

CONFERENCE

International Symposium on Catalysis and Fine Chemicals

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On March, 2001, a conference organized by the Council on Catalysis, Waseda University, was held in Tokyo. This was a remarkable event with a number of invited lectures read by many famous chemists. But the most important was that numerous Japanese young scientists took part in the conference; they made five-minute reports and posters. In my opinion, just that part of the conference was the most impressive, for it demonstrated very interesting studies which are now performed in Japan and a great potential of Japan in an important field of chemistry, determining the development of many branches of industry.

The principal topic (a "red line" of the conference) was the development of effective ecologically friendly and economically feasible chemical processes. Just for that reason, the conference was opened by J.C. Warner (USA) with his lecture "Green Chemistry Environmental and Economic Considerations During the Design Stage of Product Development," where he summarized the "Green Chemistry" principles and gave particular examples of their utilization. It was emphasized that catalysis is just a field of chemistry developing toward most ecologically safe processes.

The same problems were covered by R.A. Sheldon (The Netherlands) who reported on the principles of his concept termed "atom efficiency" and gave examples of large-scale processes utilizing the "Green Chemistry" principles. It was shown that the reduction of α,β -unsaturated acids to aldehydes, catalyzed by immobilized ruthenium complexes, is a considerably more advanced process (from the viewpoint of green chemistry) than the well known palladium-catalyzed reduction of carboxylic acid chlorides since in the former case only water is formed together with the target product.

An excellent illustration of solving problems on the up-to-date level was the lecture "Green Lewis Acid Catalysis for Benign Chemical Synthesis" made by S. Kobayashi (Japan); the author reported on catalytic processes in water with the use of new Lewis acids such as $\text{Pr}(\text{NO}_3)_3$ -crown ether or $\text{Rb}(\text{OTf})_2$ -crown ether.

I. Shinkai (USA–Japan), as usually, demonstrated remarkable examples of highly stereoselective syntheses of drugs belonging to new generations. These processes included as key stages catalytic reactions like hydrogenation of carbonyl group or C–C bond formation with the use of arylboronic acids.

A specific role in homogeneous catalysis by palladium complexes was considered by A. Yamamoto and I. Shimizu whose lecture covered both key problems in the palladium chemistry and new reactions, such as synthesis of unsaturated acids by carbonylation of allyl formates.

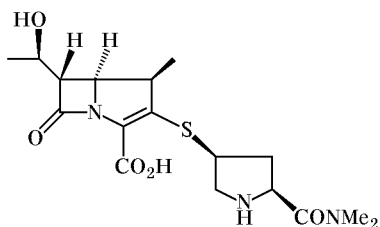
A number of lectures and posters dealt with enzymatic catalysis. For example, S.-C. Shoda (Japan) used catalysis by enzymes at various stages of synthesis of functionalized oligosaccharides. Design of various cyclic systems by ruthenium-catalyzed metathesis was reported by M. Mori (Japan). I. Beletskaya (Russia) demonstrated building up of C–P, C–N, and C–M bonds by substitution and addition reactions catalyzed by Pd and Ni complexes.

I. Ishii (Japan) in his remarkable lecture reported on the important role of radical processes in organic synthesis, including oxidation and nitration, as a result of using *N*-hydroxyphthalimide as catalyst. The author considered ready oxidation of cyclohexane to adipic acid with oxygen, of toluene to benzoic acid, and of *p*-xylene to terephthalic acid in the system O_2 -manganese or cobalt salt-cocatalyst.

The use of organometallic compounds and catalysis in the synthesis of polymeric materials having divinyl-arene fragments linked through silicon was the topic of the lecture made by T.-I. Luh (Taiwan). Such materials possess interesting optoelectronic properties. The formation of five-membered ring in tandem cycloaddition processes involving di- and trienes and CO under catalysis by carbonyl cobalt complexes was reported by J.K. Chung (Korea).

The lecture of M. Sunagawa (Sumitomo Pharmaceuticals Co.) seemed to stand somewhat apart; it

was concerned with the manufacture of meropenem (1- β -methylcarbapenem antibiotic):



Various aspects of asymmetric synthesis were widely considered. A.S.C. Chan (Hong Kong) proposed a new family of chiral ligands for asymmetric hydrogenation and alkylation. The following bisphosphine ligand showed good results:



It can readily be separated by acidification and is more resistant to oxidation. The hydrogenation of β -keto esters, catalyzed by Ru complex with the above ligand, ensured high ee values. Asymmetric formation of C–H and C–C bonds was used in the synthesis of drugs.

T. Hayashi (Japan) reported on numerous examples of highly enantioselective 1,4-addition to electron-deficient olefins (α,β -unsaturated ketones, esters,

1-alkenylphosphonates, and nitroalkenes) by the action of aryl- or alkenylboronic acids in the presence of rhodium complexes, as well as on asymmetric addition of organotin compounds to Schiff bases under catalysis by Rh–MOP. X. Lu (China) described enantioselective cyclization of enyne esters into optically active γ -butyrolactones, catalyzed by Pd(II) complexes. The possibility of using robots and combinatorial synthesis, e.g., in the search for efficient olefin hydrogenation catalysts, was reported by T. Uno (Japan), a representative of the leading company in this field, Synya Technologies. Up to 100 such reactions can be carried out in one day.

Posters demonstrated various types of catalysis, but the emphasis was placed on hybrid homogeneous–heterogeneous catalysis. This concerns both metal-complex catalysis where supported or immobilized transition metal complexes were used and acid–base catalysis where solid acids and bases were preferred. Many new catalytic systems were proposed for oxidation of methane, epoxidation, cyclopropanation, olefin metathesis, polymerization, Diels–Alder reactions, etc. Interesting catalysts promote reduction of carboxylic acids to aldehydes or hydrogenation of esters to alcohols. Very interesting were data on new radical reactions. As usually, new ways of asymmetric synthesis were proposed, among which asymmetric hydrosilylation of dienes by the action of HSiCl_3 should be noted.

Much attention was given to reactions occurring with no organic solvent, in aqueous medium, in supercritical carbon dioxide, and in ionic liquids.