

國家科學委員會化學研究推動中心

CHEMISTRY RESEARCH PROMOTION CENTER

NATIONAL SCIENCE COUNCIL

P.O. Box 23-202, Taipei, Taiwan 106, Republic of China

---

TEL: (886-2)-2363-5357

FAX: (886-2)-2363-6359

系主任大鑒：

資訊的流通有利於整體競爭力的提升，為了增加化學界資訊的流通，化學中心將不定期寄給全國各系所研究相關之訊息，供各系所張貼。

此舉在中研院化學所行之有年（訊息張貼於信箱前之布告欄，供同仁取信時瀏覽），獲得同仁一致好評。由於張貼時間長達一個月，同仁可以在暇餘接觸這些訊息，不若電子郵件只要當天無暇閱讀，便極有可能淪為垃圾郵件。化學中心試行以相同的方式，與國內同仁分享國際動態，望貴系予以支持。

當前綠色/永續化學為各國公認亟需化學界關心之課題，故短期內資訊內容將以永續化學為主，各系所同仁如有任何資訊亦歡迎提供，內容無須限定於永續化學。

由於永續化學包含所有化學層面，設定研究優先順序成為各團體努力之目標。美國化學會 Green Chemistry Institute 下之 Pharmaceutical Roundtable，六大藥廠在腦力激盪之後，日前提出十二項優先努力的研究目標，特印出與同仁分享。

化學中心謹誌

九十五年十二月一日

# Green chemistry at the 1st European Chemistry Congress

DOI: 10.1039/b614462b

Christian Böing and Clemens B. Minnich recall the *Green and Sustainable Chemistry and Processes* symposium of the 1st European Chemistry Congress.

Between August 27th and 31st, 2006 the 1st European Chemistry Congress was held in Budapest. It was organised by the European Association for Chemical and Molecular Sciences (EuChemS) and featured a broad spectrum of chemistry topics covered through five plenary lectures by nobel laureates and ten special topic symposia. One of these symposia, organised by *Walter Leitner* (RWTH Aachen University, Aachen, Germany) and *István Horváth* (Eötvös University, Budapest, Hungary) and sponsored by BASF AG, focused on *Green and Sustainable Chemistry and Processes*. Since it was impossible to address all aspects of green chemistry within two days, the focus was clearly set on chemical reactions and processes. The organisers were able to invite a number of leading scientists as well as young researchers to present their recent work in that field. The symposium was well recognised by the attendees of the congress, so most of the time the lecture hall was filled completely or even overcrowded (see picture) with more than 150 listeners following stimulating talks about cutting edge research and innovation from academia as well as from industry.

After a short introduction by the symposium chairman *Walter Leitner*, *Roger Sheldon* (TU Delft, Delft, Netherlands) opened the first session with his lecture about "Multistep Catalytic Cascade Processes for Sustainable Organic Synthesis". He reported on his recent work on one pot processes using a combination of chemocatalytic methods with biocatalysts. His group succeeded in overcoming the well known problem of incompatibility of the required surroundings for chemical catalysts and enzymes by means of compartmentalisation techniques. In particular, the coupled immobilisation of lipases for the racemisation and

deacylases for the hydrolysis of amides was presented (preparation of cross-linked enzymatic aggregates, CLEA). Furthermore, he showed highly elegant ways for the production of chiral alcohols and amines.

The second invited lecture given by *Peter Saling* (BASF AG, Ludwigshafen, Germany) was entitled "Strategies for Sustainable Development of Chemical Synthesis with the Eco-Efficiency Analysis and SEE-Balance". He showed how BASF AG estimates the sustainability of a process by using the eco-efficiency analysis and SEE-balance. The eco-efficiency analysis was developed as a tool to visualise environmental and cost factors to decision makers, and leads to a fingerprint of a process already in an early phase of process design. As an example he compared the BASIL process, which utilises the easy separation of an ionic liquid by-product from a reaction mixture, with the original process

that instead leads to the formation of a solid ammonium salt. It was clearly shown that the BASIL process, which is well recognised in the green chemistry community, is superior to the traditional process. Finally the SEE-balance tool was introduced where societal aspects of the process are also included.

The second session of the first day continued with a lecture from industry. *Keith W. Hutchenson* (DuPont Central Research and Development, Wilmington, DE, USA) reported on "Sustainable Products and Processes from Biorenewables at DuPont". He pointed out that DuPont committed themselves to gather 25% revenue from renewables in 2010. A key project to fulfil this target is the development of a so-called "Integrated Corn-Based BioRefinery" (ICBR), which allows the production of alternative fuels, such as bioethanol, or chemicals from renewable sources. The ICBR can convert corn grain into fermentable sugars for the production of value added products. Another example is the production of 1,3-propanediol, a building block for polyester synthesis (commercialised under the trade name Sonora), from glycerol feedstock. Levulinic acid is another important building block and platform molecule for DuPont's strategy, and this can be synthesised from cellulose in a commercially viable way as exemplified by the Biofine process that started operation most recently in Italy.

The last invited lecture of the first day was given by *Ronny Neumann* from the Weizmann Institute (Rehovot, Israel) on the "Activation of Molecular Oxygen by Binary Polyoxometalate Containing Catalysts". He demonstrated his concept of using organometallic polyoxometalate or nanoparticle-polyoxometalate hybrid catalysts in oxidation reactions with molecular oxygen as the oxidant. This was exemplified by the aerobic oxidation



Fig. 1 Crowded lecture hall during a session (photo: László T. Mika).



Fig. 2 Discussions in front of the posters (photo: László T. Mika).

of methane to methanol and acetaldehyde, by the aerobic epoxidation of alkenes, as well as the oxidative dehydrogenation of alkenes to alkanes.

After the last lecture of the first day, the poster session started and, despite the fact that it was located in another building, a lively discussion between the attendees started and contributed to the positive impression of the symposium.

The second day of the symposium was opened by the keynote lecture of *Walter Leitner* (RWTH Aachen University, Aachen, Germany). It was a general feature of the congress that the organiser of a special topic symposium also gave the appending keynote lecture. He presented the recent progress in utilising supercritical carbon dioxide in combination with water, poly(ethylene)glycol and ionic liquids as advanced solvent systems for catalysis. Techniques for catalyst immobilisation and continuous-flow operations with organometallic, nano-scale as well as organic catalysts

were discussed. He completed his talk with the enantioselective aza-Baylis–Hillman reaction catalysed by an achiral Lewis base in a chiral ionic liquid, providing the first example of high level chiral induction by a reaction solvent.

*Shu Kobayashi* (The University of Tokyo, Tokyo, Japan) described his recent work on “Lewis Acid Catalysis in Aqueous Media” and addressed the water compatibility of different Lewis acidic rare earth metals, and in particular bismuth complexes. He has developed Lewis acid catalysts based on  $\text{Bi}(\text{OTf})_3$  in combination with chiral bipyridine ligands for asymmetric reactions in water. Furthermore, his group stabilised scandium-based Lewis acidic catalysts on homogeneous and heterogenised long-chain alkyl sulfonates. During this talk a multitude of impressive results were shown, and the speaker was able to convince the audience that water plays a key role in Lewis acid catalysis.

*Dieter Vogt* (TU Eindhoven, Eindhoven, The Netherlands) was given the opportunity to present the closing lecture of the symposium, and he talked about the “Immobilisation and Compartmentalisation of Homogeneous Catalysts” in “Shades of green”. After talks on heterogeneous systems and catalyst immobilisation in biphasic media, this presentation addressed catalyst recycling with membrane techniques. Dendritic catalysts were used to ensure that the catalyst is held back by the membrane. In the second part of his lecture Vogt showed his recent work on emulsified borate containing submicron particles as support for cationic homogeneous catalysts and their application in the rhodium catalysed hydrogenation.

Apart from the keynote and invited lectures described above, a variety of outstanding short oral contributions and poster appetisers given by young researchers and students were



Fig. 3 The BASF Prize for Sarah L. Poe (photo: André Mortreux).

contributed to the symposium. To recognise these, the Green Chemistry journal and BASF AG sponsored a prize for the best oral contribution by a young scientist and for the best poster presentation by a student, respectively. *Federica Zaccheria* (Università degli Studi di Milano, Milan, Italy) was awarded the Green Chemistry Prize for the best oral contribution and received a free one-year subscription to Green Chemistry. In her lecture, she presented her recent work on “Selective Transfer Dehydrogenation of Non-activated Alcohols over  $\text{Cu}/\text{Al}_2\text{O}_3$ ”. The BASF poster price was given to *Sarah L. Poe* (Cornell University, Ithaca, NY, USA) for her excellent poster about the development and application of a one-pot Henry reaction/Michael addition cascade.

All in all, the special topic symposium on *Green and Sustainable Chemistry and Processes* was a full success, and we are looking forward to a similarly focused symposium as part of the 2nd European Chemistry Congress in Torino 2008!

**Christian Böing** and **Clemens B. Minnich**.

Institut für Technische und Makromolekulare Chemie, RWTH Aachen University, Germany. E-mail: boeing@itmc.rwth-aachen.de, minnich@itmc.rwth-aachen.de.

## Research Challenges and Sustainable Designs on Display at the 10th Annual Green Chemistry & Engineering Conference

Julie B. Manley

The world's most innovative sustainable designs were on display at the [10th Annual Green Chemistry & Engineering Conference](#) June 26–30 in Washington, D.C. The challenge to design for sustainability is a worldwide challenge and one undertaken by chemists and engineers from across the globe. More than 400 people from Argentina to Bahrain, Egypt to Ethiopia, Germany to India, Japan to Switzerland, and the United Kingdom to the United States participated in this year's conference. The conference is driven by a belief that as chemists and engineers, we have the power to design a sustainable future.

The week began with the announcement of the winners of the [2006 Presidential Green Chemistry Challenge Awards](#). Congratulations to Merck & Co., S. C. Johnson & Son, Codexis, Arkon Consultants and Nupro Technologies, and Gallen J. Suppes from the University of Missouri N-Columbia. The conference's opening session featured vice-presidents, presidents, and CEOs who identified the business value that green chemistry has provided to their organizations. The three days of technical programming that followed featured advancements in five core tracks: energy, agriculture, renewable feedstocks, toxicity reduction, and health and medicine.

Keynote speakers included George M. Gray, Assistant Administrator, Office of Research & Development, U.S. Environmental Protection Agency; Stuart L. Hart, Samuel C. Johnson Chair in Sustainable Global Enterprise, Cornell University; and Dan E. Anzizu, Director of the National Renewable Energy Laboratory. The banquet speaker was Henry Red Cloud, a descendant of Chief Red Cloud and President of Lakota Solar Enterprises. Numerous plenary speakers covered business and technical topics related to green chemistry, including D. Christopher Watts, team leader with the U.S. Food and Drug Administration Center for Drug Evaluation & Research, who discussed their programs ranging from process analytical technology to green chemistry.

The pharmaceutical industry demonstrated their enduring commitment to green chemistry and engineering through the ACS Green Chemistry Institute (GCI) Pharmaceutical Roundtable by sponsoring and organizing the Health and Medicine technical track. The [GCI Pharmaceutical Roundtable](#) is a collaboration among global pharmaceutical corporations to integrate green chemistry and engineering into their industry. To complement the large number of pharmaceutical case studies presented at the conference, the roundtable group work was presented in the form of a proposed mass intensity metric for the industry and a challenge to the broader research community to identify greener alternatives to common reactions used in the pharmaceutical industry.

Based on a survey of member companies, the GCI Pharmaceutical Roundtable prioritized the following reactions in search of greener alternatives:

- Current Reactions
  - Amide formation
  - OH activation
  - Amide reduction
  - Green Mitsunobu reactions
  - Oxidation/Epoxidations
- More Aspirational Reactions
  - C-H activation of aromatics
  - Chiral amine synthesis
  - Asymmetric hydrogenation
  - Green fluorination methods
  - *N*-centred chemistry
- Key Ideas Outside the Reaction Theme
  - Solvent-less reactor cleaning
  - Green alternatives to dipolar aprotic solvents

As one of the sponsors and organizers of the 10th Annual Green Chemistry & Engineering Conference, the GCI Pharmaceutical Roundtable thanks everyone who participated in this year's conference, and we challenge everyone to design innovations that support a sustainable future. For more information about the GCI Pharmaceutical Roundtable and our research priorities, please go to our [website](#) or contact [gci@acs.org](mailto:gci@acs.org) directly.

*This article first appeared on July 10, 2006.*

Last Updated: 2006-07-10

Copyright (c) 2006 American Chemical Society.  
All Rights Reserved.



**GreenChem2006**

**June 26–30, 2006**

**WASHINGTON, DC**