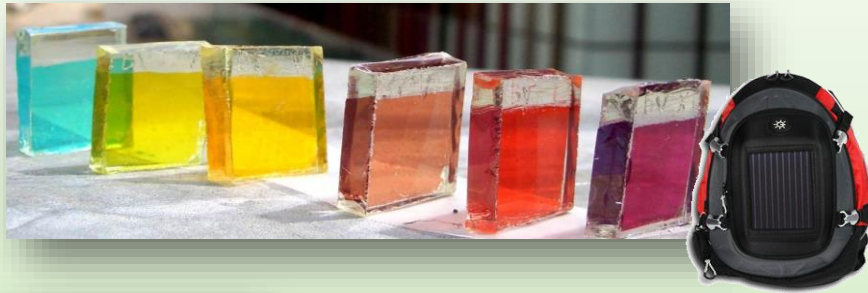


CHEMISTRY BIOLOGY

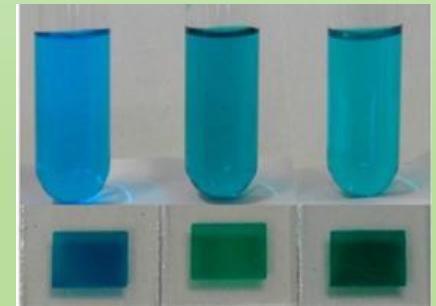
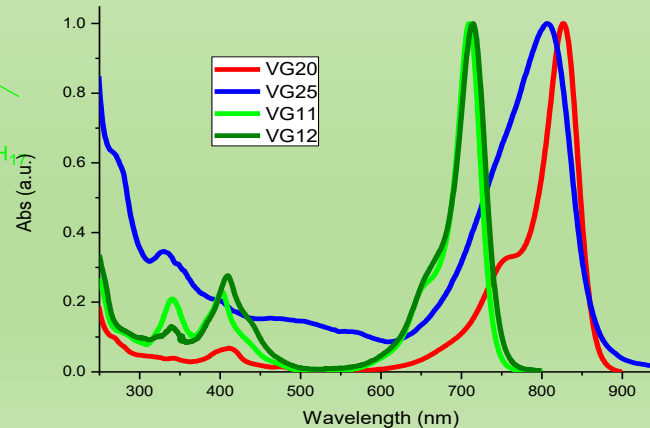
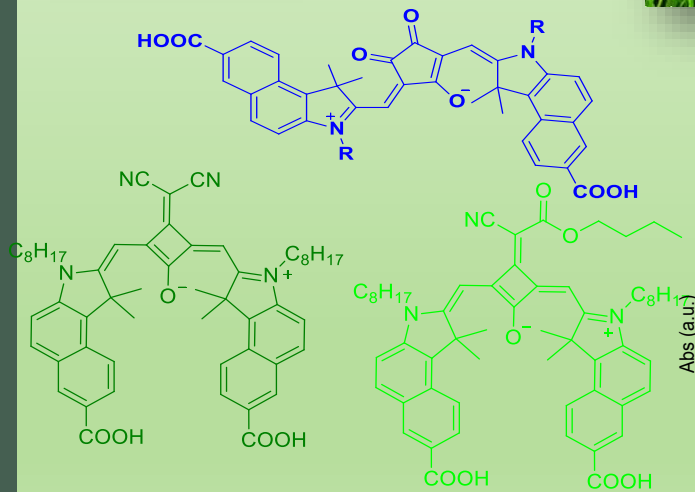


Plant Hormones

Dye-Sensitized Solar Cells (DSSCs)

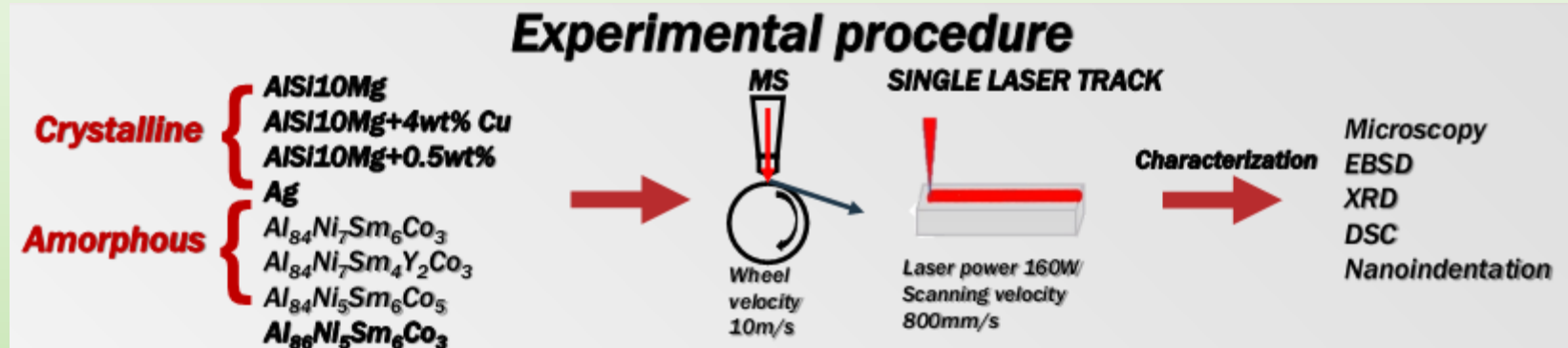


- Low production cost
- Simple preparation procedure
- Easy scale-up
- Transparency, flexibility
- Work with weak/diffuse light
- 10/20 years of stability
- Efficiency of 12-14%

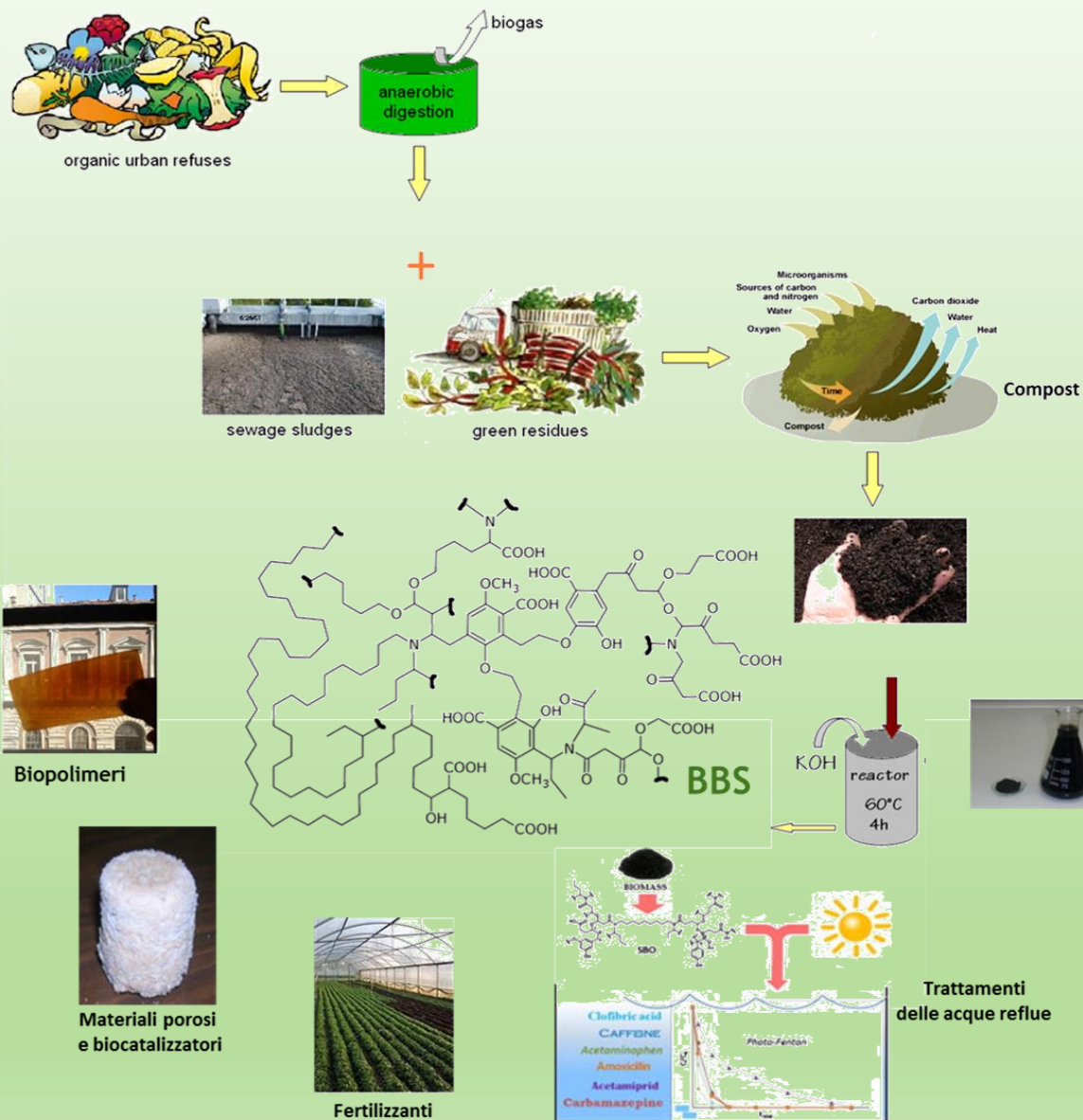


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Development of new Al alloys specifically designed for Additive Manufacturing



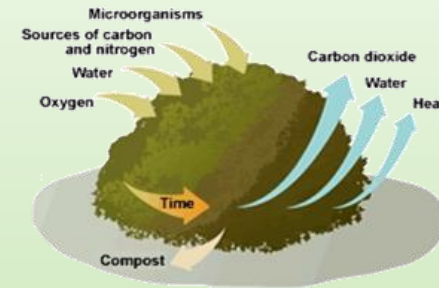
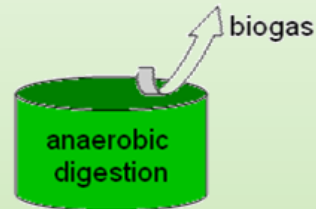
Sostanze a Base Bio (BBS) estratte dal compost



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Biostimolanti da biomasse residuali per il florovivaismo

Prove sperimentali di crescita su *Hibiscus*
(*Hibiscus moscheutos* L. subsp. *Hibiscus palustris*)



SF: fertilizzazione standard

LF: bassa fertilizzazione

LFSD: bassa fertilizzazione con digestato solubile

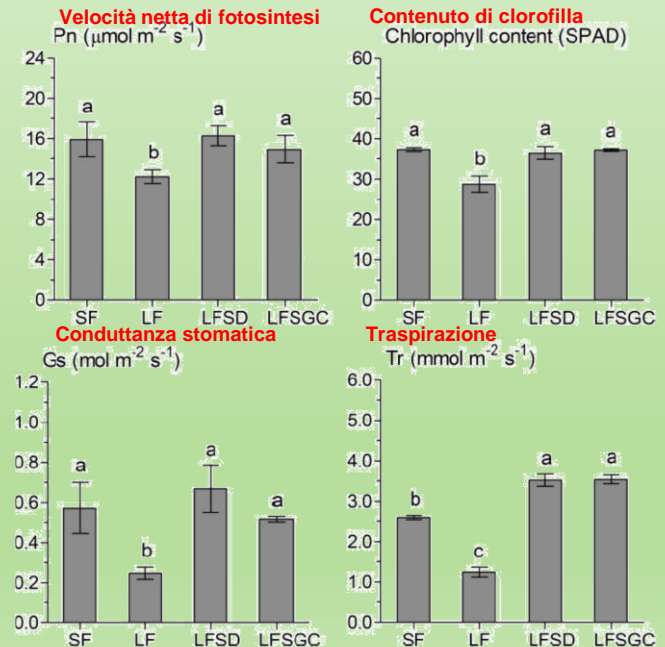
LFSGC: bassa fertilizzazione con compost green



Analisi degli scambi gassosi



Trapianto in vaso



Valorizzazione delle biomasse da filiera ligno-cellulosica



AMIDI E
CARBOIDRAITI

BIOETANOLO
BIOMETANOLO



OLI E
GRASSI

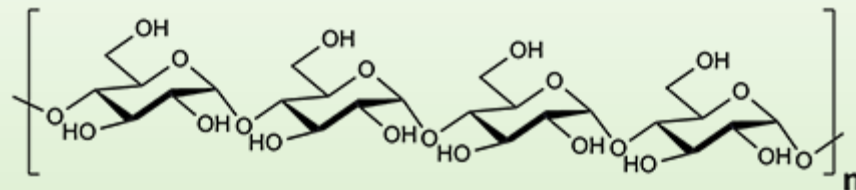
BIODIESEL



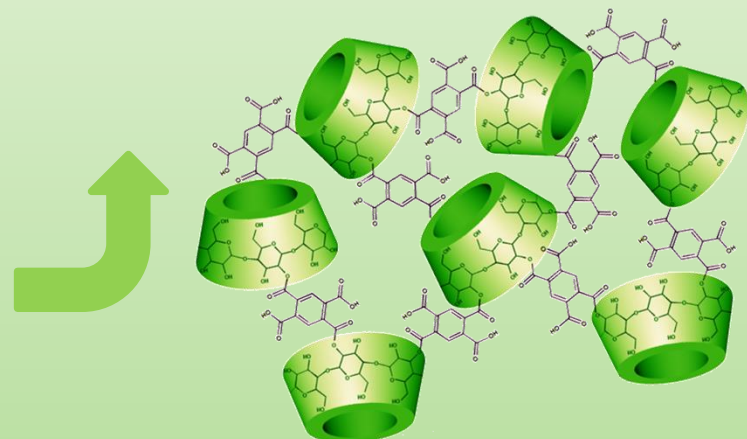
MATRICE
LIGNOCELLULOSICA

CHEMICALS AND FUELS

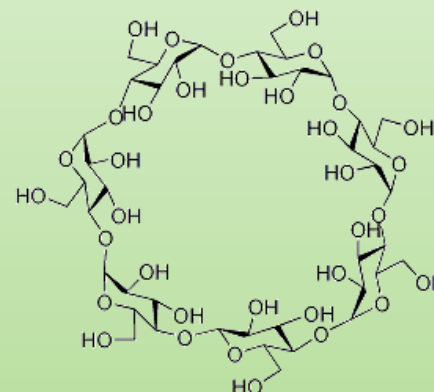
Biopolimeri a base di carboidrati



Amido
Conversione enzimatica/
parziale idrolisi



Linker



Ciclodestrine



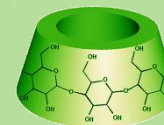
Maltodestrine

Biopolimeri solubili ed insolubili, con idrofilicità e carica elettrica modulabili ed elevato potere complessante

Applicazione principale:

Nanocontainer per l'assorbimento e rilascio di composti d'interesse

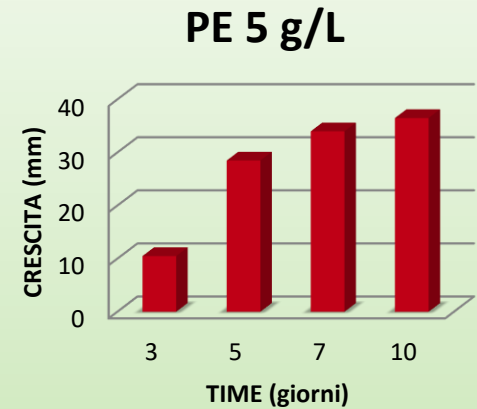
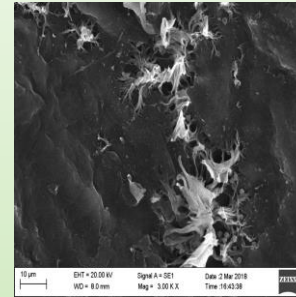
Drug delivery, DNA/RNA transfection, Metal complexation, Agropharma, Environment (removal of pollutants), Smart fabrics, Li/air batteries, Precursors of carbon materials, Photochirogenesis, Biosensors, Smart packaging, Electrospinning



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Biodegradation of biodegradable and “non biodegradable” polymers *

Growth of selected fungi over PE



Growth of selected fungi over polycaprolactone



* In collaboration with prof. Cristina Varese
Mycotheca dell'Università degli Studi di Torino

Green Chemistry e Sustainable Industrial Chemistry @ SURFIN

«core business» scientifico:
comprensione dei fattori che regolano l'attività di siti attivi di catalizzatori e fotocatalizzatori, per l'ottimizzazione delle loro prestazioni per processi sostenibili e green



Nanostructured materials for catalysis

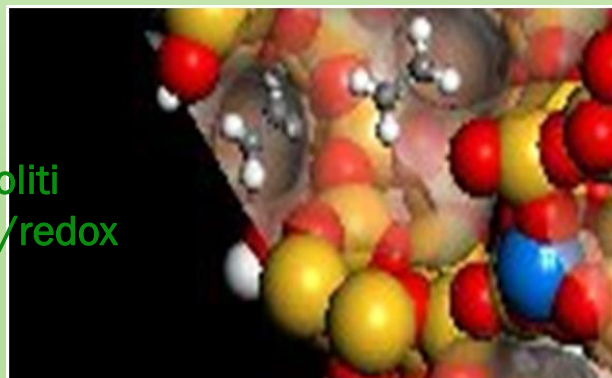


Nano-metalli supportati

Zeoliti acide/redox

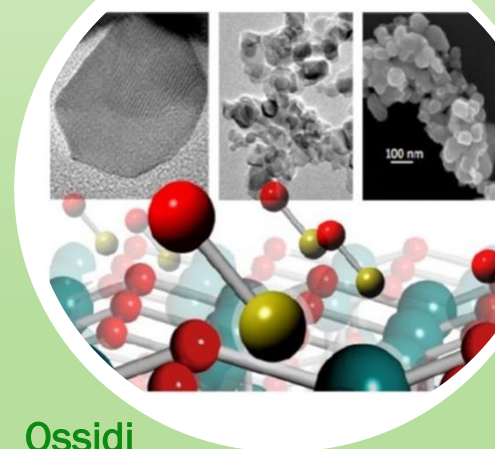
Metal-organici frameworks

Nanostructured materials for adsorption



Nanoparticelle funzionalizzate

Photoactive materials



Ossidi

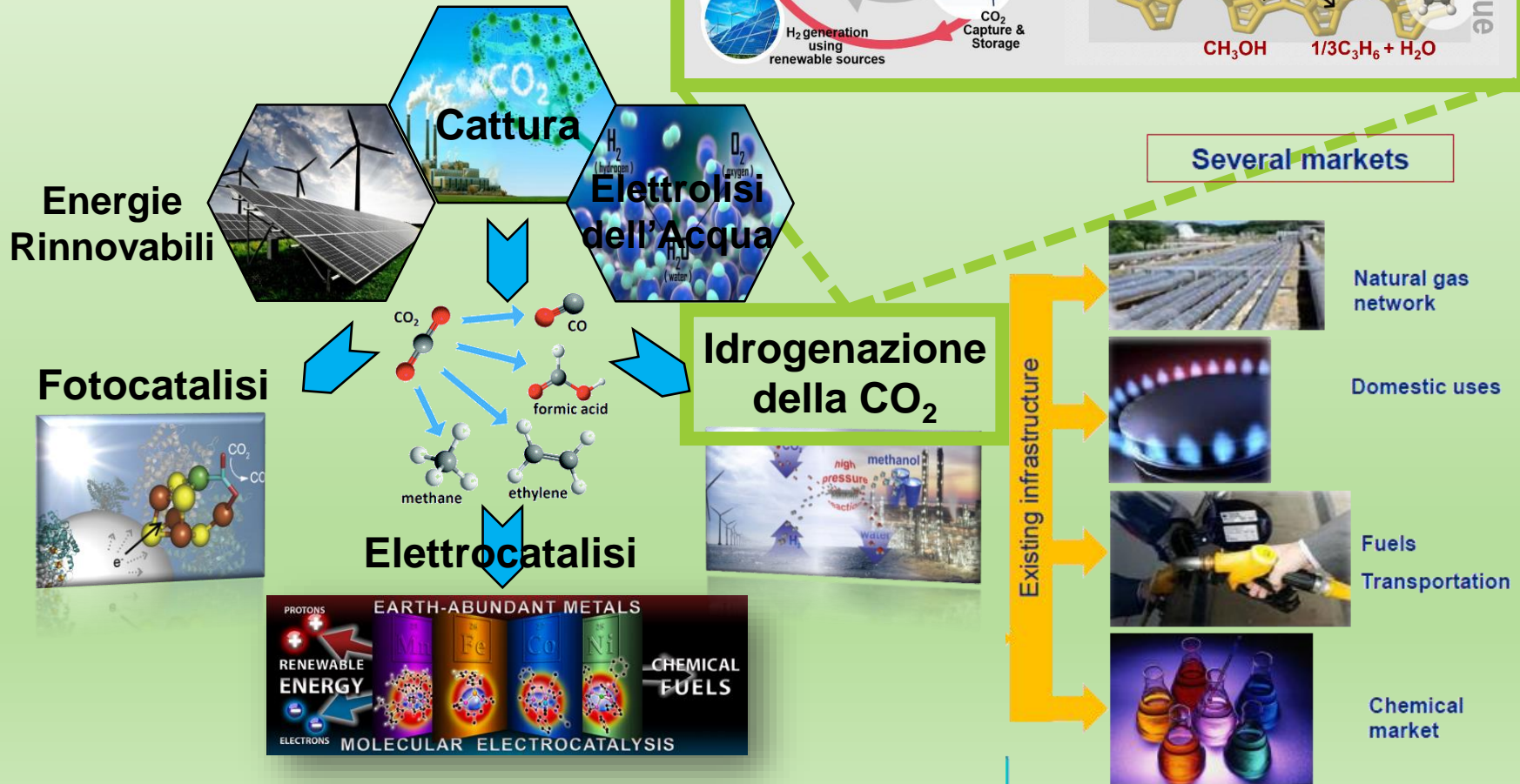
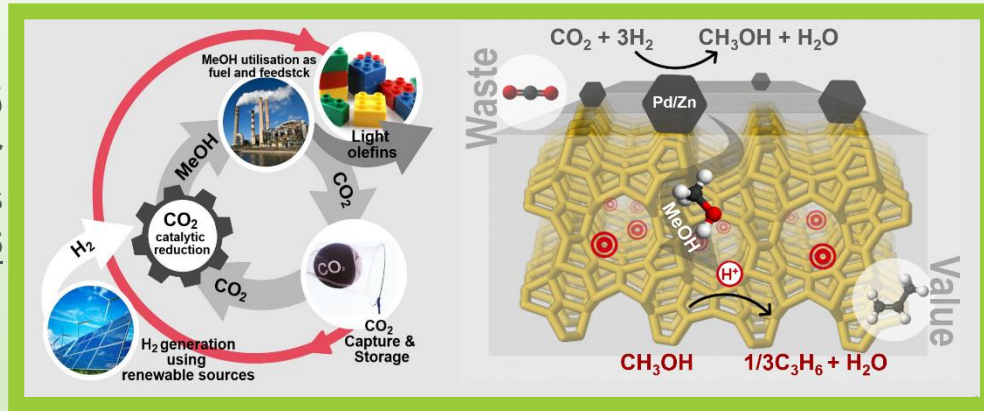
E molti altri...

Possibili strategie per usare la CO₂



COZMOS

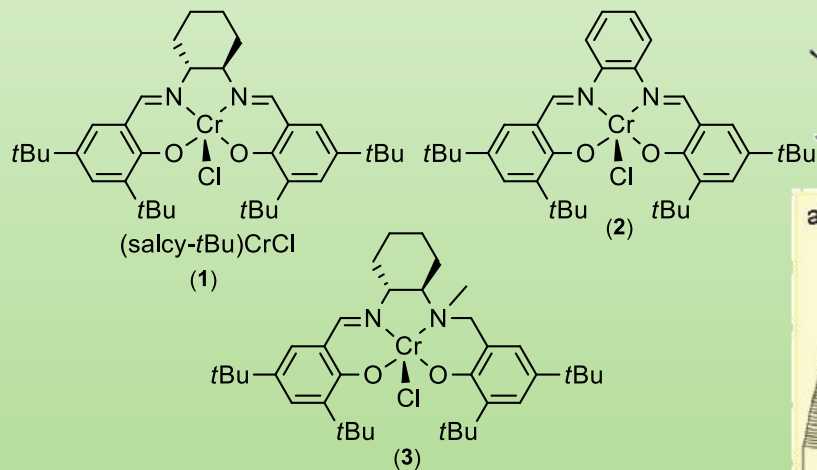
Efficient CO₂ conversion over multisite Zeolite-Metal nanocatalysts to fuels and Olefins



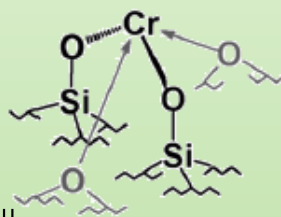
CO₂ come monomero per la sintesi di plastiche biodegradabili (policarbonati, PC): catalizzatori

CATALIZZATORI OMOGENEI

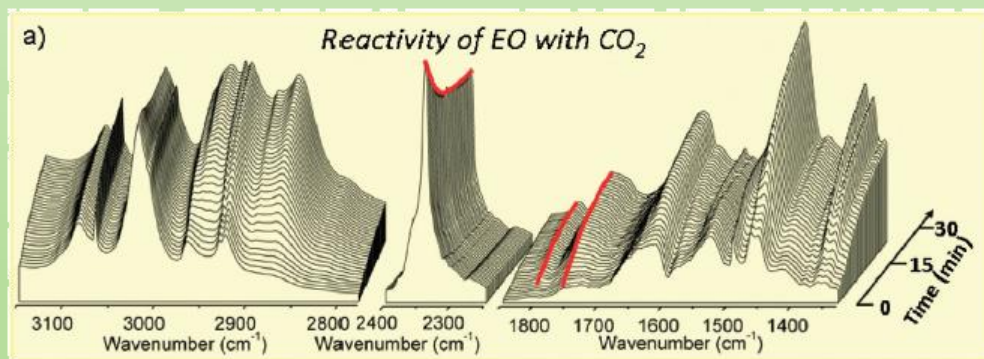
Un certo numero di complessi di Cr con leganti azotati sono in grado di copolimerizzare epossidi e CO₂.



CATALIZZATORI ETEROGENEI



Si pensa di testare il catalizzatore Phillips, noto per polimerizzare l'etilene, e sue varianti.



Phys. Chem. Chem. Phys., 2012, **14**, 6538–6543

Contacts

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