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**UNITED NATIONS INDUSTRIAL
DEVELOPMENT ORGANISATION**



**INTERNATIONAL CENTRE FOR SCIENCE
AND HIGH TECHNOLOGY**



**INSTITUTE OF CATALYSIS
BULGARIAN ACADEMY OF SCIENCES**

FINAL REPORT

WORKSHOP

on

**CATALYSIS FOR SUSTAINABLE CHEMISTRY:
STRUCTURE, PROCESSES AND INDUSTRIAL
APPLICATIONS**

3–6 November 2000

Institute of Catalysis, Sofia, Bulgaria

UNIDO PROJECT TF/GLO/00/105

CONTRACT No.: 2000/210

OBJECTIVES

The main objectives of this workshop were as follows:

- To evaluate the state-of-art of modern chemical industry and its impact on society development and environmental problems.
- To identify the current problems of chemical industry with respect to applications of industrial catalytic processes
- To build awareness among experts from industry, R&D institutions and universities working in the field of catalysis and process development about the recent development of new catalytic technologies.
- To identify the current developments of chemical industry with respect to less polluting processes and emphasis on developing cleaner technologies.
- Evaluate the priorities in the field of the countries from the region and formulate possible co-operative programmes and common projects
- Transfer of information and knowledge in advance areas of catalysis and clean technologies from experts from R&D institutes, industries and universities.
- Identification of the current state of technologies used in Southeast European countries and a strategy to replace polluting ones with catalytic processes.
- Identification of possible projects with collaboration among the institutes and industries creating a regional ICS-UNIDO International Network.

ORGANISATION

The workshop was organised jointly by the International Centre for Science and High Technology (ICS), United Nations Industrial Development Organisation (UNIDO) and Institute of Catalysis, Bulgarian Academy of Sciences, Sofia, Bulgaria.

The local Organising Committee consisted of Prof. L. A. Petrov (Chairman), Assoc. Prof. Ch. Bonev, Assoc. Prof. G. Kadinov, Assoc. Prof. I. Mitov, and Assoc. Prof. Ch. Vladov.

DATES AND VENUE

The Workshop was held during 3–6 November 2000 at Institute of Catalysis, Bulgarian Academy of Sciences, Sofia, Bulgaria.

FUNDING

The expenditure sanctioned by UNIDO for this project was USD 20000. The amount received from UNIDO on 17th October 2000 was USD 16000 (USD 30 were deducted by Bank as Bank Charges) to cover the expenses towards the items listed in the budget. The hosting country (Bulgaria) contributed USD 3000 towards various items. The Organising Committee had covered tickets for all international participants and Bulgarian participants living outside of Sofia. The arrangements for meals, hotels, etc., with reasonable costs and quality were made. A summary of the final budget is given in Appendix 1.

SCIENTIFIC PROGRAM

The workshop program is presented in Appendix 2. It involved 7 keynote one-hour lectures (Table 1, Appendix 3), 10 oral 30-min presentations (Table 2, Appendix 4), 52 poster presentations (Appendix 5) and 9 country reports.

The key topics covered during the workshop were:

- Catalytic reaction kinetics under steady and non-steady conditions
- Catalyst selection: theory and practice
- Improvement of the quality of the catalysts used at present in the existing processes.
- Development of the new catalytic materials.
- Searching a new raw material basis for the chemical industry, petrochemistry, and organic synthesis.
- New catalysts and catalytic processes for environmental protection: chemical industry, fuels, transportation
- Catalytic processes for pollutants destruction/elimination
- New catalysts and catalytic processes for organic synthesis and oil processing.
- New catalysts and catalytic processes for fine chemicals production.
- New catalysts and catalytic processes for fertiliser industry
- Catalyst deactivation
- Principally new catalysts and processes: catalytic combustion, gas sensors, fuel cells, photochemical catalysis, etc.
- Principles of combinatorial catalysis.
- Country presentation and general discussion.

PARTICIPATION

102 participants from Azerbaijan, Bulgaria, Denmark, France, Hungary, Italy, Macedonia, Poland, Romania, Russia, Slovakia, Spain, and Yugoslavia took part in this workshop.

KEYNOTE SPEAKERS

Lecturers from different countries were present and details are given in Table 1.

Table 1. List of Keynote Lecturers of the Workshop

No	KEYNOTE LECTURER	INSTITUTION	COUNTRY
1	M. Clerici	Eni Tecnologie S.p.A., Milan	Italy
2	V. Cortes-Corberan	Institute of Catalysis and Petrochemistry, CSIC, Madrid	Spain
3	A. Kiennemann	LERCSI ECPM, UMR 7515, Strasbourg	France
4	L. Petrov	Institute of Catalysis, Bulgarian Academy of Sciences, Sofia	Bulgaria
5	D. Sanfilippo	Snamprogetti S.p.A., Milan	Italy
6	H. Topsøe*	Haldor Topsøe A/S, Copenhagen	Denmark
7	F. Trifiro	Universita degli Studi di Bologna, Bologna	Italy

*1999–2000 European Federation of Catalysis Societies (EFCATS) Francois Gault Lecturer

Table 2. List of speakers of 30-min oral presentations

No	SPEAKER	INSTITUTION	COUNTRY
1	M. Caldararu	I. G. Murgulescu Institute of Physical Chemistry, Romanian Academy of Sciences, Bucharest	Romania
2	S. Damyanova	Institute of Catalysis, Bulgarian Academy of Sciences, Sofia	Bulgaria
3	S. Göbölös	Institute of Chemistry, Chemical Research Centre, Hungarian Academy of Sciences, Budapest	Hungary
4	D. Grošková	Slovak University of Technology, Faculty of Chemical Technology, Bratislava	Slovak Republic
5	L. Ilieva	Institute of Catalysis, Bulgarian Academy of Sciences, Sofia	Bulgaria
6	D. Kamenski	A. Zlatarov University, Burgas	Bulgaria
7	P. Kovacheva	Institute of Catalysis, Bulgarian Academy of Sciences, Sofia	Bulgaria
8	D. Panayotov	Institute of General and Inorganic Chemistry, Bulgarian Academy of Sciences, Sofia	Bulgaria
9	M. Yu. Sinev	Semenov Institute of Chemical Physics, Russian Academy of Sciences, Moscow	Russia
10	V. Vyslovskii	Institute of Inorganic and Physical Chemistry, Azerbaijan Academy of Sciences, Baku	Azerbaijan

PARTICIPANTS

Several forms and invitation letters were disseminated among most of the academic institutions, R&D institutes and industrial companies in the region of the following countries: Bulgaria, Czech Republic, Hungary, Latvia, Macedonia, Poland, Romania, Russia, Slovak Republic, Slovenia, Turkey, Ukraine, Yugoslavia. 102 participants representing 9 countries regularly attended the workshop. Participants' affiliations included universities (20.8%) and R&D centres (73.2%) and industry (6%).

Table 3. Participants according to countries

No	COUNTRY	NUMBER OF PARTICIPANTS
1	Azerbaijan	1
2	Bulgaria	79
3	Denmark	1
4	France	1
5	Hungary	1
6	Italy	3
7	Macedonia	2
8	Poland	3
9	Romania	3
10	Russia	1
11	Slovakia	1
12	Spain	1
13	Yugoslavia	5

The complete list of participants is attached (Appendix 6).

WORKSHOP MATERIALS

Each participant and lecturer was provided with a workshop package containing the following:

Abstracts of invited lectures, oral and poster presentations

Workshop program

List of participants with their mailing addresses

Pen and notebook

Identification badge

OPENING CEREMONY

The Opening Ceremony of the workshop was organised at the Auditorium of Institute of Catalysis, Bulgarian Academy of Sciences. The function was presided over by Prof. L. A. Petrov, Director of the Institute of Catalysis.

SOCIAL EVENTS

Lunches and dinners were organised for all participants of the Workshop. An excursion with a dinner was organised for foreign guests and Bulgarian speakers.

ASSESSMENT

Assessment of the workshop was performed by an optional questionnaire distributed to all participants. A summary of this assessment is given in Table 4. According to the result of this assessment the workshop was very successful and the organisation was excellent, most evaluations have been from very good to excellent.

All participants would recommend others to attend a similar activity.

Table 4. Summary of the questionnaire (%) based on 70 participants

A. Organisation

Item	Excellent	Very good	Good	Fair	No answer
2. Information process	37.7	42	17.3	1.5	1.5
3. Announcement and pre-course material	32	40.5	21.7	1.5	4.3
4. Scientific program	37.7	53.5	1.5		4.3
4.1 Applied lecture\Workshop	52.2	42	1.5		4.3
4.2 Small working groups	29	20.3	5.7		45
4.3 Case studies	29	21.7	4.3		45
4.4 Time spent by lecturers in class and after class on specific questions	33.3	39.1	4.4		23.2

Item	Balanced	Unbalanced	No answer
4.5 Students scientific knowledge	77	2.8	20.2

B. Duration of program

Item	Just right	Too long	Too short	No answer
1. Number of days	92.7		7.3	
2. Length of working days	52	45	1.5	1.5

C. Training facilities & hotel

Item	Excellent	Very good	Good	Fair	No answer
1. Lecture/Training rooms	53.6	30.4	8.7		7.3
2. Breaks/refreshments	43.5	33.3	17.4		5.8
3. Hotel accommodation	23.2	31.8	4.4		40.6
4. Meals at the hotel	37.7	37.7	10		14.6

Item	Excellent	Very good	Good	Fair	No answer
D. Organiser's response	68	29	1.5		1.5
E. Overall program organisation	66.6	30.4	1.5		1.5

F. Would you recommend to others to attend a similar activity in the future?

	Yes	Maybe	No
	100		

G. Evaluation of lectures and speakers

Item	Excellent	Very good	Good	Fair	No answer
1. Course material	43.5	31.8	14.5		10.2
2. Resident lecture presentation	42	36.2	14.4		7.4
3. International lecture presentation	63.7	24.6	4.3		7.4
4. Ability of lecturers to answer specific questions	58	30.4	4.2		7.4

POSSIBLE FOLLOW-UP

In concluding session, a general discussion based on country reports was held. It was noted that a main obstacle for effective R&D activity and co-operation with industry is very limited

funding of research projects by the different sources. The following conclusions were drawn:

- Prof. L. Petrov is going to co-ordinate the works on the establishment of a network on catalysis and cleaner technologies in Southeast Europe on which data provided by the participants in the workshop will be summarised.
- Distribution of information about second hand scientific equipment available in West European chemical companies and universities will be of help for all participants.
- A common will was expressed for organising in future more events supported by UNIDO dealing with different topics of catalysis.
- Contributions of key lecturers and country reports (distributed during the workshop as photocopies of presented transparencies) and poster abstracts will be finalised in the form of a Book of Proceedings.
- It is suggested that country reports of selected countries of Central and Eastern Europe are covering the following issues are prepared within the ICS-UNIDO W.P. 2001:
 - Hot spots/pollution from the industry
 - Obsolete technologies/needs for cleaner technologies (research capabilities/technology scale-up facilities)
 - Ongoing and planned research and industrial projects

CLOSING CEREMONY

Prof. F. Trifiro and Prof. L. Petrov expressed their satisfaction of the high scientific quality of presentations and activity of all participants.

Prof. L. Petrov expressed thanks to ICS-UNIDO for including the Workshop in its program and for financial support of the event.

Special thanks to Prof. Stanislav Miertus, Area Coordinator Pure and Applied Chemistry, ICS-UNIDO for his permanent attention and help to the local Organizing Committee.