2024

生物质基精细化学品合成与应用新技术国际研讨会

International Symposium on New Technologies for the Synthesis and Application of Biomass Based Fine Chemicals

会议手册

Conference book

西安交通大学 · 创新港校区　2024.8.31-9.4

2024

生物质基精细化学品合成与应用新技术国际研讨会

International Symposium on New Technologies for the Synthesis and Application of Biomass Based Fine Chemicals

WELCOME LETTER

It is our great honor to welcome you to Xi'an Jiaotong University, China, for the "*International Symposium on New Technologies for the Synthesis and Application of Biomass Based Fine Chemicals*" to be held in Xi'an, China, from August 31st to September 4th, 2024.

The aim of this focused and targeted conference is to bring together relevant experts and talented young scientists from Chinese and international sectors (Australia, Belgium, France, Germany, India, Italy, Japan, Netherlands, Saudi Arabia, Spain, United Kingdom) in biomass, green chemistry and sustainable development. The main objective of the "*International Symposium on New Technologies for the Synthesis and Application of Biomass Based Fine Chemicals*" is to identify breakthrough chemical and technological project ideas and establish competitive consortia that can lead to collaborative projects, potential applications and innovations in the biorefinery sector.

During these five days, the symposium will promote innovative biomass valorization with the aim of building a better world. With an emphasis on interdisciplinarity, the topics covered will includen.

- √ novel catalytic reactions (homogeneous, heterogeneous and enzymatic as well as their combinations) applied to bio-based compounds or using bio-based reagents, either sequentially or in a combined one-pot manner;
- √ novel catalytic reactions (homogeneous, heterogeneous and enzymatic as well as their combinations) using green solvents (e.g. water, ionic liquids...);
- √ ambitious new technologies using flow chemistry, critical fluids, enzymes, microwaves, microreactors, nanocatalysts and, above all, innovative combinations of these technologies;
- √ environmental sustainability by developing cleaner and more efficient catalytic processes that reduce greenhouse gas emissions, reduce waste production and protect natural ecosystems;
- √ energy by contributing to the production of biofuels, improving energy efficiency and implementing renewable energy sources to address global energy challenges;
- √ mobility by playing a critical role in the development of clean and efficient transportation fuels, facilitating the transition to more sustainable and less polluting modes of transportation;
- √ circular economy by integrating catalytic processes into production chains and maximizing the valorization of waste and by-products.

Zhicheng ZHANG
Chairman of the conference

Christophe Len
Co-chairman of the conference

PROGRAM

30 August 2024

14:00-20:00 Arrival / Diner in MoMc
14:00-20:00 Registration / Materials pick-up

31 August 2024

09:00-10:20 Opening Ceremony
10:20-10:50 Group photo + Mid-Morning Coffee Break and Networking in the Exhibit Hall

Session 1 / Chairman Christophe Len

10:50-11:25 P1/ **Keiichi Tomishige**
Development of heterogeneous catalysts for C-O hydrogenolysis and H2-driven deoxydehydration
11:25-12:00 P2/ **Yingwei Li**
Metal-organic frameworks-based materials for biomass transformations
12:00-12:30 P3/ **Changlei Xia**
Biomass Mediated Functionalized Composite for Environmental Application

12:30-14:00 Lunch and open discussion (Restaurant self-service)

Session 2 / Chairman Yingwei Li

14:00-14:35 P4/ **Aurore Richel** *(visio)*
Lignin, an innovative biomolecule: case studies focused on a circular economy approach in Northwestern Europe
14:35-15:10 P5/ **Jun Yue**
Continuous flow microreactors for catalytic biomass conversion
15:10-15:45 P6/ **Deyang Zhao**
Anderson-type polyoxometalates support on orange peel activated carbon for efficient ethyl levulinate production
15:45-16:20 P7/ **Rafael Luque** *(visio)*
Benign-by-design nanomaterials for a more sustainable future: present and outlook

16:20-16:50 Mid-Afternoon Coffee Break and Networking in the Exhibit Hall

Session 3 / Chairman Weiyi Ouyang

16:50-17:25 P8/ **Changwei Hu**
Tetraethyl orthosilicate (TEOS) production from biomass

17:25-18:00 P9/ **Bimlesh Lochab**
Sustainable polymers: Waste- and bio-feedstocks are goldmines for innovative applications

18:45-…Free time and diner (Restaurant self-service)

01 September 2024

Session 4 / Chairman Keiichi Tomishige

09:00-09:35 P10/ **Tao Zhang** *(visio)*
Catalytic valorization of lignocellulose to low-molecular oxygen- and nitrogen-containing compounds
09:35-10:10 P11/ **Grahame Mackenzie**
Versatile sporopollenin exine microcapsules (SpECs) from Lycopodium clavatum L.spores as protection and delivery vehicles and building blocks for new bio-composites

10:10-10:40 Mid-Morning Coffee Break and Networking in the Exhibit Hall

Session 5 / Chairman Sunil Sharma

10:40-11:15 P12/ **Adam Lee**
Catalysing sustainable chemical manufacturing from biomass
11:15-11:50 P13/ **Carol Lin**
Development of waste biorefineries towards a circular bioeconomy
11:50-12:25 P14/ **Catherine Pinel**
Selective transformation of biomass in the presence of heterogeneous catalysts

11:50-12:30 Lunch and open discussion (Restaurant self-service)

13:00-21:00 Cultural event

02 September 2024

Session 6 / Chairman Adam Lee

09:00-09:35 P15/ **Tierui Zhang**
Defective layered double hydroxide based nanostructured photocatalysts
09:35-10:10 P16/ **Francesco Mauriello**
Advancing global sustainable technologies through the unified conversion of biomass and plastics by heterogeneous catalysis

10:10-10:40 Mid-Morning Coffee Break and Networking in the Exhibit Hall

Session 7 / Chairman Yang Sun

10:40-11:15 P17/ **Sudarsanam Putla**
Carbon-carbon condensation of biomass-based furans using shape-controlled metal oxide-based catalysts

11:15-11:50 P18/ **Huiying Zeng**
Cleavage/cross-coupling strategy for converting lignin into high value-added compounds

11:50-12:25 P19/ **Qi Liu**
Application of biomass materials in improving the performance of biodegradable mulching films

12:25-14:00 Lunch and open discussion (Restaurant self-service)

Session 8 / Chairman Tierui Zhang

14:00-14:35 P20/ **Mario Pagliaro** *(visio)*
Reshoring fine chemical and pharmaceutical productions

14:35-15:10 P21/ **Sunil Sharma**
Glycerol and carbohydrate based amphiphilic architectures for biomedical applications

15:10-15:45 P22/ **Ting Su**
Design and Energy Application of Photocatalysts Based on Polyoxometalates

15:45-16:20 P23/ **Christ Stevens** *(visio)*
Combining fermentation technology and green chemistry the chemical modification of sophorolipids

16:20-16:50 Mid-Afternoon Coffee Break and Networking in the Exhibit Hall

Session 9 / Chairman Gianvito Vile

16:50-17:25 P24/ **Jincai Wu**
Ring-opening polymerization of aromatic cyclic esters derived from biomass

17:25-18:00 P25/ **Thomas Len**
Breaking boundaries: ultradispersed early transition metals supported on TiO2 for efficient CO2 hydrogenation

18:00-19:00 Free time

19:00-20:30 Gala Dinner in Hotel MoMc

03 September 2024

Session 10 / Chairman Yuhe Liao

09:00-09:35 P26/ **Roberto Rinaldi**
To break or not to break? Spectroscopic fingerprints for rapid screening of lignin's potential as a raw material to produce chemicals or materials

09:35-10:10 P27/ **Sho Yamaguchi**
Development of nickel carbide nanoparticle catalysts for the liquid-phase hydrogenation of biomass-derived carbon resources into valuable chemicals

10:10-10:40 Mid-Morning Coffee Break and Networking in the Exhibit Hall

Session 11 / Chairman Carol Lin

10:40-11:15 P28/ **Shunmugavel Saravanamurugan**
Catalytic biomass valorisation to chemicals: an indispensable future direction

11:15-11:50 P29/ **Jie Chen**
Enhancement of Transfer Processes in Solar Fuel Conversion Systems

11:50-12:25 P30/ **Prince Nana Amaniampong**
Cavitation bubble as microreactor: performing chemistry in a bubble

12:25-14:00 Lunch and open discussion (Restaurant self-service)

Session 12 / Chairman Qinxian Jia

14:00-14:35 P31/ **Yuhe Liao**
Catalytic Fractionation and Valorization of Lignocellulosic Biomass

14:35-15:10 P32/ **Weiran Yang**
Strategies for biobased dicarboxylic acid production

15:10-15:45 P33/ **Majd Al-Naji** *(visio)*
Catalyzing sustainability: heterogeneous catalysis as one of the main cornerstones

15:45-16:20 P34/ **Junjian Xie**
Accurate design and synthesis of high-density biofuels

16:20-16:50 Mid-Afternoon Coffee Break and Networking in the Exhibit Hall

Session 13 / Chairman Roberto Rinaldi

16:50-17:25 P35/ **Andrew Marr** *(visio)*
Combining biocatalysis, organometallic catalysis and ionic liquids for biomimetic biomass conversion

17:25-18:00 P36/ **Yanlong Gu**
Minimizing the use of non-green polar aprotic solvents by rational design of catalytic systems

18:45-…Free time and diner (Restaurant self-service)

04 September 2024

Session 14 / Chairman Yanlong Gu

09:00-09:35 P37/ **Gianvito Vile**
Single-atom catalysts for light-driven C-X coupling methods
09:35-10:10 P38/ **Shengda Qi**
Capillary electrophoresis-mass spectrometry and their application in bioanalysis

10:10-10:40 Coffee break

Session 15 / Chairman Grahame Mackenzie

10:40-11:15 P39/ **Giancarlo Cravotto**
Semi-industrial cascade protocols for the valorization of agri-food waste: highly efficient extraction and conversion of residual biomass
11:15-11:50 P40/ **Christophe Len**
Continuous flow synthesis: an innovative approach for upgrading selected biobased chemicals
11:50-12:00 Closing session

12:00-13:00 Lunch (Restaurant self-service)

Introduction of School of Chemistry in Xi'an Jiaotong University

The School of Chemistry of Xi'an Jiaotong University (XJTU) is derived from the Department of Chemistry (founded in 1928) of National Chiao Tung University. In 1994, XJTU restored the School of Science with the disciplines of Chemistry, Mathematics, and Physics. To meet the strategic deployment of the university, the discipline of Chemistry was expanded to become the School of Chemistry in 2020.

Currently, the School of Chemistry consists of four departments, i.e., the Department of Applied Chemistry, the Department of Chemistry, the University Chemistry Faculty, and the Experimental Chemistry Teaching Center. The school now comprises Shaanxi Province University Engineering Research Center for Energy Storage Materials and Chemistry, a University-Enterprise Joint Research Center for Power Battery Recycling Engineering Technology, Shannxi Province Innovation and Intelligence Introduction Base of New Organic Synthetic Methods and Molecular Design and Synthesis, while hosting MOE (Ministry of Education) Key Laboratory of Nonequilibrium Synthesis and Regulation of Matter as well as Xi'an Key Laboratory of Sustainable Energy Material Chemistry. At the campus of Western China Science and Technology Innovation Harbor, the School of Chemistry owns the Institute of Organic and Polymer Chemistry, the Institute of Molecular Science and Applied Chemistry, and the Institute of Sustainable Energy Material Chemistry. The school offers a Ph.D. program in Chemistry a Ph.D. program in Material Chemistry and Physics, and a master's program in Chemistry. Besides, the school currently boasts the Shaanxi Provincial Chemical Experiment Teaching Demonstration Center and the Shaanxi Provincial Chemical Virtual Simulation Experiment Center. During the past five years, the School of Chemistry has built up three national excellent online courses, a provincial excellent online course, a provincial first-class offline course, and a provincial curriculum ideology and politics demonstration course, with a Shaanxi provincial outstanding teaching team, three provincial and ministerial reform projects, and eight officially published textbooks.

The School of Chemistry currently has 130 faculty and staff members, including 80 with senior titles, including a Clarivate Analytics Global Highly cited Scholar, two Elsevier Global Highly Cited Scholars, and three National-level Talents. Among the faculty members, a professor is awarded the Special Government Allowance of The State Council, four professors are granted the 21st Century Talent Fund by MOE, two professors are honored as Shaanxi Provincial Talents, nineteen faculty members are awarded the School Fund for Distinguished Young Scholars, and one professor has been awarded the title of Shaanxi Provincial Outstanding Teacher.

At present, the school enrolls about 600 students, including nearly 300 undergraduates and over 300 postgraduates. The school offers two undergraduate programs, i.e., Chemistry and Applied Chemistry, of which Applied Chemistry is granted the National First-class Specialty Construction Site. Upholding the fine tradition of "high starting point, solid foundation, strict requirements, and emphasis on practice", the School of Chemistry has established a world-class talent training system with complete professional knowledge and technique.

Guided by the national economic battlefield and the major concerns of the country, and aiming at the international academic frontiers, the school engages itself in the synthesis methods and reaction mechanisms of complex matter, profoundly explores the relationship between the multi-level structure and properties of materials, and develops new matter with high-performance and promotes its applications. By focus on the resolution of key problems of new synthesis methods of complex chemicals, structure-activity relationships and its application involved in the areas such as new energy, biological medicine, artificial intelligence, the internet of things, etc., the school has made breakthroughs in several directions, including efficient drug transmission and precision diagnosis and treatment, advanced energy material chemistry, intelligent responsive polymer, etc. Therefore, in the School of Chemistry, a first-class chemistry discipline featuring application-oriented and interdisciplinary has been built.

GUIDELINES

Registration

Location & time: Lobby of Hotel MoMc, August 30th, 2024
Conference venue: Hanying Building 5-E107, iHarbour campus, Xi'an Jiaotong University
西安交通大学创新港校区涵英楼5-E107

Conference materials

Please collect the conference material bags (including conference badge, conference manuals, USB key, and pen) at registration desk. Please enter the venue with your own conference badge and keep the badge properly during the conference.

Conference catering

Gala dinner: Hotel MoMc, 19:00-20:30, September 2nd, 2024
We offer self-service buffet in the university canteen (4thfoor of Tonghe Canteen) from August 31st, 2024 to September 4th, 2024.

Note

We will organize stream the event online to external audiences. To facilitate the streaming, please send your presentation slides to weiyi.ouyang@xjtu.edu.cn one day before your presentation.

Organizing committee

Chairman: Zhicheng ZHANG, Christophe LEN
Secretary: Yang SUN
Member: Weiyi OUYANG, Xiaoyong LI, Qinxiang JIA, Yong WU, Wanqin WANG, AiZhao PAN
Contact: Weiyi OUYANG (Phone: +8613196307830; Email: weiyi.ouyang@xjtu.edu.cn)

Route from hotel to conference venue

2024

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International Symposium on New Technologies for the Synthesis and Application of Biomass Based Fine Chemicals

ABSTRACT & BIO

Development of heterogeneous catalysts for C-O hydrogenolysis and H_2-driven deoxydehydration

Keiichi TOMISHIGE

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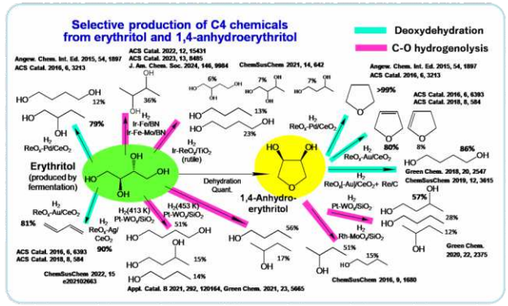
Hydrodeoxygenation is one of important catalytic reactions in biomass refineries for the production of fuels and chemicals [1]. Our group has been developing the heterogeneous catalysts for C-O hydrogenolysis and H_2-driven deoxydehydration, and we have reported the effective bimetallic catalysts for C-O hydrogenolysis such as Rh-ReOx, Rh-MoOx, Ir-ReOx, Pt-WOx and Ir-Fe catalysts, and that the effective supported $ReOx/CeO_2$ and $MoOx/TiO_2$ catalysts modified with metal particles for deoxydehydration using H_2 as a reducing agent. These catalysts have been applied to the reaction of a variety of biomass-derived substrates, for example, to the hydrodeoxygation of erythritol and 1,4-anhydroerythritol, which is described in this presentation. At present, C4 chemicals have been derived from naphtha, which will be decreased by the shift to gas industries. C4 chemicals are one of building blocks in the petrochemical industry. Therefore, the synthesis of C4 chemicals from biomass can be a promising method for the substitution of naphtha. It has been known that erythritol is produced by the fermentation of glucose and glycerol [2]. As shown in figure below, the development of heterogeneous catalysts enables the selective conversion of erythritol and 1,4-anhydroerythritol using H_2 as a reductant to various C4 chemicals such as 1,4-, 1,2-, 1,3-, and 2,3-butanediols, tetrahydrofuran, dihydrofuran, butadiene, and so on [3-5].



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Development of heterogeneous catalysts for C-O hydrogenolysis and H_2-driven deoxydehydration

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BIO

Prof. Keiichi Tomishige received his B.S., M.S. and Ph.D. from Graduate School of Science, Department of Chemistry, The University of Tokyo. During his Ph.D. course in 1994, he moved to Graduate School of Engineering, The University of Tokyo as a research associate. In 1998, he became a lecturer, and then he moved to Institute of Materials Science, University of Tsukuba as a lecturer in 2001. Since 2004 he has been an associate professor, Graduate School of Pure and Applied Sciences, University of Tsukuba. Since 2010, he is a professor, School of Engineering, Tohoku University. His research interests are the development of heterogeneous catalysts for production of biomass - derived chemicals and non-reductive CO2 conversion. He has also a role of Associate Editor of Green Chemistry. He has published about 400 original publications and review articles (H 96, 27,000 citations, Scopus).

Metal-organic frameworks-based materials for biomass transformations

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Metal-organic frameworks (MOFs) are a new class of porous materials, which have potential applications in a wide range of areas including catalysis, gas storage, separation, and energies. Owing to their high surface area, porosity, and chemical tunability, the utilizations of MOFs in heterogeneous catalysis have attracted tremendous attention.

Taking advantage of their ordered structures and relatively low thermal stability, MOFs could be utilized for the preparation of new metal oxides or carbon nanomaterials by thermal decomposition. In MOFs, the highly ordered metal ions are isolated by organic ligands regularly, which will play an important role in preventing metal from aggregation during thermolysis. Here we report that metal nanoparticles/atoms embedded in carbon prepared from MOFs thermonlysis could catalyze a variety of transformations, such as aerobic oxidation of alcohols to esters, domino synthesis of natural flavones, and furfural upgrading to aviation biofuels. [1-5].

References

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Metal-organic frameworks-based materials for biomass transformations

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Dr. Yingwei Li is a Professor (Dean) of the School of Chemistry and Chemical Engineering at South China University of Technology. He received his B.S. degree in 1998 and Ph.D. in 2003, both from the Department of Chemistry of Tsinghua University, and he then conducted postdoctoral work at the University of Calgary and the University of Michigan (Ann Arbor) from 2003 to 2007. He joined the South China University of Technology as a full professor in 2007. His research interests mainly focus on the design and synthesis of new metal-organic framework based materials for advanced catalysis applications. He is the author or co-author of more than 200 peer-reviewed scientific publications. He is an Editorial Group Member of National Science Review and Chinese Journal of Catalysis, and an Editorial Advisory Board Member of ACS Catalysis.

Biomass Mediated Functionalized Composite for Environmental Application

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The growth of the human population and activities leads to environmental pollution such as microplastics, metal ions, and organic dyes. The water bodies pollution problem needs to be urgently treated. Biomass materials such as plant polyphenols and woods play critical roles in wastewater treatment owing to their environmentally friendly, renewability, and unique physicochemical properties. Meanwhile, nanomaterials were supposed to have a vast potential as functional materials in environmental engineering. However, there are challenges with nanocomplex for recyclability, reliable/stable, and scale-up industrial integration. Here, this report will summarize that we have worked on wastewater treatment based on biomass materials [1-5]. A series of versatile, low-cost, stable, and recycled easily, systematic, and simple integrating platforms were nano-engineered by a simple, fast self-assembly strategy based on natural biomass materials to explore contaminant removal, which presented an excellent removal property. We are guided by the concept of green and sustainable preparation technology, using low-cost, renewable natural biomass to prepare high-performance wastewater treatment materials.

References

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Biomass Mediated Functionalized Composite for Environmental Application

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Prof. Dr. Changlei Xia, Associate Dean of the College of Materials Science and Engineering at Nanjing Forestry University, obtained Ph.D. in Mechanical and Energy Engineering from the University of North Texas (2016), BS (2007) and MS (2010) degrees both in Polymer Science and Engineering from University of Science and Technology of China. He worked as a Postdoctoral Fellow at University of Cincinnati and University of North Texas (2016-2019), respectively. He has published over 200 papers in the field of biomass-derived materials and energy, with a H-index of 50 (Google Scholar in July 2024). He also services as Associate Editor in Alexandria Engineering Journal, and Guest Editors in several SCI journals (e.g., Environmental Pollution, etc.).

Lignin, an innovative biomolecule: case studies focused on a circular economy approach in Northwestern Europe

Aurore RICHEL

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In Europe, circular economy approaches are currently developing and benefiting from both public and private support. In particular, the emergence of agricultural, forestry, and industrial conversion waste and by-products has created interest in defining valorization loops involving lignocellulosic materials [1]. While initiatives have been established for the valorization of the polysaccharides that constitute lignocellulose, significant research efforts have also been directed towards lignin. This presentation will thus review various studies, particularly those conducted at the University of Liège, which focus on the entire lignin value chain [2].

First, we will explore how to effectively select a raw material for the specific isolation of lignin. In the second part of the presentation, we will examine the promising research avenues that stand out from previous state-of-the-art efforts. We will see that lignin, often exploited as an antioxidant or reinforcing agent can also serve as a base material for the design of fuels or additives, unique material for obtaining electrically conductive films, as well as to produce new devices for wastewater treatment [3-5].

References

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Lignin, an innovative biomolecule: case studies focused on a circular economy approach in Northwestern Europe

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Aurore Richel (F) holds a Ph.D. in Chemical Sciences from ULiège (University of Liège). She currently serves as a Full Professor (tenured) and heads the Laboratory of Biomass and Green Technologies at the University of Liège (Belgium). Her expertise lies in research and teaching related to renewable resources chemistry and green chemistry. A. Richel is involved in numerous national and international research projects focused on bioenergy and bioproducts production, including the development of innovative protocols for producing new bioplastics or alternative fuels for the road or air transport sectors from plant biomass, within a circular economy framework. She has authored over 185 publications in international journals, several book chapters, patents, and a scientific book titled "Lignin and Hemicelluloses in Biorefineries" (CRC Press). She is also engaged in chemistry popularization through her personal website (www.chem4us.be) and the development of an online course (MOOC available on the French platform FUN) dedicated to "biomass and green chemistry." In March 2023, she was elected as a full member of the Royal Academy of Sciences, Letters, and Fine Arts of Belgium.

Continuous flow microreactors for catalytic biomass conversion

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The limited reserve of fossil resources and their significant contribution to greenhouse gas emission have directed numerous academic and industrial efforts recently towards the use of more sustainable feedstocks for the production of fuels, chemicals and materials. Within this context, conversion of renewable and abundant biomass into valuable bio-based chemical products is currently one focus of many research and development activities. Microreactor technology is considered a typical example of process intensification, which holds great promises for catalytic biomass conversion. In continuous flow microreactors, high efficient and selective conversion of biomass and its derivatives can be achieved, due to the precise reaction parameter control, significant transport intensification, and improved chemistry [1].

This work will introduce the recent research in our group on the use of continuous flow microreactors for the catalytic transformation of biomass derivatives into a variety of bio-based fuels and chemicals. Typical reaction examples include sugar dehydration to furanic platform chemicals, glucose oxidation to produce gluconic acid, 5-hydroxymethylfurfural oxidation to produce polymer building blocks, levulinic acid hydrogenation to γ-valerolactone, as well as biodiesel synthesis [2-7]. The operating principles of such reaction systems involving both homogeneous and heterogeneous catalysts will be demonstrated in microreactors. The intensification potential of microreactor flow processing, the catalytic mechanisms, kinetic and microreactor modelling aspects will be also discussed.

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Continuous flow microreactors for catalytic biomass conversion

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Dr. Jun Yue received his PhD in Process Engineering from Université de Savoie in France in 2008, supported by a joint PhD program with Dalian Institute of Chemical Physics, Chinese Academy of Sciences in China. Between 2009 and 2014, he has been working as a postdoc in the Laboratory of Chemical Reactor Engineering at Eindhoven University of Technology in the Netherlands. Since August 2014, he has moved to the University of Groningen in the Netherlands and is currently associate professor in green process intensification. The research group of Dr. Jun Yue focus on developing novel reactor and process intensification concepts in general, and their uses combined with catalysis for highly efficient synthesis of green fuels, chemicals and materials in particular. He has published 70 papers in peer-reviewed SCI journals (H-index: 30; total citations > 3700; Source: Google Scholar).

Anderson-type polyoxometalates support on orange peel activated carbon for efficient ethyl levulinate production

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Ethyl levulinate (EL) is hailed as the ideal lipid chemical derived from biomass due to its low toxicity, high lubricity, and low temperature fluidity, making it suitable as a fuel additive for gasoline, diesel, etc [1-3].

This study highlights a series of Anderson-type polyoxometalates (POMs), namely ($Na_3H_6FeMo_6O_{24}$ ($FeMo_6$), $(NH_4)_4H_6ZnMo_6O_{24}$ ($ZnMo_6$), $(NH_4)_3H_6CoMo_6O_{24}$ ($CoMo_6$), and $(NH_4)_4H_6CuMo_6O_{24}$ ($CuMo_6$)-orange peel activated carbon (OPAC) catalysts, which are synthesized for the production of EL from furfural alcohol (FAL). Impressively, 20% ZnMo6-OPAC possesses suitable total acidic strength (3.3 $cm^3\ g^{-1}$) with highest Brønsted-Lewis ratio (1.3), enhanced reducibility capacity, as well as a moderate BET surface area (500.5 $m^2\ g^{-1}$) with appropriate pore volume and size (3.5 nm) to afford excellent performance. The active species responsible for the alcoholysis of FAL to EL was identified as e- through scavenger experiments. From DFT calculation, FAL is more likely to be adsorbed on $ZnMo_6$-OPAC (-0.533 eV) than OPAC surface (-0.144 eV), as well as the robust electron transferring capacity of $ZnMo_6$-OPAC (-0.3259 e) vs. OPAC (-0.0009 e) after Anderson-type POMs loading. Important intermediates such as ethoxymethylfuran (EMF) and 5-ethoxy-5-(ethyl-oxidaneylidene) pentan-2-one were found through GC-MS. Catalyst recycling showed good performance up to the fifth cycle (70% FAL conversion and 47% EL yield), showcasing its potential for practical application [4].

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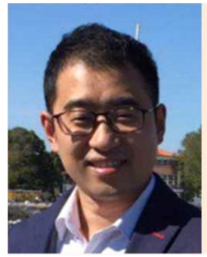
Anderson-type polyoxometalates support on orange peel activated carbon for efficient ethyl levulinate production



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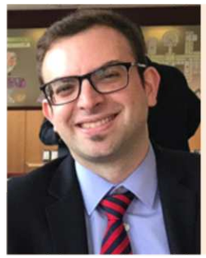
Deyang Zhao received his Ph.D. in 2020 from the Université de Technologie de Compiègne (France) under the Supervision of Prof. Christophe Len. The project of his Ph.D. (UT-INSA) was funded by the China Scholarship Council (CSC). He worked as a visiting scholar in the Universidad de Córdoba in Spain in 2017 during the period of his Ph.D, then he moved to Chimie ParisTech until Ph.D. graduation. He has been a lecturer at Ludong University since 2021. In 2023, he studied as a visiting scholar in Tsinghua University under the supervision of Prof. Zhenzhong Yang. His research interests focus on the biomass-based downstream derivatives (furfural, furfuryl alcohol, methyl levulinate, HMF, FDCA etc.) valorization in the intensified process, including microwave heating or continuous flow using ILs, Anderson-type polyoxometalates and Janus materials. He has published more than 40 publications, including *Green Chem., Fuel, ACS Sustainable Chem. Eng., ChemSusChem* etc. He is a member of the editorial board of *Chemical Newsletter* and a review editor of *Frontiers in Chemistry*.

Benign-by-design nanomaterials for a more sustainable future: present and outlook



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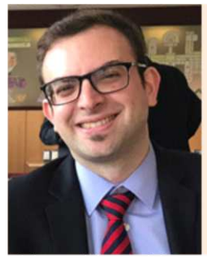
The design of benign and environmentally sound methodologies has been the driving force of scientists in recent years towards more sustainable methodologies.

Attractive and innovative protocols that nowadays are even part of industrial ventures including biomass-derived porous carbonaceous materials, designer nanomaterials for catalytic applications and catalytic strategies for biomass/waste conversion into useful materials, chemicals and fuels have been recently developed in our group in recent years. These topics have extensively covered the preparation and design of (nano)materials, biocatalysts and photocatalysts and their utilisation in heterogeneously (bio)(photo)(electro)catalysed processes, flow chemistry as well as in biomass/waste valorisation practices.

An important research avenue from the group deals with the search for novel and alternative reaction media in Organic Synthesis including mechanochemistry, organocatalysis and photo-redox processes as well as greener catalytic processes in Organic Chemistry (flow chemistry) for the synthesis of APIs.

In this lecture, we aim to provide an overview of efforts from our group in leading the future of global scientists in benign-by-design methodologies including the "waste-to-pharma" concept.

Benign-by-design nanomaterials for a more sustainable future: present and outlook



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Rafael Luque (PhD in 2005 from Universidad de Cordoba, Spain) has significant experience in biomass and waste valorization practices to materials, fuels and chemicals including nanoscale chemistry, green chemistry and catalysis as well as environmental remediation with a particular interest on plastic waste and bioremediation (900+ publications, h-index 107, >53,000 citations, 7 patents, 10 edited books). He has been named 2018, 2019, 2020, 2021 and 2022 Highly Cited Researcher (Clarivate Analytics). Prof. Luque is currently DFSP Chair Professor at King Saud University (Saudi Arabia), holding various positions as Head of B4 group (Bioresources, Biopolymers, Biotechnology and Biorefineries) and Project Director at National University of Science and Technology Polytehnica Bucharest (Romania), Director of the Center for Molecular Design and Synthesis of Innovative Compounds for Medicine at RUDN University in Moscow (Russia), International Distinguished Scientist and Rectoral Advisor at Universidad ECOTEC (Ecuador) as well as Rosario Pietropaolo Honorary Chair at Universitá degli studi Mediterranea di Reggio Calabria (Italy).

Tetraethyl orthosilicate (TEOS) production from biomass

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Tetraethyl Orthosilicate (TEOS) has many applications, while the present industrial production from SiCl4 or Si accompanies with huge amount of HCl used/produced or harsh conditions needed. Meanwhile, the researches on the production of TEOS using SiO2 as starting material usually require multi-step reactions and the use of strong bases. Given the current trend for sustainable development, the synthesis of TEOS from biomass attracts much attention.

This study highlights recent advances in the production of TEOS from biomass. The kinds of biomass used, physical, chemical and biological pretreatment of rice straw on the preparation of TEOS were explored with emphasis on silicon's form and transformation mechanism. The connection of silicon with other components in lignocellulose biomass was probed, and the combined valorization of both inorganic ash and organic components was achieved. Amorphous silica could also be converted to siloxane with simultaneously conversion of mixed biomass. Efficient preparation of alkoxysilanes from biomass-enriched silica sources and their autocatalytic mechanisms were revealed. The conceptualization, synthesis, and detailed examination of TEOS production from biomass were comprehensively addressed [1-4].

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Tetraethyl orthosilicate (TEOS) production from biomass

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Prof. Dr. Changwei Hu received his Bachlor, Master, and Ph.D. from the Sichuan University. He has been Professor at Sichuan University since 1996. Fellow of the Chinese Chemical Society; Fellow of the Royal Society of Chemistry; Member of the Scientific Board of the International Sustainable Chemistry Collaborative Centre (ISC3); RSC Green Chemistry series Editorial Board (advisor); International Advisory Board of ChemSusChem; Associate Editor of Sustainable Chemistry for the Environment; Associate Editor of Innovation Discovery; Member of Editorial Board for Catalysts, Biomass, Current Organocatalysis, Journal of Modern Agriculture and Biotechnology; etc. Highly Cited Scholar in China by Elsevier since 2021, Excellent National Teacher of Teaching (China), and Special Allowances Expert of the State Council, China. His current research interests include the catalytic conversion of bio-based materials (bio-oil, sugars, raw algae, and lignocellulosic biomass) into fuels and useful chemicals; catalytic functionalization of C-H bonds from the viewpoint of atom economy; catalytic activation of green house gases; molecular modeling on catalytic systems; and other green chemistry interrelated researches. He has published more than 500 papers in peer-reviewed journals, and authored more than 30 patents.

Sustainable polymers: Waste- and bio-feedstocks are goldmines for innovative applications

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Depleting fossil fuel reserves and increasing waste reservoirs are among the world's most pressing problems. This calls for exploring naturally occurring building blocks for developing bio-based polymers. Polybenzoxazine is a new class of thermally curable thermosets being pitched as superior alternates of phenolics. In this work, I intend to exploit the options of synthesizing partially bio-based polybenzoxazines following green chemical principles of atom economy, bio-renewable feedstock, solventless synthesis, and nontoxic waste generation. In addition, the molecular flexibility of benzoxazine moiety has been utilized by studying the relation between higher functionality and properties. These polymers have shown improved thermal stability compared to their non-green counterparts and the ability to copolymerize with elemental sulfur as one of the high-tonnage industrial wastes, thus finding wide applicability [1-5] from adhesive, antibacterial, water purification materials to cathodes for next-generation beyond Lithium-ion battery (LIB) and self-healing materials.

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Sustainable polymers: Waste- and bio-feedstocks are goldmines for innovative applications

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Bimlesh Lochab (Department of Chemistry, Professor & Head, FRSC) did M.Sc. (Chemistry), M.Tech. (Polymer Science and Technology) from IIT, Delhi, India and D. Phil. (Chemistry) from the University of Oxford, UK. BL was post-doctoral fellow and lecturer (retained) at the University of Oxford, and followed by PDF at University of Nottingham, UK. Recipient of several awards, the first Most Creative Research Award@Luxembourg Institute of science & Technology, Research Excellence Award@ Shiv Nadar University, CRSI Bronze award, APA Young Scientist Award, BIRAC-SRISTI GYTI (Gandhian Young Technological Innovation) award, Young Scientist Award (DST), Distinguished alumna award. BL invited to give a commentary on work by the promise of Green Chemistry by Hon. Mike Lancaster in Investigating Pathways to Resolve Environmental Challenges, ICUS XXVIII, the Unity of Sciences. BL is selected as 75 Women in SHE IS - 75 WOMEN IN CHEMISTRY featured in the fourth edition of She Is, by Beyond Black in partnership with the Office of the Principal Scientific Adviser, GoI and RSC. Received several invitation requests for media coverage as an expert in the sustainable chemistry for national television by DST, YouTube, DD News, Newspapers etc. BL presided several sessions in ACS conference and gave several plenary and keynote lectures. BL is an invited Fellow of Royal Science of Chemistry (FRSC), Fellowship from C. R. Barber Trust Fund (IoP, UK), Felix Scholarship (UK), Council of Scientific and Industrial Research–Junior Research Fellowship, and Radha Sai Ram Memorial prize. Membership of ACS, APA, CRSI and the Society for Polymer Science (India) SPS (Lifetime), Member of Institute of Physics and Polymer Physics group, UK. BL is Chief Executive member of Sustainability Forum and National Advisory Committee Member in APA, and EC member for the Society of Polymer Science, India (SPSI). BL worked on 12 research grants (out of which 1 is with GE industry, 1 International grant Canada and 2 are ongoing). BL (h-index = 29, i10-index = 46) has published 78 (ACS, RSC, Wiley, Springer, Elsevier, etc.) articles, 10 patents, 1 book and 6 book chapters, on the renewable waste-derived sourced materials and their exploration to multitude of applications (energy storage, adhesives, drug delivery, antibacterial) using the tenets of Green Chemistry.

Catalytic valorization of lignocelluose to low-molecular oxygen- and nitrogen-containing compounds

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Biomass, consisting of hydrogen, oxygen, and carbon, is the most promising renewable resource for producing valuable chemicals. Transforming biomass into low-molecular oxygenates is highly important due to the relatively high oxygen content of biomass in comparison with fossil resource. Additionally, nitrogen-containing compounds are more valuable than oxygenates and widely applied in synthesis of agrochemicals and pharmaceuticals.

This study first introduces the catalytic conversion of cellulose/hemicellulose to low-molecular oxygenates including ethylene glycol and ethanol. In 2008, for the first time, my group developed this process using Ni-promoted tungsten carbides [1]. Cellulose/Hemicellulose could be converted to ethylene glycol on catalysts containing transition metal (Pt, Rh, Rh, or Ni) and W species [2-5]. We also developed a multifunctional catalyst Mo/Pt/WOx, selectively producing ethanol from one-pot conversion of cellulose [6]. Then, recent progress in the catalytic transformation of biomass-based aldehydes into N-containing compounds in my group will be summarized. New synthesis pathways towards pyrimidine [7], benzylamines [8], quinolones [9], and carbazoles [10] have been developed, opening new avenues towards the transformation of cheap biomass into high-value N-containing compounds. Finally, the scale-up of DLEG (Direct Lignocellulose Ethylene Glycol) process will be introduced. A 1000 t/a pilot plant was established by us in Puyang, China, with an ethylene glycol yield of ~ 80% and purity of ≥99%. The commercialization of this technology is in progress.

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Catalytic valorization of lignocelluose to low-molecular oxygen- and nitrogen-containing compounds

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Tao Zhang is a professor at Dalian Institute of Chemical Physics (DICP), Chinese Academy of Sciences (CAS). He is an academician of CAS, The World Academy of Sciences and the Canadian Academy of Engineering. He was the director of DICP (2007-2017) and vice president of CAS (2017-2023). Professor Zhang's main research interest lies in the catalysts and new materials for energy conversion. He coined the new concept of "Single-Atom Catalysis" in 2011 and invented a new catalytic process from cellulose to ethylene glycol in 2008. Over the past decade, Prof. Zhang has successfully designed a great number of nano, subnano and single-atom catalysts for the applications in energy conversion and environmental protection. Prof. Zhang is the members of Editorial Board or Advisory Board of Green Chemistry, Applied Catalysis B: Environmental, ACS Sustainable Chemistry & Engineering, Industrial & Engineering Chemistry Research, ChemPhyChem, and the co-editors-in-chief of Chinese Journal of Catalysis. He has also received many research awards, including National Award of Technology Invention (2008, 2006, 2005), Excellent Young Scientist Award of Chinese Catalysis Society (2008), Zhou Guang Zhao Foundation Award for Applied Science (2009), Distinguished Award of Chinese Academy of Sciences (2010), The Science and Technology Progress Award of HLHL Foundation (2016), Science China Materials Innovation Award (2018), ChinaNano Award (2019) and Advance of Catalysis Award of the Asian-Pacific Association of Catalysis Societies (2023).

Catalysing sustainable chemical manufacturing from biomass

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The anthropogenic origin of climate change from combustible carbon, and desire to establish a global circular economy is driving the quest for new sustainable manufacturing processes [1]. Catalysis has a rich history of facilitating energy efficient, selective molecular transformations, and will play a pivotal role in overcoming the scientific and engineering barriers to sustainable and economically viable energy vectors and chemicals. This presentation describes challenges in the design of catalytic technologies for biofuels and platform chemicals synthesis [2].

Advances in the rational design of nanoporous solid acid and base catalysts enable the fabrication of hierarchical porous architectures [3] in which different active sites are spatially compartmentalised. Synergies between nanoporous solid acids and metal nanoparticles also facilitate active and selective upgrading of phenolic components of pyrolysis bio-oils to hydrocarbon fuels, and precious metal thrifting [4]. Active site compartmentalization and flow chemistry facilitates chemical cascades to produce valuable chemical intermediates [5].

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Catalysing sustainable chemical manufacturing from biomass

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Adam received his BA and PhD from the University of Cambridge at which he also undertook a postdoctoral fellowship. He is Professor of Sustainable Chemistry at Griffith University, and previously held Chair appointments at Cardiff, Warwick, Monash, Aston and RMIT Universities. His research addresses the rational design of nanoengineered materials for energy and environmental applications. He is a Fellow of the Royal Society of Chemistry and Royal Australian Chemical Institute, Associate Fellow of the IChemE, Editor-in-Chief of *Materials Today Chemistry*, and recipient of the 2011 McBain Medal, 2012 Beilby Medal and Prize, and 2023 RACI Welcome Award. Adam has co-authored >300 publications (h=index 81, 24861 cites) and is a co-investigator and Flagship Project co-lead on the recently funded ARC Centre of Excellence 'Green Electrochemical Transformation of Carbon Dioxide' GetCO2.

Versatile sporopollenin exine microcapsules (SpECs) from Lycopodium clavatum L.spores as protection and delivery vehicles and building blocks for new bio-composites

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Lycopodium clavatum spores are a bulk commodity used in such as herbal remedies and pyrotechnics. In recent years there has been increasing interest to form microcapsules (SpECs) by evacuating the cytoplasmic contents[1]. The outer shell of SpECs is composed of sporopollenin, which is a highly stable polymer due to the high-level of crosslinking of constituent lipophilic units. The polymer possesses conjugated phenolic groups that shield the contents against UV-light and carboxylic acid groups, which offer flexibility for derivatization and modifying polarity characteristics[2]. These protective properties, along with the elasticity of SpECs, have found application in decorative cosmetics (under licence from Sporomex since 2012 [3]). Furthermore, SpECs can help protect and deliver active compounds when taken orally. An additional and major advantage is that SpECs can enhance bioavailability in human volunteers, via the oral route, for encapsulated vitamin D and eicosapentaenoic acid (EPA) respectively, versus when they were administered in free form [4]. SpECs have also proved advantageous for use in delivering immunocontraceptives in conjunction with trimethyl chitosan (TMC) nanoparticles via the oral route in rats, versus when TMC-immunocontraceptive conjugates are administered alone [5]. Other nanoparticles investigated were those produced from starch.

We have shown that SpECs can also be used as building blocks to construct new types of porous bioconjugates in which such as live yeast cells can be housed, protected, and shown to function efficiently [6].

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Versatile sporopollenin exine microcapsules (SpECs) from Lycopodium clavatum L.spores as protection and delivery vehicles and building blocks for new bio-composites

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Development of waste biorefineries towards a circular bioeconomy

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Food waste is a global problem, as the high water content and low heating value of food waste limited its valorisation options. Therefore, our research team aims at valorisation of organic waste materials through bioconversion processes to recover their inherent nutrients for transformation into value-added products. Waste-based biorefinery not only provides a mean for waste treatment, but also promotes the development of circular economy by valorisation of wastes into value-added products [1]. In this talk, we aim to provide an overview of recent efforts from our group in leading the future of global researchers. In this talk, two recent projects which serve as examples to demonstrate the recent development of integrated biorefinery strategies for production of value-added products, namely microbial biosurfactants and non-woven medical textiles for healthcare apparel. Our research group developed a green production process to produce value-added microbial biosurfactants, namely sophorolipids (SLs), using food waste and *Starmerella bombicola* [2]. Although the adoption of food waste to produce SLs has shed light on the mutual benefit of simultaneously resolving the environmental problem and producing a value-added product, several key hurdles have increased the SL production cost: (i) Inhibition effect of second-generation feedstock on SL production. (ii) Operational costs for hydrolysate preparation. (iii) High enzyme cost for food waste hydrolysis. To overcome these, the inhibitory components in food waste hydrolysate are identified first, then several strategies including adaptive laboratory evolution, biorereactor design, genetic engineering, and one-pot hydrolysis-fermentation are used to increase SL productivity as well as reduce the SL production cost. This study not only facilitate the SL production to benefit the market, as well as lead to a carbon-neutral biorefinery and positively affect society. The demand for environmentally friendly personal protective equipment (PPE) is high due to the coronavirus pandemic. However, conventional slectrostatic-based surgical masks and healthcare apparel are single-use, non-biodegradable and ofren end up as mismanaged waste. Therefore, development of sustainable and biodegradable non-woven texitiles is essential. In this talk, a novel sustainable approach for the fabrication of medical textiles for surgical mask from a substitute of food waste derived polymers polylactic acid (PLA) and poly(3-hydroxybutyrate-co-3-hydroxyvalerate) (PHBV) via electrospinning process will be presented [3].

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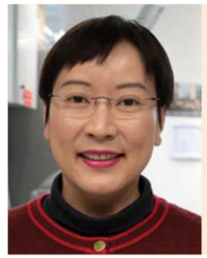
Development of waste biorefineries towards a circular bioeconomy



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BIO

Prof. Carol Lin is a Professor in School of Energy and Environment at City University of Hong Kong (CityU). She received her Bachelor's degree in Chemical and Materials Engineering with 1st class honours from The University of Auckland, New Zealand. She was awarded with PhD in 2008 in Biochemical Engineering at The University of Manchester, England. After one year as a postdoctoral researcher at Ghent University in Belgium, she returned to Hong Kong and joined the Hong Kong University of Science and Technology as a Visiting Assistant Professor. In July 2011, she began her academic career in School of Energy and Environment at CityU.

Prof. Lin has over 20 years in biorefinery, and waste and biomass valorisation. Her research interests lie in technological advancement and development of circular waste-based biorefinery for sustainable production of chemicals, materials and fuels, that contributes to reduction of environmental burden of waste disposal and enhancement of resource efficiency. She has published over 190 SCI journal papers, including 3 Hot Papers and 1 Highly Cited Paper, and co-edited five books and contributed chapters to 30 books (over 11,000 citations with an h-index of 56 in Scopus). She has been selected as the World's Top 2% Scientist (metrics complied by Stanford University). She has served as an Associate Editor for *Biochemical Engineering Journal* (Elsevier), Acting Executive Editor for *Chemical Engineering Journal* (Green and Sustainable Science and Engineering section, Elsevier), Editorial Board Member of *Sustainable Energy and Fuels* (Royal Society of Chemistry) and Guest Editor for over 10 leading SCI journals, including *Green Chemistry, Journal of Hazardous Materials.*

Selective transformation of biomass in the presence of heterogeneous catalysts

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The significant climatic upheavals and the general deterioration of the environment must lead us to step back to evaluate the impact of our anthropogenic footprint and to find quickly alternatives to the productions of essential chemical compounds. In order to reduce greenhouse gas emissions, the conversion of biomass and the derived-platform molecules into synthons for fine chemistry or specialty chemical sectors is an alternative to fossil resource use.

The development of efficient catalysts within this area of research has evolved spectacularly since the beginning of the XXIst century. Significant progresses have been achieved leading to the development of highly active and selective heterogeneous catalysts. While in some applications, catalysts developed for transformation of petrochemicals may be used, in many cases, considering the chemical diversity of biomass derivatives, specific catalysts have to be developed. Indeed, aqueous-phase processing is a key issue since highly oxygenated compounds are concerned in the lignocellulosic biomass. To address this issue, the design of ideal catalysts as well as appropriate processes are world-wide studied.
We have developed a range of catalytic systems active in hydrogenation, hydrogenolysis, aerobic oxidation or dehydrogenation of oxygenated substrates issued from biomass. The nature of the support (mainly oxides), of the metal (rhodium, ruthenium, copper, molybdenum…) affected the performances of the catalysts but also the stability [1]. In addition, the influence of potential residues or impurities present in the raw feed has rarely been studied while there is a need to better understand their effect [2]. Applications covered fine chemicals (solvent, monomer or chemical intermediates) as well as hydrogen production [3].

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Selective transformation of biomass in the presence of heterogeneous catalysts

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BIO

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Defective layered double hydroxide based nanostructured photocatalysts

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Since the interests in harvesting and conversion of solar energy revive promptly in recent years, photocatalysis technology, which can directly convert solar energy into chemical energy, has received much attention. The key to the practical application of green photocatalytic technology is to develop low cost and high efficiency photocatalytic materials. Layered double hydroxide (LDH) based nanostructured materials have been considered as very promising photocatalysts for chemical fuels and products. Recently, a series of LDH-based nanostructured photocatalysts have been designed and synthesized in my group for efficient CO_2 and N_2 reduction into high value-added heavy hydrocarbons, light olefins and ammonia, respectively, by introducing oxygen vacancies to activate reactants and intermediate species [1-10].

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Defective layered double hydroxide based nanostructured photocatalysts

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Advancing global sustainable technologies through the unified conversion of biomass and plastics by heterogeneous catalysis

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This contribution outlines how the field of green chemistry is pivotal in aligning with global ecological transition goals through its focus on sustainable chemical processes. Green chemistry innovatively employs renewable resources like various lignocellulosic biomasses and repurposes waste materials, including plastics, to develop high-value products sustainably [1-3]. This transformative research field leverages the structural similarities between biomass and plastics, particularly their polymer makeup and bond types, which are instrumental in their conversion processes.

Recent advancements have seen the development of intersecting conversion pathways for biomass and plastics, influenced by their shared chemical structures. A 'unified view' of the chemical principles that govern these processes, illustrating how understanding the cleavage of C-C and C-O bonds in lignocellulosic biomass, and similar bond types in polyolefins, advances the upcycling of waste plastics will be presented. Specifically, it will be explored how the knowledge gained from lignocellulose conversion, particularly in cleaving C_{arom}-C and ether bonds, is applicable to the production of aromatic compounds from plastics.

Furthermore, the contribution discusses innovative strategies like reductive-assisted depolymerization for overcoming the challenges posed by inert C_{aliph}-C bonds in polyolefins, thereby opening new pathways for biomass transformation. The discussion extends to the significant scientific challenges that have been addressed and those that remain underexplored in bridging the gap between theoretical and practical applications of green chemistry.

By focusing on the fundamental chemistry behind these transformations, this contribution aims to highlight how chemical knowledge is crucial in driving technological innovations that contribute to a sustainable future. Through this approach, this contribution underscores the potential for fundamental science to catalyze significant advancements in green chemistry, thereby supporting broader environmental and sustainability goals on a worldwide scale.

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Prof. Dr. Francesco Mauriello received his Ph.D. in Industrial Chemistry in 2008 from the University of Bologna, Italy. Following his doctoral studies, he undertook postdoctoral research at Politecnico di Torino from March 2008 to February 2010 and later at the Mediterranea University of Reggio Calabria from March 2010 to November 2011. Since January 2022, he has been serving as an Associate Professor at the Mediterranea University of Reggio Calabria, Italy, focusing on the valorization of biomass and waste into value-added materials, fuels, and chemicals. Prof. Mauriello's professional journey includes multiple international academic positions. He has served as a Visiting Assistant Professor at several prestigious institutions, including the Catalysis Research Center at Hokkaido University in Japan and the CAT Catalytic Center at Aachen University in Germany. As of May 2024, his scientific contributions include 52 articles, 8 reviews, and numerous conference papers and book chapters, leading to a significant citation count and an H-index of 24. His current research projects focus on green chemistry for the circular economy and catalytic upcycling of polyolefin waste, supported by substantial funding from national and regional sources. He is an active member of several national and international chemical societies and committees and from January 2021 is in the national board member of the Interdivisional Group of Catalysis (GIC) of the Italian Chemical Society (SCI).

Carbon-carbon condensation of biomass-based furans using shape-controlled metal oxide-based catalysts

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The carbon-carbon (C-C) condensation of biomass-derived furans is a promising approach for producing renewable diesel fuel precursors. In particular, the C-C condensation of furfural and 2-methylfurfural using a potential heterogeneous catalyst with optimum acidic properties gives a renewable C-15 diesel fuel precursor. We developed a highly selective heterogeneous Nb_2O_5 nanocatalyst for solvent-free C-C condensation of bio-furans. The morphology-controll of Nb_2O_5 particles (nanorods) and calcination at 300 oC provided optimum acid sites for catalyzing the condensation of furfural with 2-methylfuran. A wide range of renewable diesel fuel precursors by applying various substituted furans and benzaldehydes were synthesized using the Nb_2O_5 catalyst. The Nb_2O_5 catalyst is stable in terms of structure and morphology and showed good reusability for up to 5 cycles. The practical feasibility of this catalytic approach was elucidated by estimating sustainable green chemistry metrics. The conceptualization, synthesis, and detailed structure-activity properties of shape-controlled Nb_2O_5 catalysts for the C-C condensation of furfural and 2-methylfurfural will be comprehensively addressed in the presentation [1-6].

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Cleavage/cross-coupling strategy for converting lignin into high value-added compounds

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The conversion of renewable resources into higher value-added organic chemicals is becoming more and more important for our society's future sustainable development. Lignins, being the second abundant organic carbon renewable resources on Earth, have traditionally been treated as waste in the pulp and paper industry. Among the three types of ether linkages in lignins, the 4-O-5 linkage diaryl ether bond is the strongest, while the β-O-4 linkage bond is the most abundant. Selective cleavage of these linkages holds potential to yield smaller, processable bio-based aromatic polymeric materials and compounds [1]. Additionally, there has been a long synthetic interest in coupling reactions with aryl ethers via C(Ar)–O bond cleavage. Up to date, cleavage of model compounds containing 4-O-5 and β-O-4 ether linkages has produced alkanes (such as cyclohexanes) and oxygen-containing compounds (including phenol, cyclohexane, cyclohexanone, and cyclohexanol) [2]. Herein, we present a cleavage/cross-coupling strategy for lignin valorization aimed at generating high value-added nitrogen-containing compounds from lignin degradation.

In this presentation, we will discuss the direct formal cross-coupling of 4-O-5 linkage model compounds, diaryl ethers, with amines [3] and ammonia [4]. This cleavage/cross-coupling strategy aims to produce valuable nitrogen-containing derivatives. Additionally, we applied this strategy to β-O-4 ether linkage model compounds, successfully generating benzyl amine [5]. Recently, we achieved depolymerization of six different sources of native lignin under redox-neutral conditions, eliminating the need for additional oxidants, bases, and transition metals [6].

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Cleavage/cross-coupling strategy for converting lignin into high value-added compounds

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Application of biomass materials in improving the performance of biodegradable mulching films

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Biodegradable mulching films are considered green agricultural inputs, which are expected to partially replace traditional polyethylene films and effectively alleviate agricultural "white pollution". However, their insufficient weatherability and barrier properties, along with high costs, limit their widespread application. In recent years, research addressing these two key technological bottlenecks and cost control has increased. Unlike traditional polyethylene films, biodegradable ones degrade in situ in agricultural soil environments during and after use. Therefore, modifying with biomass materials to enhance their performance is undoubtedly a greener and more sustainable approach among various techniques.

This study provides examples of modifying and preparing biodegradable mulching films using materials such as cellulose, lignin, as well as agricultural and forestry waste. Through testing and characterization, the impact of these biomass materials on the biodegradability, mechanical properties, barrier properties, and weatherability of biodegradable mulching films was investigated. Additionally, standardized testing methods and field evaluation experiments are also summarized for studying the performance and mulching effectiveness of the films, as well as their impact on crop yields. These efforts effectively enhance the performance of biodegradable films and will strongly promote their green development and widespread application [1-4].

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Application of biomass materials in improving the performance of biodegradable mulching films

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Dr. Qi Liu received her Ph.D. from the University of Liège (Belgium) in 2017. She is working as an associate professor at the Institute of the Chinese Academy of Agricultural Sciences (IEDA)-Chinese Academy of Agricultural Sciences (CAAS). Her research now mainly focuses on the modification, characterization, testing techniques, and environmental safety evaluation of biodegradable mulching films. She has led more than 10 projects and sub-projects, including the National Natural Science Foundation project, the "14th Five-Year Plan" National Key Research and Development Program sub-project, and others. She has published over 50 academic papers, with more than 10 as the first or corresponding author in journals such as *ACS Sustainable Chemistry & Engineering*, *Carbohydrate Polymers*, *and Journal of Hazardous Materials*. Additionally, she has been granted five Chinese invention patents as the first inventor. Her research achievements have won her a Chinese Agricultural Science and Technology Award (second prize), a Shennong Chinese Agricultural Science and Technology Award (innovative team prize), and a Great Technological Innovation Award from the Chinese Academy of Agricultural Sciences (first prize). Based on her research results and academic contributions, she has been granted the title of Agricultural Science Talent at IEDA-CAAS since 2022.

Reshoring fine chemical and pharmaceutical productions

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Prolonged shortage of active pharmaceutical ingredients (APIs) in many countries that do not produce critically important APIs requires urgent reshoring of said fine chemical productions. The situation is even worsened by now frequent disruption of the global supply chains, first during the COVID-19 crisis [1] and subsequently with the ongoing Red Sea crisis [2].

Shortage of APIs and formulated drugs, however, continued after the end of the COVID-19 crisis. By late 2023, for example, in response to a shortage of liquid Ibuprofen authorities in the USA were forced to temporarily allow manufacturers to produce and distribute non-approved antipyretic and anti-inflammatory drugs [3].

Many governments in European and North American countries have formally asked companies to repatriate API production. Until the mid-1990s, indeed, western Europe countries, the USA and Japan produced 90% of the world's APIs. In 2017, however, China alone was producing about 40% of the global production of pharmaceutical ingredients [4].

In this lecture, I will first outline the main economic and policy aspects emerging from selected cases of API production reshoring to Europe. Hence, broadening the analysis to include selected cases in China and India, I will address the issue of industrial uptake of continuous manufacturing in fine chemicals production from an economic and industrial viewpoint. I will conclude presenting the three main findings emerging from the present concrete analysis of the concrete situation.

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Reshoring fine chemical and pharmaceutical productions

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Mario Pagliaro is Research Director at Italy's Research Council based in Palermo, Italy, where he leads a research Group focusing on nanochemistry, solar energy, green chemistry and the bioeconomy. Developed in co-operation with leading researchers based in more than 20 countries, his Group's research is reported in nearly 360 frequently cited research papers.
During his doctoral work partly carried out in Israel with David Avnir, he jointly developed a catalyst for alcohol selective oxidations that will be later commercialized with the tradename "Silia*Cat* TEMPO". "IntegroPectin", "NiGraf", "CytroCell@PIL", "GrafeoPlad", "AquaSun", "SiliOrange", "AnchoisOil", "Omeg@Silica", "AnchoisFert", "SiliaSun", "CytroCell", "HyTan", "GreenCaps" and "LimoFish" are some of the new names created by Dr Pagliaro to identify his Laboratory's new functional materials and enabling technologies.

Frequently cited for his excellence in teaching, he has given more than 100 invited public presentations at conferences, seminars, workshops and meetings on the topics of his research and educational activities. In 2008, when a few scholars believed in the forthcoming emergence of photovoltaic technology as a significant contributor to the global energy generation mix, Dr Pagliaro introduced the term "helionomics" in his joint book *Flexible Solar Cells* (Wiley-VCH) which has also been translated in Chinese. Dr Pagliaro ranks in the top 2% World Ranking list of Scientists in all fields of science, 2nd amid the world's top 10 bioeconomy scholars, and currently ranks 27th within the top 100 Top Italian Scientists in material and nano sciences.

Glycerol and carbohydrate based amphiphilic architectures for biomedical applications

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Targeted drug delivery using nanocarriers, which addresses specific tissues or organs in the human body, is an area of research interest that has gained significant attention in recent years. Polymeric micelles with a characteristic core-shell structure are useful nanocarriers for systemic and controlled delivery of drugs due to their high loading, small size, longer duration of circulation in the body, and passive accumulation in tissues. Furthermore, the size, stability and morphology of polymeric architectures are found to be sensitively dependent on the molecular structure as well as their physico-chemical properties. Thus, the fabrication of defined structures and morphologies has been a persistent challenge in the field of polymer synthesis.

We have designed and developed a cleaner and greener chemo-enzymatic method for the synthesis of new bio-based building blocks i.e. carbohydrates and glycerol for the synthesis of amphiphilic polymeric architectures. These polymeric architectures form nano-sized aggregates in aqueous medium and are capable of encapsulating hydrophobic drugs and dyes.

The synthetic methodology, characterization and transport study results will be discussed during the symposium [1-10].

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BIO

Dr. Sunil K. Sharma joined the Department of Chemistry in March 2004 as Associate Professor and appointed full Professor in March 2010. He obtained BSc (Hons), MSc, and PhD degrees from the University of Delhi, India. His doctoral work was in the areas of synthetic and natural product chemistry. He has Postdoctoral / Visiting Scientist research experience of more than ten years at Freie Universitat Berlin (Germany), Massachusetts Institute of Technology (MIT, USA), University of Massachusetts (USA), Boston College (USA), Copenhagen University & University of Southern Denmark (Denmark), University of Liverpool (UK), and CSIC (Spain). He is a recipient of DBT-CREST Award (2011), DBT Overseas Associate Award (2007), International Authors Award from Royal Society of Chemistry (UK, 1999), and fellowships from University Grants Commission (India, 1986), Spanish Ministry of Education and Science (Spain, 1993), Danish International Development Agency (Denmark, 1996), and NIH (USA, 2000). Prof. Sharma's current research interests focus on Organic synthesis, Bio-catalysis, Stimuli-responsive polymer-based functional materials and Nanotechnology. Prof. Sharma has published over 167 peer reviewed journal papers with: average impact 4.3; total citations 5600 ; i10 index 133; H-index 38. Presently Prof. Sharma has a research group of seven PhD students. Twenty three PhD and two MPhil degrees have been awarded to students under his supervision. He has been granted research projects funded by BIRAC-DBT, CSIR, DBT, SERB-DST, DRDO, Government of India, Indo-German Science & Technology Center (IGSTC), Polytechnic University, New York (USA), and University of Delhi. Professor Sharma is having active research collaborations with various National and International (Germany, Italy, USA) groups. He has been the part of key office bearers of many National and International Conferences organized by the Department.

Design and Energy Application of Photocatalysts Based on Polyoxometalates

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As the energy crisis intensifies, the imperative to utilize energy efficiently has never been more critical. Among the many pressing challenges, the development of high-performance catalysts stands out as a paramount priority. These catalysts are crucial for enhancing the efficiency of various industrial processes and for driving forward the sustainable use of energy resources [1,2].

Polyoxometalates (POMs) have garnered significant attention among researchers in the realms of both homogeneous and heterogeneous catalysis. The Anderson-type POMs, in particular, stand out as versatile catalysts. They boast a range of benefits, including adjustable acidity, robust redox properties, and enhanced electron transfer capabilities, all of which contribute to their exceptional performance across a spectrum of catalytic reactions. This report delves into our latest breakthroughs in the design of efficient photocatalysts leveraging POMs. We explore their application in photocatalytic oxidation desulfurization and the oxidation of 5-hydroxymethylfurfural (HMF), highlighting their synergistic interactions with various carriers such as titanium dioxide (TiO_2), carbon nitride (C_3N_4), and metal sulfides. Our findings reveal that the optimized catalysts exhibit enhanced surface areas and improved stability, which are pivotal for elevating their catalytic efficacy and recyclability in heterogeneous reactions. We have also investigated the factors that influence the optimal photocatalytic oxidation capacity of catalysts, aiming to identify the most favorable conditions for these processes. The report will provide a thorough examination of the conceptualization, synthesis, and detailed characterization of these photocatalytic derivatives. This comprehensive analysis will shed light on their physicochemical properties, offering insights into how they can be further optimized for enhanced performance in various catalytic applications [3-6].

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Dr. Ting SU completed her Ph.D. in 2017 at the Harbin Institute of Technology, under the expert guidance of Professor Yulin Yang. Following her graduation, she joined Yantai University in the same year and was promoted to the rank of Associate Professor in 2021. In 2020, she enriched her academic experience as a visiting scholar at Chimie ParisTech under the expert guidance of Prof. Christophe Len. Dr. SU's research is centered on the innovative design and practical application of Anderson-type polyoxometalates as catalysts. She is also deeply involved in the valorization of biomass-based downstream derivatives through photocatalytic methods, as well as in the fields of photocatalytic oxidation desulfurization and solar cell technology, encompassing dye-sensitized solar cells and perovskite solar cells. Her scholarly contributions have been recognized through over 60 publications, which have garnered more than 1200 citations. Her work has been featured in prestigious journals such as *Applied Catalysis B: Environmental, Chemical Engineering Journal, ChemSusChem, Fuel, Green Chemistry, ACS Applied Materials & Interfaces,* etc. She is a review editor of *Frontiers in Chemistry.*

Combining fermentation technology and green chemistry the chemical modification of sophorolipids

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In the pursuit of sustainability, the European chemical industry is increasingly becoming aware of the importance of renewable resources. They are good alternatives for fossil resources since the latter have a major environmental impact and a limited supply. Traditionally, renewable resources are broken down into base chemicals which are then used to synthesize the desired products. The cost for these renewable based chemicals is very often higher than for their fossil counterparts, rendering them uncompetitive for the synthesis of high value products. Instead, natural compounds with a complex structure can directly be used as building blocks in an organic synthesis pathway to reduce the number of synthetic steps required to obtain high value products. Their chemical modification contributes to the sustainability of the process and the end product. This green synthesis approach can be applied on sophorolipids. These glycolipids are produced directly by the yeast Starmerella bombicola from renewable resources through fermentation. They have been successfully commercialized as biosurfactants due to their surface-active properties, beneficial biological activities and high production quantities. A drawback is that, to date, their microbial production is restricted to only a few derivatives. Consequently, the variation in their surface-active properties such as hydrophilic/lipophilic balance or foaming properties is limited and their biological activities have not yet been optimized. A chemical modification pathway was developed to extend the existing set of sophorolipid analogues. The major microbial product, i.e. the diacetylated sophorolipid lacton, was transformed into a sophorolipid platform molecule in a limited number of consecutive steps. This platform molecule was then used for the synthesis of a range of innovative sophorolipid analogues which can serve as green surface-active compounds or compounds with biomedical potential.

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Prof. Dr. ir. Christian V. Stevens (1965) is currently senior full professor at the Department of Green Chemistry and Technology, Faculty of Bioscience Engineering (Ghent University). He graduated as bio-engineer in chemistry in 1988 and obtained a PhD in 1992 at Ghent University. He then performed postdoctoral work at the University of Florida, USA with the late Prof. Alan Katritzky as a NATO Research Fellow. In 1994, he performed a postdoctoral training at the University of Alicante (Spain) with Prof. Miguel Yus and became research leader of the FWO-Flanders (Fund for Scientific Research) in 1995.

In 2000, he became associate professor and started the research group SynBioC (Synthesis, Bioresources and Bio-organic Chemistry). In 2008 he became full professor, was Chair of the Department in 20216-2017, and was promoted to senior full professor in 2014. He became Fellow of the Royal Society of Chemistry Britain in 2011.

In 2015, he received the First Prize in the Emerging Technologies Competition from the Royal Society of Chemistry (UK, London) and is Elected Member of the Royal Flemish Academy for Science and the Arts. Prof. C.V. Stevens published over 360 international peer reviewed scientific papers and reviews. He holds also several patents on the synthesis and applications of heterocyclic compounds and renewable resources. His research interests are focussed on microreactor technology, on synthetic heterocyclic chemistry related to agrochemical and medicinal applications and on the use of rewable resources for the industry.

Ring-opening polymerization of aromatic cyclic esters derived from biomass

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Biodegradable synthetic polyester has been widely used in packaging materials, textiles, biomedicine and other fields, but the low glass transition temperature of the biodegradable polyester represented by polylactic acid limits their application range. Hydroxycarboxylic acids with phenyl as substituting groups have high glass transition temperature, high melting point, and high thermal decomposition temperature, and this kind of high heat resistance has attracted extensive attention of scientists. Because of the specificity of aryl, the controllability, stereoselectivity and sequence structure control of ring-opening polymerization of related monomers need further study.

In recent years, the research group has carried out polymerization and copolymerization of related cyclic esters such as mandelic acid, tropinic acid and salicylic acid [1-3], obtained a series of polyesters and copolyesters with controllable stereostructure and sequence structure, and realized the synthesis of some polymer polyesters. The microstructure of these polyesters has a certain effect on the polymer properties, its glass transition temperature, high melting point, and high thermal decomposition temperature.

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Wu Jincai, Professor, He received his PhD in Inorganic Chemistry from Lanzhou University in June 2003. From October 2003 to July 2005, he did postdoctoral research at Chung Hsing University in Taiwan. From 2006 to 2007, he did postdoctoral research at University of Bern in Switzerland. In September 2005, he was appointed as an associate professor in the School of Chemistry and Chemical Engineering of Lanzhou University. In May 2011, he was promoted to a professor, and in the same year, he was appointed as a doctoral supervisor. In 2022, he was awarded as a third-level Cui Ying Professor of Lanzhou University. He has long been engaged in catalytic chemistry, polymer synthesis methodology, and coordination chemistry research. Recent research focuses on biomass conversion chemistry, biodegradation polymer synthesis directions. He participated in a number of National Foundation projects of China. So far, he has published more than 100 papers in J. Am. Chem. Soc., Angew.Chem. Int.Edit., Macromolecules, ACS Macro Lett., etc.

Breaking boundaries: ultradispersed early transition metals supported on TiO_2 for efficient CO_2 hydrogenation

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The concentration of CO_2 in the atmosphere has been increasing steadily since the first industrial revolution in the 18th century, with a more and more rapid evolution in recent years. It is undeniable that this increase in concentration comes from human activity and the 35,000 Mt of anthropogenic CO_2 released into the atmosphere yearly. By itself, the carbon dioxide is responsible for 45% of the greenhouse gas effect, thus, the carbon capture and utilization is a key strategy to tackle global warming. The obtention of a valuable green fuel and platform molecule such as methanol from this greenhouse gas can pave the way to a more sustainable future by following the "methanol economy" concept.

Beyond the industrial $Cu/ZnO/Al_2O_3$ syngas-to-methanol catalyst, alternative materials have been suggested to enhance both the methanol yield and the catalyst stability in CO_2 hydrogenation. However, these catalysts often rely on rare and/or strategic elements such as Au, Pd, In, Ga, Zn, and Ce. Therefore, the elaboration of a novel, green, non-critical and cost-effective alternative is desirable. In this talk, the CO_2 hydrogenation to methanol over various ultradispersed early transition metals supported on TiO_2 will be presented with a specific focus on Mo/TiO_2 single-atom catalysts. Previously described as inactive, the Mo/TiO_2 system was recently revealed efficient for CO_2 hydrogenation to methanol. It appeared that the reaction kinetics strongly depends on the titania phase, rutile nanorods (RNRs) exhibiting the best performance. Moreover, the potential of molybdenum ultradispersed on other transition metal oxides, such as CeO_2, ZnO, Al_2O_3, and ZrO_2 have been studied. In the (most promising) case of titania, an in-depth operando X-ray absorption spectroscopy (XAS) investigation was carried out to decipher the nature of the active phase [1-2]

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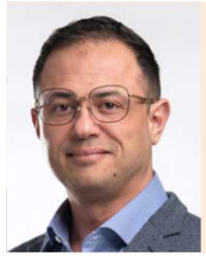
Thomas Len graduated in 2018 with an engineering degree from ESCOM (France) and a master degree at UPJV (France). Dr. Thomas Len defended his PhD focused on CO2 valorization and single-atom catalysis in 2021 under the supervision of Dr. Laurent Piccolo at the Université de Lyon, France. He joined Prof. Rafael Luque in the Universidad de Cordoba, Spain in 2022 and became Juan de la Cierva trainee in 2023. To date, Thomas published 23 peer-reviewed articles and 1 book chapter (Scholar: Citation: >400; H-factor: 11; i10-factor: 11) and gave over 30 orals and posters presentations in national and international congresses.

To break or not to break? Spectroscopic fingerprints for rapid screening of lignin's potential as a raw material to produce chemicals or materials



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Valorisation of lignin, a key component of plant biomass, is essential for advancing the bio-based economy. Unfortunately, the valuable native structural features of lignin are often compromised during traditional extraction processes such as Organosolv and Kraft pulping [1,2]. To maintain lignin's structural integrity and reactivity—crucial for converting it into high-value chemicals, biofuels, and materials—there is a need for more precise control over the chemical processes used in lignin extraction [1,2]. Supported by advanced HSQC NMR spectral data, this talk examines UV-Vis spectroscopy as an effective technique to identify and analyse significant structural and molecular differences in lignin according to various extraction methods. Our discussion is divided into three main parts. First, we discuss the rationale and strategic approaches to lignin valorisation, in line with the principles of Green Chemistry and Green Engineering. Second, we highlight the importance of fractionating lignin by molar mass to explore its molecular diversity. Third, we evaluate the valorisation potential based on molecular structures, emphasising how spectroscopic data can illuminate opportunities for valorisation. In this context, methods such as H-transfer reductive catalytic fractionation (HT-RCF) that preserve lignin's native structural architecture are proven to effectively maintain its inherent reactivity. The stabilisation of high molar mass lignin species through selective reductive processes in HT-RCF ensures that they remain close to their natural structural architecture [3]. This evolution of the RCF concept, which aims at producing lignin polymers with controlled properties, represents a significant development in the lignin-first strategy. It introduces a strategic pathway for creating sustainable materials directly from lignin extraction, circumventing the resource- and energy-intensive traditional processes that depend on post-depolymerisation, functionalisation, and (re)polymerisation as routes for lignin utilisation.

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Dr. Roberto Rinaldi, FRSC is a naturalised British academic distinguished for his catalysis-driven innovations in biomass conversion, notably the "lignin-first" biorefining approach. He obtained his PhD in Inorganic Chemistry from the Institute of Chemistry at the University of Campinas in São Paulo, Brazil, in 2006. Moving to Germany in 2007, he quickly ascended from a postdoctoral role to Junior Research Group Leader at the Max-Planck-Institut für Kohlenforschung by 2009. In 2010, Dr. Rinaldi was promoted to Independent Research Group Leader (W2 professor), backed by a prestigious Sofja-Kovalevskaja Award from the Alexander von Humboldt Foundation (1.54 M€, 2010-2015) to pioneer methods for lignin valorisation. In 2015, Dr. Rinaldi joined Imperial College London as a Senior Lecturer in the Department of Chemical Engineering and was promoted to Reader in Applied Chemistry in 2018. He currently heads Tomorrow's Chemical Technologies Lab, bolstered by a highly competitive ERC Consolidator Grant "LIGNINFIRST" (2 M€, 2017-2022). Recognised for his significant contributions in the field of lignocellulosic biomass fractionation, Dr. Rinaldi received the Willi Keim Prize from ProcessNet/DECHEMA, Germany, in 2014. He was appointed a Fellow of the Royal Society of Chemistry (FRSC) in 2017. He has authored approximately 100 research papers and book chapters, including the reference book "Catalytic Hydrogenation for Biomass Valorisation" published in the RSC Energy and Environment Book Series in 2014. He filed 14 application patents in biomass conversion and catalysis. His scholarly work has attracted over 12,000 citations (h-index 47). He has supervised 17 PhD and 21 MSc students and mentored 20 postdoctoral research fellows. Dr. Rinaldi also serves as an associate editor for npj Materials Sustainability and on the advisory boards of ChemCatChem and Green Chemistry.

Development of nickel carbide nanoparticle catalysts for the liquid-phase hydrogenation of biomass-derived carbon resources into valuable chemicals

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Lignocellulosic biomass is expected to serve as one of the alternatives to fossil fuel as there is no competition with food. Hence, the production of commercially and industrially important materials from lignocellulosic biomass-derived carbon resources is essential to establish chemical processes that do not depend on fossil resources. We have recently reported the highly efficient transformations of lignocellulosic biomass-derived sugars [1-11] or carboxylic acid derivatives [12-14] to useful chemical feedstocks over homogeneous and heterogeneous metal catalysts.

Very recently, we have developed nickel carbide nanoparticles (Ni_3C NPs) as a new class of heterogeneous catalysts for the liquid-phase hydrogenation of nitriles to primary amines [15]. The catalytic performance of Ni_3C NPs significantly differed from that of Ni Nps; Ni_3C NPs catalyst operated well under very mild conditions (1 bar H_2 pressure) and displayed a broad substrate scope and good reusability. Inspired by this finding, in this presentation, I would like to introduce the recent achievements in the application of Ni_3C NPs catalyst to the liquid-phase hydrogenation of lignocellulosic biomass-derived carbon resources to important chemicals.

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Development of nickel carbide nanoparticle catalysts for the liquid-phase hydrogenation of biomass-derived carbon resources into valuable chemicals

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Dr. Sho Yamaguchi received his Ph.D. in 2012 from Tokyo Institute of Technology under the supervision of Prof. Dr. Takashi Takahashi followed by a post-doctoral fellow at the Max Planck Institute for Molecular Physiology in Dortmund, Germany. In 2013, he became an assistant Professor at Tokyo Institute of Technology (Prof. Dr. Toshihide Baba) and moved to Toyota Central R&D Laboratories, Inc. (Dr. Shinji Inagaki) in 2017. In 2020, he re-started an academic career as an assistant Professor in Osaka University (Prof. Dr. Tomoo Mizugaki). He has published total 53 original publications/review articles and 9 book chapters. Among recent awards and recognition to his scientific career, in 2022, he was honored with "The Award for Young Researchers from Osaka University" and "The Catalysis Society of Japan Award for Young Researchers". His current research explores the design and development of a highly active heterogeneous catalyst and its application to liquid-phase organic reactions.

Catalytic biomass valorisation to chemicals: an indispensable future direction

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Terrestrial biomass, especially lignocellulosic biomass, is an alternative to fossil fuels and an imperative, sustainable feedstock for producing valuable chemicals rather than fuels. On the one hand, fuels can be substituted with renewable energies, such as solar and wind, from a long-term perspective due to the steady decline of confined fossil resources. On the other hand, producing chemicals from any biomass becomes indispensable as there are no carbon sources. The transformation of biomass-derived substrates to chemicals by means of heterogenous catalysis is one of the appealing and intriguing approaches due to their wide array of inherent physico-chemical properties. Notably, zeolite- and metal oxide-based catalysts have been well-documented in the past decade due to their characteristic features, such as surface area, pore volume, pore size, adsorption/desorption, porosity, plane, exposure of active species, crystallinity/ amorphous, defective sites (oxygen vacancy/oxophilic sites). Biomass transformation generally entails a range of reactions such as oxidation, reduction, dehydration, isomerisation, hydrodeoxygenation and reductive amination to produce target chemicals in high yields.

This presentation focuses on the catalytic production of carboxylic acids/esters (e.g., lactic acid and 2,5-furandicarboxylic acid), ketoses (e.g., aldoses to ketoses), dehydration products (e.g., 5-hydroxymethyl furfural) amine via reductive amination (e.g., furfuryl amine) from biomass-based substrates. Importantly, how the characteristic features of the employed materials (zeolite- and metal oxide-based ones) play a key role in the transformation are discussed during the presentation [1-8].

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Catalytic biomass valorisation to chemicals: an indispensable future direction

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Dr. S. Saravanamurugan is Scientist-F at the Center of Innovative and Applied Bioprocessing (CIAB), Mohali, India. He obtained his PhD in the field of heterogeneous catalysis from Anna University, India, in 2005. He worked as a research scientist/post-doctoral fellow at KAIST/Inha University, South Korea. He worked as a Post-doctoral fellow and Senior Researcher at Centre for Catalysis and Sustainable Chemistry, Technical University of Denmark (DTU), Denmark, for over eight years. His main research topics include biomass transformation with zeolite/zeotype and mixed oxide catalysts. He has over 80 peer-reviewed publications and 10 book chapters, and he has co-edited two books and seven patents filed/granted with more than 6000 citations (h-Index 35). He received a DST-DAAD Fellowship during his doctoral studies (2004), the Early Career Research Award (SERB) (2017) and was admitted as a fellow of the International Society for Energy, Environment and Sustainability (ISEES) (2020). He was a visiting professor at Guizhou University, China (2015-2021) and is an adjunct Associate Professor at the Regional Centre for Bechnology, India. Notably, he has been elected as a Fellow of the Royal Society of Chemistry (FRSC) (2021).

Enhancement of Transfer Processes in Solar Fuel Conversion Systems

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Solar fuel conversion refers to the use of renewable energy such as solar energy, carbon dioxide and water to synthesize hydrocarbon fuel, which is a kind of energy storage technology to store the intermittent and dispersed renewable energy. At present, the solar fuel conversion technology is divided into the three technical routes, which are photocatalysis, photoelectric catalysis, and photovoltaic-electrocatalysis. In view of the basic principle, the essence of each technical route is the absorption, transfer and conversion of photon energy to chemical energy, and the process can also be decoupled into two steps of "photo energy to electrical/heat energy", and "electrical/heat energy to chemical energy". The energy loss in the process mainly includes photon loss, carrier loss and electrochemical loss. Therefore, how to improve the energy utilization rate of the photochemical conversion whole process is the key scientific problem in this field.

This report demonstrates some examples showing that strengthen the energy/mass transfer process could enhance the efficiency of the solar fuel conversion, and the focuses of this report are on the capture and absorption of the long wavelength photons, the intensification of directional transfer of carriers, and the surface catalytic reaction process. The energy/mass transport mechanism, strategy and methods to strengthen the energy conversion, and the non-destructive amplification of solar fuel conversion device are highlighted. The results reported herein may provide some inspirations for the researchers in the field of solar fuel conversion.

Enhancement of Transfer Processes in Solar Fuel Conversion Systems

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Prof. Dr. Jie Chen received his Ph.D. in 2017 from Xi'an Jiaotong University (XJTU) followed by a post-doctoral fellow at the King Abdullah University of Science and Technology. In 2021, he became associate Professor at XJTU and was promoted to full Professor in 2022. He focuses on the application-oriented basic research of solar photochemical conversion materials and devices. To date, he has published over 70 papers in international journals and co-authored a chapter in a book. Among these, he has published more than 30 papers as the first or corresponding author in high-impact SCI journals such as Chem. Rev., J. Am. Chem. Soc., Adv. Mater., Nano Lett., ACS Energy Lett. (3), Adv. Energy Mater. (2), and Sci. Bull. His research papers have been cited over 7,500 times, and he has an H-index of 39. He has received several accolades, including the National Excellent Young Scientists Fund (Overseas), Shaanxi Qin Chuang Yuan High-level Innovation and Entrepreneurship Talent, and awards for Outstanding Doctoral Dissertation from both Shaanxi Province and Xi'an Jiaotong University. From 2020 to 2023, he was consecutively recognized as one of the top 2% of scientists globally by Stanford University. Currently, he serves as a young editorial board member for eScience and Frontiers in Energy.

Cavitation bubble as microreactor: performing chemistry in a bubble

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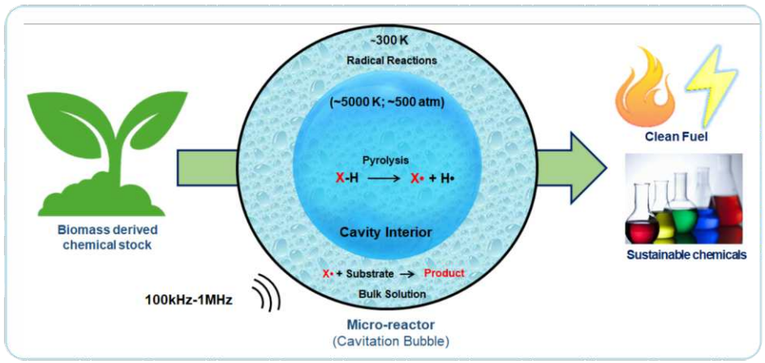
The use of unconventional activation techniques, such as low and high frequency ultrasound (US), in combination with heterogeneous catalysts offers a powerful synergistic approach to transform renewable resources to value added chemicals. Taking advantage of the cavitation bubbles generated during ultrasound irradiation which often acts as a micro-reactor and the localized extreme conditions of temperature and pressure, small molecules can be activated to yield highly reactive radicals that can in synergy with catalysis promote the selective conversion bio-based substrates into valuable products which are hitherto difficult to obtained under conventional routes and at mild reaction conditions. Through selected examples, we demonstrate the potential of high frequency ultrasound working in concert with catalysis in promoting the formation of relevant industrially valuable chemicals.



Cavitation bubble as microreactor: performing chemistry in a bubble

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Prince Nana Amaniampong is a CNRS Researcher at the Institute of Chemistry of Environments and Materials of Poitiers (IC2MP, University of Poitiers).

After his master's degree in Energy Technology and Environment, he joined the Nanyang Technological University Singapore, where he received his doctorate in heterogeneous oxidation catalysis in 2016. His PhD work focused on the development of supported gold nanoparticle catalysts for selective bio-based oxidation reactions. He then carried out a post-doctorate in the group of G. Chatel and then Francois Jérome at the Institute of Chemistry of Environments and Materials of Poitiers, University of Poitiers France (2016-2019), where he developed the application of sonochemistry and sonocatalysis using high frequency ultrasound technologies in the selective transformation of bio-based substrates into industrially relevant chemicals.

Appointed as a CNRS Researcher in 2019, he has been actively involved in the development of sonochemistry as an alternative activation tools in assisting catalytic reactions that are generally considered sluggish and challenging.

In 2021, he was appointed as an editorial board member of Ultrasonics Sonochemistry journal, Molecular Catalysis, ChemPlusChem and a Topical Advisory board member of the journal Catalysts (IF: 4.146) and is an author of over 30 peer-reviewed articles (, 7 book chapters, 1 patent, which have given rise to more than 1000 citations (h index = 21).

In 2024, he was awarded the prestigious CNRS Bronze Medal for his work on Sonochemistry and Sonocatalysis. Prince also received the coveted ERC Starting Grant in 2023, on a project that focuses on the control of cavitation bubbles for the activation of small molecules. In 2022, he received the French Chemical Society Young Researcher Award for the Catalysis Division (DivCat).

He is part of the IC2MP (France) - SOLVAY (E2P2L Shanghai) research and industrial partnership consortium that aims at innovating and taking research breakthroughs from the lab-bench to industrial commercialization.

Catalytic Fractionation and Valorization of Lignocellulosic Biomass

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Lignocellulosic biomass contains cellulose, hemicellulose, and lignin, and cellulose is encapsulated in an amorphous, cross-linked hemicellulose/pectin matrix in primary cell walls and a hemicellulose/lignin matrix in secondary cell walls. This structural arrangement gives plants their strength and rigidity, and it makes cellulose highly resistant to biological and chemical attack. Selective fractionation of lignocellulosic biomass towards different components is the key to achieve the valorization of the whole biomass. However, the traditional fractionation methods focused on utilization of cellulose and hemicellulose. Lignin is usually treated as a waste due to partial depolymerization and repolymerization toward recalcitrant structure, which hampers depolymerization of lignin. In the presentation, it will show the works we have done for catalytic fractionation of lignocellulosic biomass to obtain solid holocellulose and lignin oil. Meanwhile, catalytic valorization of the obtained lignin oil towards high value chemicals and fuels will be discussed.

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Catalytic Fractionation and Valorization of Lignocellulosic Biomass

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Yuhe Liao currently is a professor at Guangzhou Institute of Energy Conversion (GIEC), Chinese Academy of Sciences. He received his PhD in Bioscience Engineering at KU Leuven in 2018 under the guidance of Prof. Bert F. Sels and Dr Danny Verboekend in the field of heterogeneous catalysis for biomass conversion. Afterwards, he did post-doctoral work (2018–2020) at the same university on the topic of CO_2 capture and utilization. The research of his group focuses on heterogeneous catalysis, biomass and CO_2 conversion, and organic waste valorisation.

Strategies for biobased dicarboxylic acid production

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Dicarboxylic acids are important chemicals in the chemical industry, widely used in polymer, food, medicine and other industries. The market demand is large and growing every year. It is of great practical significance to prepare biobased binary carboxylic acid through making full use of the high oxygen content of biomass.

This report mainly introduces our research on the preparation of biobased binary carboxylic acids in recent years, including glyceric acid to succinic acid by one-step reduction carbonylation, tartaric acid to succinic acid by iodine catalytic hydrodeoxygenation, 3-iodopropionic acid to adipic acid by carbon-carbon coupling, and tetrahydrofuran to adipic acid by one-step bicarbonylation. These preparation methods and catalytic systems provide new ideas for the conversion of other similar biomass feedstock to dicarboxylic acids [1-3].

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Strategies for biobased dicarboxylic acid production

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Prof. Weiran Yang got her BS from University of Science and Technology of China in 2004, and got her PhD from the Pennsylvania State University in 2010, and subsequently worked for the Pennsylvania State University, Cornell University, and Dow Chemical company. She joined Nanchang University in 2016 and now is the distinguished professor of Nanchang University. Professor Yang Weiran has been committed to the synthesis of green biomass-based chemicals, the reuse of solid waste resources, and the synthesis of biodegradable polymer materials. She has published more than 50 high-level papers in Top journals such as ACS Catalysis, Chemical Engineering journal, Chinese Journal of Catalysis, Green Chemistry, and 15 authorized patents. In 2017, she won the "Overseas High-level Talents" youth Project and the "New Century Hundred Million Talents Project" of Jiangxi Province. In recent years, she has won the "Elsevier Best Poster Prize" and the nomination award of "Powerful Young Scientists" from the Chinese Chemical Society.

Catalyzing sustainability: heterogeneous catalysis as one of the main cornerstones

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Heterogeneous catalysis will play an important role in the transition to a circular economy based on the use of renewable resources and waste streams. In this talk, we will discuss the preparation of novel carbocatalyst-based systems. These catalytic systems have been implemented for various sustainable processes and will be presented in this talk. In the first part of the lecture, biorefinery processes based on the cellulosic fraction and lignin have been developed in my laboratory and will be discussed. In the second part, we will show the efficient use of metal-free acidic carbocatalyst containing dual functionalities, including high specific surface area, acid site density, and hydrogenation function, in plastic waste recycling. Additionally, we will present recent technologies in plastic waste recycling. Finally, we will discuss a basic carbocatalyst for the ring-opening polymerization of ε-caprolactone to produce biodegradable polycaprolactone [1-3].

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Catalyzing sustainability: heterogeneous catalysis as one of the main cornerstones

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Dr. Majd Al-Naji obtained his Master's degree in Structural Chemistry and Spectroscopy from Universität Leipzig (2010–2013). Afterwards, he joined the group of Heterogeneous Catalysis in Leipzig under the guidance of Prof. Dr. Roger Gläser (2013–2017). Dr. Al-Naji will defend his habilitation thesis on July 2024 at the University of Leipzig. Dr. Al-Naji was a postdoctoral researcher at the Center for Sustainable Catalysis and Engineering at KU Leuven with Prof. Dr. Bert F. Sels (2017). He was the leader of the Biorefinery and Sustainable Chemistry group at the Max Planck Institute of Colloids and Interfaces (2018–2021). Currently, he is the leader of the Sustainable Value Chains group at BasCat – UniCat BASF JointLab at Technical University Berlin and habilitent at Universität Leipzig.

Accurate design and synthesis of high-density biofuels

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High-density jet fuels, generally with density higher than 0.8 g/mL, composed of cyclic hydrocarbons have great potential to improve the flight distance, flight speed and loading capacity of aerospace vehicles. Usually high-density fuels are produced using petroleum intermediates as raw feedstock. As response to the exhaustion of traditional fossil fuels, a new route is developed to obtain high-density fuels from biomass-derived resources, such as turpentine, cyclic ketones, furan, phenols, cyclic alcohols and so on. According to the reaction characteristics, high activity and high selectivity acidic catalysts including HPW modified MCM-41, MOF-encapsulating HPW and hydrophobic mesoporous acidic resin are prepared to catalyze dimerization, aldol condensation and alkylation reaction, respectively. By synthesizing polycycloalkanes to improve the density, adding the branched substituents to improve the low temperature properties, several biomass-derived high-density fuels with comparable performance to petroleum-based high-density fuels are obtained [1-5].

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Accurate design and synthesis of high-density biofuels

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Dr. Junjian Xie is an associate professor at the School of Chemistry and Chemical Engineering in Northwestern Polytechnical University. He was selected for the Youth Talent Program of Xi'an Association for Science and Technology. He received M.S. and Ph.D. degrees in Chemical Technology from Tianjin University in 2016 and 2020 under the supervision of Prof. Jijun Zou. His research interests mainly surround biomass conversion, high-density biofuels and photocatalytic organic synthesis. The relevant research results have been published in over 30 SCI papers in high-level journals such as AIChE J, Green Chem, Fuel, Fuel Process Technol, and Chem Commun. In the past three years, He has undertaken multiple scientific research projects, including the National Natural Science Foundation of China, key projects of the Ministry of Industry and Information Technology, the Shaanxi Provincial Natural Science Foundation, the Chongqing Natural Science Foundation and the China Postdoctoral Science Foundation.

Combining biocatalysis, organometallic catalysis and ionic liquids for biomimetic biomass conversion

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Nature provides great inspiration for living a more circular life, in better balance with our natural environment. It also provides great resources for synthesising chemicals. This lecture will look at some of work to harness the wisdom of nature by employing biomimicry to create catalysts that convert biomass. In this way we can find routes from a variety of cheap biomass to bio-renewable intermediates that spawn a wide variety of value-added chemicals. Whole cell biocatalysis is a powerful first step in the transition from biomass side products to valuable fine chemicals. Ionic liquids were employed as a key tool for sustainable chemistry. What sets ionic liquids apart from other solvents and bulk liquids, is the ability to strategically alter key properties by changing the ions and functional groups. For example, reducing the hydrophilicity by including alkyl groups can lead to solvents that will dissolve polar molecules, yet are immiscible with water; and changing the functional groups on either ion can yield ionic liquids ranging from strongly basic to strongly acidic. An engineered ionic liquid environment can be created around a catalytic centre by entrapping chemocatalyst or biocatalyst with an ionic liquid within a gel. These catalytic ionic liquid gels (ionogels/ iongels) have been demonstrated for organometallic, ionic liquid, and enzymatic catalysts.

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Combining biocatalysis, organometallic catalysis and ionic liquids for biomimetic biomass conversion

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BIO

Andrew C. Marr received a PhD from the University of St Andrews in 1998, on industrial organometallic catalysis under Prof. David Cole-Hamilton. After PDRA positions on hydrogenase enzymes with Prof. Martin Schröder (University of Nottingham), and ligand synthesis with Prof. Paul Pringle (University of Bristol), he was appointed to a McClay lectureship (2001) and then a faculty position in Chemistry in Queen's University Belfast (2004), where he joined the QUILL laboratories for ionic liquids research headed by Prof. Kenneth Seddon. He is a Reader in Green & Sustainable Chemistry and Head of the Chemistry & Medicinal Chemistry programs. He is also an Associate Editor of ACS Sustainable Chemistry & Engineering.

Minimizing the use of non-green polar aprotic solvents by rational design of catalytic systems

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Polar aprotic solvents are widely used in chemical synthesis due to their strong dipole properties, which can dissolve salts and stabilize reaction intermediates. However, most polar aprotic solvents are toxic, flammable, and explosive. Therefore, the replacement of polar aprotic solvents is one of the important tasks for green chemistry researchers. Our research group has developed ionic liquid materials with both dipole solvent function and catalytic function, such as nitro-functionalized ionic liquids and cyclic sulfone-functionalized acidic ionic liquids, using a catalyst and solvent integration strategy. The above ionic liquids have shown excellent performance in various transition metal catalyzed and acid catalyzed reactions, and can achieve the target reaction well without using polar aprotic solvents, providing a suitable alternative for the replacement of polar aprotic solvents [1-3].

Our research group has also used dipolar functional group-modified hypercrosslinked polymers as carriers, and achieved several acid-catalyzed and transition metal-catalyzed reactions in relatively green alcohol and ester media through the polar induction effect of dipolar fragments. With the aid of electron beam irradiation technology, our research group has also developed a universal method for the dipolar modification of solid acids, which has improved the acid catalytic performance of solid acids in ester solvents, avoiding the use of non-green polar aprotic solvents [4].

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Minimizing the use of non-green polar aprotic solvents by rational design of catalytic systems

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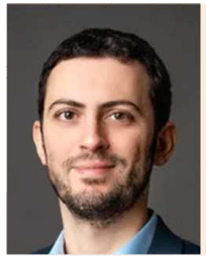
Yanlong Gu obtained his PhD degree from Lanzhou Institute of Chemical Physics, Chinese Academy of Science under supervision of Prof. Youquan Deng. He started then a journey as post-doc researcher in the group of Prof. Shu Kobayashi, The University of Tokyo, Japan (one year), and the group of Prof. Francois Jerome, The University of Poitiers, France (two years). Since October 2008, Yanlong Gu become a professor in School of Chemistry and Chemical Engineering, Huazhong University of Science and Technology, Wuhan, China. He is also a vice director of Xinjing Technology Co. Ltd., Hubei Province, China, which is mainly dealing with the production of fine chemicals. Yanlong Gu has a broad interest in homogeneous catalysis, green organic synthesis, ionic liquids and functional materials for new energy chemistry. In the past decade, Gu has published more than 100 research papers, and contributed three book chapters in the fields. Yanlong Gu is a board member of some journals including Chinese Journal of Catalysis, and Industrial Chemistry & Materials.

Single-atom catalysts for light-driven C-X coupling methods



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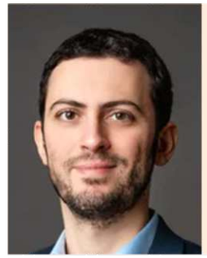
New catalytic materials are urgently needed to drive the transition to a cleaner and more sustainable future. Single-atom catalysts are the frontier of catalysis engineering, and they can accelerate the shift to greener chemical processes due to their groundbreaking reactivity and the ability to economize the amount of critical raw materials. In this lecture, I will present my group's work in this emerging field, from the discovery of these new catalysts to the possibility of using these materials in place of organometallic catalysts in organic transformations. With the help of density functional theory calculations and characterization studies, I will also elucidate the structure of these materials and the charge transfer driving the reaction mechanism. Finally, I will demonstrate how the catalysts can be nanostructured in flow microreactors to obtain structured thin films and foams with integrated single-atom functionalities.

Single-atom catalysts for light-driven C-X coupling methods



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Prof. Dr. Gianvito Vilé graduated with honors in Chemical Engineering from Politecnico di Milano and received his PhD from ETH Zurich, with the ETH medal for his thesis. He is currently Associate Professor of Chemical Processes at Politecnico di Milano. His research focuses on understanding the structure and reactivity of single-atom catalysts, and designing continuous catalytic processes with pharmaceutical relevance. He has received several awards for his research, including the ETH Medal, the Dimistris N. Chorafas Award from the Weizmann Institute of Sciences, the Felder Award from the pharmaceutical company Bracco, and the ERC Starting Grant from the European Research Council. He is the coordinator or partner of several European projects (SAC_2.0, GreenDigiPharma, SSEFR, SACforCO2, and SusPharma). He is also expert evaluator or panel member for several national or international scientific foundations.
Gianvito is Fellow of the Young Academy of Europe, a pan-European academy of 200 top young scientists and scholars from every discipline in Europe, connected with the Academia Europaea. He is also Editorial or Advisory Board Member of Applied Catalysis B, ChemCatChem, ACS ES&T Engineering, CEP:PI, and Chemical Science.ry & Medicinal Chemistry programs. He is also an Associate Editor of ACS Sustainable Chemistry & Engineering.

Capillary electrophoresis-mass spectrometry and their application in bioanalysis

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Capillary electrophoresis (CE) is a versatile analytical method that is widely used in various fields for the separation and analysis of numerous substances such as biological macromolecules, neutral molecules, and organic small molecules, especially its lowest sample usage (nanoliters) [1]. Based on the different nature of analytes and detection requirements, researchers have developed different CE separation modes, including capillary electrochromatography, capillary zone electrophoresis, capillary micellar electrokinetic chromatography, and so on. Recently, covalent organic framework materials (COFs) [2,3] and other porous nanomaterials have been developed as OT-CEC stationary phases. We have developed some CE and CE-MS methods for biological samples analysis such as the simultaneous analysis of creatinine and metformin, p-aminohippuric acid, digoxin, and ketoconazole and so on.

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Associate Prof. Dr. Shengda QI received his Ph.D. in 2006 from Lanzhou University. He thereafter went to Hong Kong Baptist University as a postdoctoral fellow in Prof. Zhaoxiang Bian' group, developing novel CE methods for the analysis of neurotransmitters. He transferred to Iowa State University in 2010 as a visiting scholar and worked on fluorescent spectroscopy analysis single molecule under the guidance of Prof. Edward S. Yeung. The main topics were focused on the single protein molecule transport inside nanotubes. In 2009, He became an associate professor of chemistry at Lanzhou University. He has published ~ 50 original publications. His current research interests include capillary electrophoresis and Mass spectrometry.

Semi-industrial cascade protocols for the valorization of agri-food waste: highly efficient extraction and conversion of residual biomass

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By-products and waste management has garnered significant attention in the agro-industrial sector due to current environmental concerns and increasing consumer focus on sustainability. Despite the plethora of publications addressing extraction protocols for primary and secondary metabolites from agri-food by-products, scalability is hindered by high costs and energy consumption [1]. We experimented with several enabling technologies for green-extraction and biomass processing including: ultrasound, microwaves, pulsed electric fields, hydrodynamic cavitation, supercritical fluids, subcritical water, mechanochemical and enzymatic methods [2, 3]. A new paradigm in biomass extraction involves continuous-flow processes achieved by integrating cavitational techniques (ultrasound or rotor/stator hydrodynamic cavitation) with pulsed electric fields (PEF). This scalable method exhibits outstanding productivity. In the case of economically significant natural matrices like grape by-products, we successfully scaled up the processes to a semi-industrial production [4, 5]. Furthermore, recognizing grape stalks as a valuable source of lignocellulosic material, we conducted ultrasound-assisted lignin extraction and flash microwave-assisted conversion of cellulose to levulinic acid [6]. The precipitated lignin underwent microwave-assisted alkaline oxidation, resulting in the production of long-chain fatty acids and long-chain hydrocarbons as the primary products. In contrast, direct oxidation of grape stalks yielded vanillin and syringaldehyde in moderate yields [7].

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Giancarlo Cravotto is Full Professor of Organic Chemistry and Deputy Director of the Department of Drug Science and Technology (University of Turin). He started his academic career after one year of experience at the Technische Universität Berlin and few years in the industry. His research activity in the field of enabling technologies and industrial process intensification is documented by more than 550 scientific peer-reviewed papers (H. Index 77, 26,700 citations - Google Scholar), 21 international patents and several book and book chapters. Non-conventional technologies applied from laboratory to semi-industrial scale include: ultrasound, hydrodynamic cavitation, high shear homogenizers, microwaves, radio frequencies, ohmic heating, pulsed electric fields, cold plasma, ball mills, extruders, subcritical water and supercritical fluid reactors and hybrid combinations. He is Editor-in-Chief of Processes (MDPI, Basel) and associate Editor or Editorial board member of several journals (by Springer Nature, Elsevier, De Gruyter, Frontiers etc.). Scientific Research Award 2018 "Organic Chemistry for the Environment, Energy and Nanosciences" by the Italian Chemical Society. International green extraction of natural products "GENP2018" Award "Innovation in Chemistry". Kurnakov gold/silver medal 2019 (Russian Academy of Science). Gold medal "E. Paternò" 2017-2020 by the Italian Chemical Society; International RoGuiltlessplastic 2023 Price "Emerging High Technologies 2nd Place".

Continuous flow synthesis: an innovative approach for upgrading selected biobased chemicals

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The principles of sustainable development, the bio-economy, and the circular economy are increasingly being applied to the synthesis of industrially relevant molecules. In this context, furfural and glycerol, which serve as platform molecules, are the subject of diverse research approaches aimed at improving their conversion into valuable compounds. Given the current momentum in promoting green chemistry for sustainable development, chemists have recently pioneered catalytic reactions utilizing innovative technologies, such as continuous flow processes.

This study highlights recent advancements in the continuous production of derivatives obtained from furfural and glycerol. Among the noteworthy molecules of interest are furfuryl alcohol, levulinic acid and its esters, gamma valerolactone, acrolein, quinoline-type derivatives, solketal, triacetin, and glycerol oligomers. These derivatives are synthesized from biomass or carbohydrates, utilizing both homogeneous and heterogeneous catalysts. Various reaction parameters, including temperature, catalyst and feedstock loadings, and solvent types, have been meticulously fine-tuned with a focus on time efficiency. The conceptualization, synthesis, and detailed examination of the physicochemical properties of these derivatives will be comprehensively addressed [1-6].

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Continuous flow synthesis: an innovative approach for upgrading selected biobased chemicals

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Prof. Dr. Christophe Len received his Ph.D. in 1995 from the Université de Picardie Jules Verne followed by a post-doctoral fellow at the University of Hull (UK). In 1997, he became assistant Professor at UPJV and was promoted to full Professor in 2004 at the Université de Poitiers (France). In 2010, he moved as full Professor to the Université de Technologie de Compiègne – UTC (France). Since 2017, he has developed his research at Chimie ParisTech (France). He has published ~ 250 original publications and review articles, 11 book chapters, and 12 patents (H 48, 7162 citations, Scopus). Among recent awards and recognition to his scientific career, he was promoted Honorary Professor of the University of Hull, England (2012–2018), Honorary Professor at the University of Delhi, India (2022), Honorary Professor at the Xi'an Jiaotong University, China (2022-2025) and Fellow of the Royal Society of Chemistry (FRSC, 2015). In 2017, he was honored with the 2017 Glycerine Innovation Award sponsored by the American Cleaning Institute and the National Biodiesel Board. His current research explores organic chemistry and continuous flow.

Sponsor information

宁夏，是一片充满古老智慧与新生希望的土地。这里，大漠孤烟与江南水韵共存，孕育了无数的生机与希望，也孕育了贺兰山地区丰富的自然资源和独特的生态环境。宁夏天鑫源生物科技有限公司，正是在这片生机盎然的沃土上应运而生。

我们既是汲取大地精华应运而生，便也承载要科技创新、将自然的馈赠转化为生物科技璀璨明珠的使命。

为了这一使命，自成立以来，我们始终秉承“绿色、创新、共赢”的发展理念，致力于生物质资源的深度开发与高值化利用。

我们不仅集研发、生产、销售于一体，更在生物质腐植酸及其衍生产品的研究与应用领域，走在了行业前列。

腐植酸，这种广泛存在于自然界中的天然有机物质，是由动植物遗骸经过微生物分解和地球化学过程积累而成的珍贵资源。而这种珍贵优质原料，天鑫源的储量高达10万吨，我们之所以这样做，是因为对卓越品质有着不懈的追求，是为了每一吨高质量腐植酸产品的诞生都有优质原料作为根基。

先进的生产线与设备是我们打造高品质产品的坚实基础。优质的原料首先经过筛分、破碎，化为细致的原粉，进入全自动化的配料和搅拌工序。在搅拌工段中，腐植酸原粉与其他物料经过全自动化配料与投放，并在搅拌罐中进行定时、定温的搅拌。随后，腐植酸盐原浆进入沉淀池和沉淀罐，经过三级沉淀后，原浆上清液被抽入离心机工段，通过两台卧式和两台立式离心机，最终将水溶性提至99%。

接下来，产品进入烘干工段。我们天鑫源的自主研发工艺，基于多年积累的宝贵经验，对老式滚筒烘干机进行了全新升级，实现了放浆自动化、控温自动化、回水等后续工段的智能自动化处理。这不仅提升了产品的外观，使其片大、片亮、粉末极少，极大提升了生产效率与产量。

在天鑫源，腐植酸是自然与科技的完美结合。我们的核心产品——片状腐植酸钠、片状腐植酸钾、片状黄腐酸钾、烘干颗粒钾、硝基腐殖酸钾——无不凝聚了我们对质量与技术的极致追求。凭借优质的原材料和先进的工艺，我们成功将腐植酸产品广泛应用于现代农业、水产养殖业、生态修复、石油钻井及建陶材料等多个领域，为推动我国农业绿色转型和生态文明建设贡献力量。

我们的目标，是为农业可持续发展、环境保护及大分子碳基链新材料、新能源领域提供强有力的技术支持和产品解决方案。

为此，我们与新希望六和集团、东方希望集团、正大集团、双胞胎集团、唐人神集团、通威集团、禾丰集团、漓源集团等多家知名企业建立了紧密合作关系，共同推动行业发展，实现合作共赢。

每一吨腐植酸产品，都是天鑫源对大地的深情献礼；每一份努力，都是我们对未来的坚定承诺。正如宁夏的广袤天地，天鑫源始终以胸怀大志的姿态，坚定前行。未来的道路上，我们将继续秉承“绿色、创新、共赢”的理念，与客户、合作伙伴携手并进，为实现共同的繁荣与可持续发展而不懈努力。天鑫源，这座屹立在宁夏大地的科技高地，正以不可阻挡的姿态，迎接更加辉煌的明天。

张旭昊 总经理