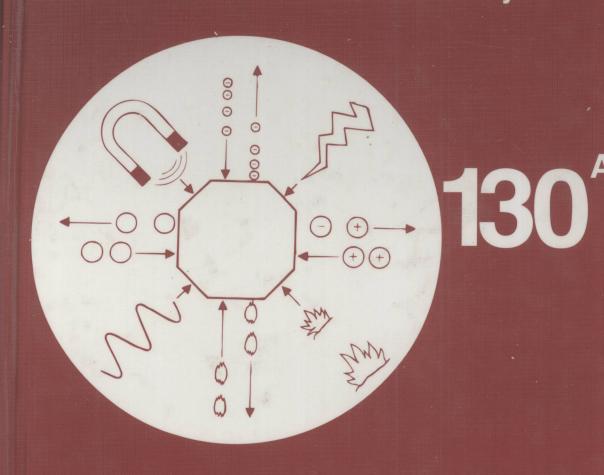
studies in surface science and catalysis



# 12th INTERNATIONAL CONGRESS ON CATALYSIS



A. Corma F.V. Melo S. Mendioroz J.L.G. Fierro (editors)

# Studies in Surface Science and Catalysis

Advisory Editors: B. Delmon and J.T. Yates

Vol. 130

# 12th INTERNATIONAL CONGRESS ON CATALYSIS

**PART A** 

Proceedings of the 12th ICC, Granada, Spain, July 9-14, 2000

**Editors** 

Avelino Corma Francisco V. Melo

Instituto de Tecnologia Química, UPV-CSIC, Avda. de los Naranjos s/n, 46022 - Valencia, Spain

Sagrario Mendioroz José Luis G. Fierro

Instituto de Catálisis y Petroleoquímica, CSIC, Campus UAM Cantoblanco, 28049- Madrid, Spain



2000 ELSEVIER

Amsterdam - Lausanne - New York - Oxford - Shannon - Singapore - Tokyo

ELSEVIER SCIENCE B.V. Sara Burgerhartstraat 25 P.O. Box 211, 1000 AE Amsterdam, The Netherlands

@ 2000 Elsevier Science B.V. All rights reserved.

This work is protected under copyright by Elsevier Science, and the following terms and conditions apply to its use:

#### Photocopying

Single photocopies of single chapters may be made for personal use as allowed by national copyright laws. Permission of the Publisher and payment of a fee is required for all other photocopying, including multiple or systematic copying, copying for advertising or promotional purposes, resale, and all forms of document delivery. Special rates are available for educational institutions that wish to make photocopies for non-profit educational classroom use.

Permissions may be sought directly from Elsevier Science Global Rights Department, PO Box 800, Oxford OX5 1DX, UK; phone: (+44) 1865 843830, fax: (+44) 1865 853333, e-mail: permissions@elsevier.co.uk. You may also contact Global Rights directly through Elsevier's home page (http://www.elsevier.nl), by selecting 'Obtaining Permissions'.

In the USA, users may clear permissions and make payments through the Copyright Clearance Center, Inc., 222 Rosewood Drive, Danvers, MA 01923, USA; phone: (978) 7508400, fax: (978) 7504744, and in the UK through the Copyright Licensing Agency Rapid Clearance Service (CLARCS), 90 Tottenham Court Road, London W1P 0LP, UK; phone: (+44) 171 631 5555; fax: (+44) 171 631 5500. Other countries may have a local reprographic rights agency for payments.

#### Derivative Works

Tables of contents may be reproduced for internal circulation, but permission of Elsevier Science is required for external resale or distribution of such material.

Permission of the Publisher is required for all other derivative works, including compilations and translations.

#### Electronic Storage or Usage

Permission of the Publisher is required to store or use electronically any material contained in this work, including any chapter or part of a chapter.

Except as outlined above, no part of this work may be reproduced, stored in a retrieval system or transmitted in any form or by any means, electronic, mechanical, photocopying, recording or otherwise, without prior written permission of the Publisher.

Address permissions requests to: Elsevier Science Global Rights Department, at the mail, fax and e-mail addresses noted above.

#### Notice

No responsibility is assumed by the Publisher for any injury and/or damage to persons or property as a matter of products liability, negligence or otherwise, or from any use or operation of any methods, products, instructions or ideas contained in the material herein. Because of rapid advances in the medical sciences, in particular, independent verification of diagnoses and drug dosages should be made.

First edition 2000

Library of Congress Cataloging-in-Publication Data

International Congress on Catalysis (12th: 2000: Granada, Spain)
12th International Congress on Catalysis: proceedings of the 12th ICC, Granada, Spain,
July 9-14, 2000 / editors Avelino Corma ... [et al.].-- 1st ed.
p. cm.
Includes index.
ISBN 0-444-50480-X (pt. A)
1. Catalysis--Congresses. I. Corma, Avelino, 1951- II. Title.

QD505 .I57 2000 541.3'95--dc21

00-032108

ISBN: 0 444 50480 X

The paper used in this publication meets the requirements of ANSI/NISO Z39.48-1992 (Permanence of Paper). Printed in The Netherlands.

#### **PREFACE**

The twelfth Congress on Catalysis was held in Granada (Spain) under the auspices of the International Association of Catalysis Societies and the Spanish Society of Catalysis. Those Proceedings are the expression of the Scientific Sessions which constituted the main body of the Congress.

They include 5 plenary lectures, 1 award lecture, 8 keynote lectures, 124 oral presentations and 495 posters. The oral and poster contributions have been selected on the basis of the reports of at least two international reviewers, according to standards comparable to those used for specialised journals, among 1045 two-page abstracts received from 53 countries. The submitted camera-ready manuscripts were then evaluated by the International Scientific Board. Fortunately, most of the corrected manuscripts were received in due course and have been included as such in the Proceedings; however, in a few exceptions, no answer was obtained from the authors; in those cases, a first version of the manuscript appears in the Proceedings. In order to accommodate all these contributions, the Congress was divided in four parallel sessions and three additional sessions in which all the posters were displayed. The management of this fantastic volume of work forced us to take several decisions. As the contributions are published prior to the meeting for distribution to all delegates who attend the Congress in Granada, no discussions at the meeting have been included. Besides this, for space reasons we were restricted to expand the works to only six-page text.

Financial contribution from the Ministry of Education and Culture, the National Council of Scientific Research, other local and national institutions or corporations, chemical, refining and petrochemical companies made it possible to balance the budget of the Congress. Allowance for young students to pay a reduced registration fee was also possible from this income.

We are grateful to the outstanding scientists, expert in different fields of catalysis, who accepted our invitation to overview vital research areas in plenary lectures, the 1998 awardee by his illustrative conference and the keynote lecturers that introduce the various topics of the sessions covered by the Congress. The Organisers are indebted to all the scientists who accepted our invitation to come to Spain and made this meeting another outstanding success in the 44 year tradition of this event. We hope everybody will enjoy the meeting and will find these Proceedings a useful book to be added to the catalysis library. We are also grateful to Drs. A. Jongejan, managing director, Dr. P.S. Jackson, publishing director, and specially to Drs. Huub Manten of Elsevier Science Publishers for the guidance and co-operation provided in getting these four volumes printed before the Congress.

Granada, July 2000

The Editors

#### LIST OF SPONSORS

(by May 17, 2000)

#### **PATRONS**

- 1- Ministerio de Ciencia y Tecnología (Spain)
- 2- Junta de Andalucía (Spain)
- 3- Ayuntamiento de Granada (Spain)
- 4- Consejo Superior de Investigaciones Científicas (Spain)
- 5- Universidad de Granada (Spain)

#### **DONORS**

- 6- CEPSA (Spain)
- 7- REPSOL YPF (Spain)
- 8- UOP (USA)
- 9- DEGUSSA HÜLS AG (Germany)
- 10-PROCATALYSE (France)
- 11-INSTITUT FRANÇAIS DU PETROLE (France)
- 12-ENGELHARD (The Netherlands)
- 13-NOVARTIS AG (Switzerland)
- 14- SHELL International Chemicals B.V.A. (The Netherlands)
- 15-BP AMOCO Chemicals Co. (UK)
- 16-CHEVRON (USA)
- 17-EXXON-MOBIL Research and Engineering (USA)
- 18-GRACE Co. (USA)
- 19-DSM Research (The Netherlands)
- 20-SÜD-CHEMIE Inc. (USA)

#### **EXHIBITORS**

- 21-HALDOR TOPSØE (Denmark)
- 22-SE Reactor, Inc. (USA)
- 23-ENGELHARD (Italy)
- 24- ACADEMIC PRESS, Inc. (USA)
- 25- VINDUM ENGINEERING, Inc. (USA)
- 26-PSR SOTELEM (The Netherlands)
- 27- SPRINGER-VERLAG Ibérica S.A. (Spain)
- 28- CHAMBERS HISPANIA S.L. (Spain)
- 29- JOHNSON MATTHEY (USA)
- 30-GENERAL ELECTRIC Plastics S.A. (Spain)
- 31-HIDEN ANALYTICAL (UK)
- 32-KAISER Optical Instruments Industries. (France)
- 33-THERMO QUEST CE Instruments (Italy)
- 34- AIR LIQUIDE S.A. (Spain)
- 35-IBERFLUID Instruments S.A. (Spain)
- 36- ARGONAUT Technologies AG (Switzerland)
- 37- IN-SITU Research Instruments (USA)
- 38- VINCI Technologies (France)
- 39-MEL Chemicals (UK)
- 40-ISCOA Inc. (USA)
- 41-CRI Katalema (UK)
- 42- PARR Instrument (Germany)
- 43-ELSEVIER SCIENCE (The Netherlands)

# TABLE OF CONTENTS

## PLENARY LECTURES

PL-1	. In Situ Character H. Topsøe .	rization of	Cataly.	sts						1
PL-2	. Pollution Abatem M. Iwamoto .	ent throug		rogene		talysis	for Pre	serving	Clean 2	<i>Air</i> 23
PL-3	. Molecular Design M.E. Davis .	of Hetero	ogeneoi	us Cata	alysts					49
PL-4	. Millisecond Chen L.D. Schmidt .	nical Reac	tions ar	nd Rea	ctors	500				61
PL-5.	Catalysis for Oil I Future Trends	Refining a	nd Petr	ochem	istry, R	ecent L	Develop	ments a	Ind	O1
	G. Martino .				٠			٠		83
	New Catalysis fro				FEREI					
	M. A. Barteau.						• ,,			105
		K	EYNO	TE LE	ECTUR	RES				
KN-1	From Unit Operat Multidisciplinary A M. Che	ions to Ele Approach	to Cata	y Proc lyst Pr	eparati	A Mole on	cular a	nd		115
KN-2	Acidity in Zeolite (R.A. van Santen ar	Catalysis nd F.J.M.N								127
KN-3	Engineered Solid ( Reactant System							lultipha	ısic	
KN-4	D.E. De Vos, B.F.  New Solid Acid Ba						5.		٠	137
	S.A. Gembicki		nrougn							147

KN-5	Application of Titanium Oxide Photocatalysts and Unique Second-Generation Photocatalysts able to Operate under Visible Light Irradiation for Reduction of Environmental Toxins on a Global Scale  M. Anpo		157
KN-6	Catalysis for Fine Chemicals: an Industrial Perspective P. Métivier		167
KN-7	Oxidative Methanol Reforming Reactions for the Production of Hydroge J.L.G. Fierro	n	177
KN-8	Supported Metallocenes: Monosite and Multisite Catalysts for Olefin Polimerization F. Ciardelli, A. Altomare and S. Bronco		187
	ORAL COMMUNICATIONS		
	Session A		
	<b>Preparation of Catalysts</b>		
A01	A New Method for Preparing Nanometer-size Perovskitic Catalysts for CH <sub>4</sub> Flameless Combustion R.A.M. Giacomuzzi, M. Portinari, I. Rossetti and L. Forni.	•	197
A02	Experimental Investigation and Modelling of Platinum Adsorption onto Ion-modified Silica and Alumina W. Spieker, J. Regalbuto, D. Rende, M. Bricker and Q. Chen .	•	203
A03	Nanocrystalline Thin Films as a Model System for Sulfated Zirconia F.C. Jentoff, A. Fischer, G. Weinberg, U. Wild and R. Schlögl	,	209
A04	Nanoparticle Arrays as Model Catalysts: Microstructure, Thermal Stabil and Reactivity of Pr/SiO <sub>2</sub> Fabricated by Electron Beam Lithography G. Rupprechter, A.S. Eppler, A. Avoyan and G.A. Somorjai .	ity	215
A05	Epoxidation of Olefins on M-SiO <sub>2</sub> (M=Ti, Fe, V) Catalysts with Highly Isolated Transition Metal Ions Prepared by Ion Beam Implantation Q. Yang, C. Li, S. Wang, J. Lu, P. Ying, Q. Xin, W. Shi		221
	Catalysis on Metals and Metal Oxides		
A06	Cyclohexane Ring Opening on Metal-Oxide Catalysts L.M. Kustov, T.V. Vasina, O.V. Masloboishchikova, E.G. Khelkovskaya-Sergeeva and P. Zeuthen		227

A07	Olefins from Chlorocarbons: Reactions of 1,2-Dichloroethane Catalyzed by Pt-Cu L. Vadlamannati, D. Luebke, V. Kovalchuk and J.L. d'Itri		233
A08	Artificial Control of Selectivity by Dynamic Lattice Displacement of Acoustic Wave Effects: Decomposition and Oxidation of Alcohol on Ag and Pd catalysts  N. Saito, H. Nishiyama, K. Sato and Y. Inoue		239
A09	The Effect of Hydrogen Concentration on Propyne Hydrogenation over a Carbon Supported Palladium Catalyst Studied under Continuous Flow Conditions  D. Lennon, R. Marshall, G. Webb and S.D. Jackson		245
	Refining and Petrochemistry		
A10	Suggestion of a New Alternative Mechanism of the Sulfuric Acid Catalyzed Isoparaffin-Olefin Alkylation V.B. Kazansky and T.V. Vasina	d	251
A11	Hydroisomerization of n-Decane in the Presence of Sulfur and Nitrogen L.B. Galperin .		257
A12	State of Metals in the Supported Bimetallic Pt-Pd/SO <sub>4</sub> <sup>2</sup> -ZrO <sub>2</sub> System A.V. Ivanov, A.Yu. Stakheev and L.M. Kustov		263
A13	Dehydroisomerization of n-Butane over Pt Promoted Ga-Substituted Silico-aluminophosphates A. Vieira, M.A. Tovar, C. Pfaff, P. Betancourt, B. Méndez, C.M. López,		
	F.J. Machado, J. Goldwasser and M.M. Ramírez de Agudelo		269
A14	Pore Mouth Catalysis over Acidic Zeolites. Nature of Active Species P. Magnoux, M. Guisnet and I. Ferino		275
A15	Rediscovery of the Paring Reaction: The Conversion of 1,2,4-Trimethyl-Benzene over HZSM5 at Elevated Temperature  H.P. Päger, M. Pähringer, V. P. Mäller, and G.T. O.G.		
<b>A</b> 16	H.P. Röger, M. Böhringer, K.P. Möller and C.T. O'Connor		281
110	SAPO-34 Catalyst for Dimethylether Production Gr. Pop and C. Theodorescu		287
A17	Catalytic Performances of Pillared Beidellites Compared to Ultrastable Y Zeolites in Hydrocracking and Hydroisomerization Reactions		
	J.A. Martens, E. Benazzi, J. Brendlé, S. Lacombe and R. le Dred		293

## **Catalyst Characterisation**

A18	Effect of Ni on K-Doped Molybdenum-on-Carbon Catalysts: Temperature-Programmed Reduction and Reactivity to Higher-Alcohol Formation E.L. Kugler, L. Feng, X. Li and D.B. Dadyburjor	299
A19	Quantitative Determination of the Number of Active Surface Sites and the Turnover Frequencies for Methanol Oxidation over Metal Oxide Catalysts L.E. Briand and I.E. Wachs	305
A20	Metal Particles on Oxide Surfaces: Structure and Adsorption Behaviour M. Bäumer, M. Frank, P. Kühnemuth, M. Heemeier, S. Stempel and HJ. Freund	311
A21	An Atomic XAFS Study of the Metal-Support Interaction in Pt/SiO <sub>2</sub> -Al <sub>2</sub> O <sub>3</sub> and Pt/MgO-Al <sub>2</sub> O <sub>3</sub> Catalysts: An Increase in Ionization Potential of Platinum with Increasing Electronegativity of the Support Oxygen Ions D.C. Konigsberger, M.K. Oudenhuijzen, D.E. Ramaker and J.T. Miller .	317
A22	Transition State and Diffusion Controlled Selectivity in Skeletal Isomerization of Olefins L. Domokos, M.C. Paganini, F. Meunier, K. Seshan and J.A. Lercher .	323
A23	Development and Application of 3-Dimensional Transmission Electron Microscopy (3D-TEM) for the Characterisation of Metal-Zeolite Catalyst Systems  A.J. Koster, U. Ziese, A.J. Verkleij, A.H. Janssen, J. de Graaf, J.W. Geus and K.P. de Jong	329
A24	Interrogative Kinetic Characterisation of Active Catalyst Sites Using TAP Pulse Experiment J.T. Gleaves, G.S. Yablonsky, S.O. Shekhtman and P. Phanawadee	335
A25	UV Resonance Raman Spectroscopic Identification of Transition Metal Ions Incorporated in the Framework of Molecular Sieves G. Xiong, C. Li, Z. Feng, J. Li, P. Ying, H. Li and Q. Xin	341
A26	Surface Mobility of Oxygen Species on Mixed-Oxides Supported Metals C. Descorme, Y. Madier, D. Duprez and T. Birchem	347
A27	$SO_2$ -Promoted Propane Oxidation over $Pt/Al_2O_3$ Catalysts A.F. Lee, K. Wilson and R.M. Lambert	353
A28	Selective Oxidation of Toluene to Benzaldehyde: Investigation of Structure-Reactivity Relationships by in situ-Methods  A. Brückner, U. Bentrup, A. Martin, J. Radnik, L. Wilde and GU. Wolf.	359

A29	Observation of Unstable Reaction Intermediate by Picosecond Tunable Infrared Laser Pulses K. Domen, K. Kusafuka, A. Bandara, M. Hara, J.N. Kondo, J. Kubota,	
	K. Onda, A. Wada and C. Hirose	365
A30	Conditions: Evidence from In-Situ EXAFS Spectroscopy	271
		371
A31	In Situ FT-IR Investigation of Hydrocarbon Reactions over Zeolite Based Bifunctional Catalysts M. Häghel, Ch. Klahar, A. Lesters and H. W.	
	M. Höchtl, Ch. Kleber, A. Jentys and H. Vinek	377
	Session B	
	Fischer-Tropsch Synthesis	
B01	A Steady State Isotopic Transient Kinetic Analysis of the Fischer-Tropsch Synthesis Reaction over a Cobalt-Based Catalyst H.A.J. van Dikj, J.H.B.J. Hoebink and J.C. Schouten	383
B02	Use of Membranes in Fischer-Tropsch Reactors R.L. Espinoza, E. du Toit, J. Santamaría, M. Menéndez, J. Coronas	363
	and S. Irusta	389
B03	Egg-Shell Catalyst for the Synthesis of Middle Distillates C. Galarraga, E. Peluso and H. de Lasa	395
	Application of Theoretical Methods to Catalysts	
B04	Computer Aided Design of Novel Heterogeneous Catalysts – A Combinatorial Computational Chemistry Approach K. Yajima, Y. Ueda, H. Tsuruya, T. Kanougi, Y. Oumi, S.S.C. Ammal,	
	S. Takami, M. Kubo and A. Miyamoto	401
B05	Applications of Density Functional Theory to Identify Reaction Pathways for Processes Occuring in Zeolites and on Dispersed Metal Oxides	
	J.A. Ryder, M.J. Rice, F. Gilardoni, A.K. Chakraborty and A.T. Bell	407
	Fuel Cells and Electrocatalysis	
B06	Electrocatalytic Synthesis of Ammonia at Atmospheric Pressure G. Marnellos, G. Karagiannakis, S. Zisekas and M. Stoukides	413
B07	Electrocatalysis at a Pt Electrode Surface in a Fuel Cell as Observed In Situ from Pt-H and Pt-O Shape Resonances and EXAFS Scattering in Pt L <sub>2,3</sub> XANES	
	D.E. Ramaker and W.E. O'Grady	419

B08	In situ Catalytic and Electrocatalytic Studies of Internal Reforming in Solid Oxide Fuel Cells Running on Natural Gas C.M. Finnerty, R.H. Cunningham and R.M. Ormerod	425
B09	Effectof Gd <sub>2</sub> O <sub>3</sub> Doping and Steam/Carbon Ratio on the Activity of Catalyst for Internal Steam Reforming in Molten Carbonate Fuel Cell Y.J. Shin, HD. Moon, TH. Lim and HI. Lee	431
	Reactor Engineering and Catalytic Processes	
B10	A Microstructured Catalytic Reactor/Heat Exchanger for the Controlled Catalytic Reaction between H <sub>2</sub> and O <sub>2</sub> M. Janicke, A. Holzwarth, M. Fichtner, K. Schubert and F. Schüth	437
B11	Catalytic Water Denitrification in Membrane Reactor O.M. Ilinitch, F.P. Cuperus, L.V. Nosova and E.N. Gribov	443
B12	Reactivity and Thermal Profile of Metahne Partial Oxidation ar Very Short Residence Time F. Basile, G. Fornasari, F. Trifiró and A. Vaccari	449
B13	Supercritical Synthesis of Dimethyl Carbonate from CO <sub>2</sub> and Methanol T. Zhao, Y. Han and Y. Sun	455
B14	A New Catalyst for an Old Process Driven by Environmental Issues L. Abrams, W.V. Cicha, L.E. Manzer and S. Subramoney	461
	Catalysis on Sulfides, Nitrides and Carbides	
B15	Mechanism of HDN over Mo and Nb-Mo Carbide Catalysts  V. Schwartz, V.L. Teixeira da Silva, J.G. Chen and S.T. Oyama	467
B16	In Situ Characterisation of Transition Metal Sulfide Catalysts by IR Probe Molecules Adsorption and Model Reactions G. Berhault, M. Lacroix, M. Breysse, F. Maugé and JC. Lavalley	473
B17	Comprehension of the Promoting Effect in the MCr <sub>2</sub> S <sub>4</sub> Mixed Sulfide Catalysts P. Afanasiev, A. Thiollier, P. Delichere and M. Vrinat	479
B18	Potassium at Catalytic Surfaces – Stability, Electronic Promotion and Excitation A. Kotarba, G. Adamski, Z. Sojka, S. Witowski and G. Djega-Mariadassou	485
		TO2

# Catalysis for Fine Chemical Synthesis

B19	Heterogeneous Catalysis of Aldolisations on Activated Hydrotalcites J. López, R. Jacquot and F. Figueras	491
B20	The Influence of Metal-Support Interactions During Liquid-Phase Hydrogenation of an α, β-Unsaturated Aldehyde over Pt U.K. Singh and M.A. Vannice	497
B21	Tailoring of Acido-basic Properties and Metallic Function in Catalysts Obtained from LDHs for the Hydrogenation of Nitriles and of α, β-Unsaturated Aldehydes D. Tichit, B. Coq, S. Ribet, R. Durand and F. Medina	503
B22	Chemical versus Enzymatic Catalysis for the Regioselective Synthesis of Sucrose Esters of Fatty Acids M. Ferrer, M.A. Cruces, F.J. Plou, E. Pastor, G. Fuentes, M. Bernabé, J.L. Parra and A. Ballesteros	509
B23	The Higly Selective Conversion of Toluene into 4-Nitrotoluene and 2,4-Dinitrotoluene Using Zeolite H-Beta D. Vassena, A. Kogelbauer and R. Prins	515
B24	Catalytic Asymmetric Heterogeneous Aziridination and Epoxidation of Alkenes using Modified Microporous and Mesoporous Materials G.J. Hutchings, C. Langham, P. Piaggio, S. Taylor, P. McMorn, D.J. Willock, D. Bethell, P.C. Bulman Page, C. Sly, F. Hancock and F. King	521
B25	Catalytic Hydrogenation of Nitriles to prim., sec. and tert. Amines over Supported Mono- and Bimetallic Catalysts YY. Huang and W.M.H. Sachtler	527
B26	Alkali Promoted Regio-Selective Hydrogenation of Styrene Oxide to β-Phenethyl Alcohol C.V. Rode, M.M. Telkar and R.V. Chaudhari	533
B27	Production of Fatty Alcohols by Heterogeneous Catalysis at Supercritical Single-Phase Conditions S. van den Hark, M. Härröd and P. Møller	539
B28	Regioselective Oxidation of Primary Hydroxyl Groups of Sugar and its Derivatives Using a New Catalytic System Mediated by TEMPO H. Kochkar, M. Morawietz and W.F. Hölderich	545
B29	Aspects of Regioselective Control in the Hydroformylation of Methyl Methacrylate with the in situ Formed (o-Thiomethylphenyl) diphenyl- phosphine Rhodium Complex	
	H.K. Reinius, R.H. Laitinen, A.O.I. Krause and J.T. Pursiainen	551

B30	Highly Efficient Synthesis of N,N-Dialkylformamides from Carbon Dioxide and Dialkylamines over Ruthenium-Silica Hybrid Gels, L. Schmid and A. Baiker	557
B31	Metal Complex Catalyzed Functionalization of Naturally Occurring Monoterpenes: Oxidation, Hydroformylation, Alkoxicarbonylation E.V. Gusevskaya, E.N. dos Santos, R. Augusti, A.O. Dias, P.A. Robles-Dutenhefner, C.M. Foca and H.J.V. Barros	563
	1.1.1. Rootes-Datementer, C.ivi. 1 oca and 11.3. v . Datios	303
	Session C	
	<b>Environmental Catalysis. Combustion VOCs</b>	
C01	Adsocat: Adsorption/Catalytic Combustion for VOC and Odour Control E. Kullavanijaya, D.L. Trimm and N.W. Cant	569
C02	Structure Sensitivity of the Hydrocarbon Combustion Reaction over Alumina-Supported Platinum Catalysts T.F. Garetto and C.R. Apesteguía	575
C03	Ceria-Zirconia-Supported Platinum Catalyst for Hydrocarbons Combustion: Low-Temperature Activity, Deactivation and Regeneration C. Bozo, E. Garbowski, N. Guilhaume and M. Primet	581
C04	Characterisation of a γ-MnO <sub>2</sub> Catalyst Used in VOC Abatement C. Lahousse, C. Cellier, B. Delmon and P. Grange	587
C05	New Alumina/Aluminium Monoliths for the Catalytic Elimination of VOCs	
	N. Burgos, M. Paulis, A. Gil, L.M. Gandía and M. Montes	593
C06	Hydrotalcite-Derived Catalysts for Removal of Nitrogen-Containing Volatil Organic Compounds  J. Haber, K. Bahranowski, J. Janas, R. Janik, T. Machej, L. Matachowski, A. Michalik, H. Sadowska and E.M. Serwicka	599
	Environmental Catalysis. NO <sub>x</sub>	
C07	Surface Catalytic Reactions Assisted by Gas Phase Molecules on Supported Co-ensemble Catalysts A. Yamaguchi, T. Shido, K. Asakura and Y. Iwasawa	605
C08	Fresh and Used $V_2O_5$ -WO $_3$ /Ti $O_2$ SCR EUROCAT Standard Catalyst: An European Collaborative Characterization	003
	J.C. Vedrine	611

			xvii
C09	Lean $NO_x$ Reduction over $Sn_{1-x}Zr_xO_2$ Solid Solutions J. Ma, Y. Zhu, J. Wei, X. Cai and Y. Xie		617
C10	Concentration Programmed Adsorption-Desorption / Surface Reaction Study of the SCR-DeNOx Reaction I. Nova, L. Lietti, E. Tronconi and P. Forzatti		623
C11	Bifunctional Nature of $SnO_2/\gamma$ - $Al_2O_3$ Catalysts in the Selective Reduction of $NO_x$ A. Yezerets, Y. Zheng, P.W. Park, M.C. Kung and H.H. Kung		629
C12	SO <sub>2</sub> Resistant Fe/ZSM-5 Catalyst for the Conversion of Nitrogen Oxides G. Centi, G. Grasso, F. Vanzzana and F. Arena		635
C13	Mechanistic Studies of the $NO_x$ Reduction by Hydrocarbons in Oxidative Atmosphere S. Schneider, S. Ringler, P. Girard, G. Maire, F. Garin and D. Bazin	•	641
C14	NO Reduction in Presence of Methane and Ethanol on $Pd$ -Mo/ $Al_2O_3$ Catalysts L.F. De Mello, M.A.S. Baldanza, F.B. Noronha and M. Schmal .		647
C15	Fe-Vanadyl Phosphates/TiO <sub>2</sub> as SCR Catalysts G. Bagnasco, P. Gilli, M.A. Larrubia, M.A. Massucci, P. Patrono, G. Ramis and M. Turco		653
	Photochemistry		
C16	Photoinduced Non-Oxidative Methane Coupling over Silica-Alumina H. Yoshida, Y. Kato and T. Hattori	*	659
C17	Photocatalytic Oxidation of Gaseous Toluene on Polycrystalline TiO <sub>2</sub> : FT-IR Investigation of Surface Reactivity of Different Types of Catalysts G. Martra, V. Augugliaro, S. Coluccia, E. García-López, V. Loddo, L. Marchese, L. Palmisano and M. Schiavello		665
C18	Investigation of Environmental Photocatalysis by Solid-State NMR Spectroscopy D. Raftery, S. Pilkenton, C.V. Rice, A. Pradhan, M. Macnaughtan, S. Klosek and T. Hou.		671
	C1 Chemistry		
C19	A Study of CH <sub>4</sub> Reforming by CO <sub>2</sub> and H <sub>2</sub> O on Ceria-Supported Pd S. Sharma, S. Hilaire and R.J. Gorte	•	677

C20	Catalytic Behaviour on Ni Containing Catalysts in Vaporeforming of Me with Low H <sub>2</sub> O/CH <sub>4</sub> Ratio and Free Carbon Deposition H. Provendier, C. Petit and A. Kiennemann	thane	683
C21	Carbon Deposition and Reaction Steps in CO <sub>2</sub> /CH <sub>4</sub> Reforming over Ni-La <sub>2</sub> O <sub>3</sub> /5A Catalyst J.Z. Luo, L.Z. Gao, Z.L. Yu and C.T. Au		689
C22	The Autothermal Partial Oxidation Kinetics of Methanol to Produce	•	009
	Hydrogen E. Newson, P. Mizsey, T. Truong and P. Hottinger		695
C23	New Reaction Mechanism for Methane Formation in CO Hydrogenation over Pd/CeO <sub>2</sub> S. Naito, S. Aida and T. Miyao		701
C24	Methane Coupling over SrCoO <sub>3</sub> -Based Perovskites in the Absence of Gas-Phase Oxygen		701
	Yu.I. Pyatnitsky, N.I. Ilchenko, L.Yu. Dolgikh and N.V. Pavlenko		707
C25	Novel Conception of the Methanol Synthesis Mechanism on Conventional Cu-Containing Catalysts G.I. Lin, K.P. Kotyaev and A.Ya. Rozovskii		713
C26	"Real" and "Inverse" Model Catalysts for Studies of Metal-Support Interactions: CO Hydrogenation on Titania and Vanadia Supported Rh W. Reichl and K. Hayek		719
	Environmental Catalysis. Catalysis for Clean Processes and Fuel	s	
C27	Agglomeration of Pt Particles and Potential Commercial Application for Selective Hydrodechlorination of CCl <sub>4</sub> Z.C. Zhang and B.C. Beard		725
C28	Catalytic Diesel Soot Elimination on Co-K/La <sub>2</sub> O <sub>3</sub> Catalysts: Reaction Mechanism and the Effect of NO Addition E.E. Miro, F. Ravelli, M.A. Ulla, L.M. Cornaglia and C.A. Querini		<b>5</b> 2.1
C29	Environmentally Benign Carbonylation of Nitrobenzene and Aniline		731
	S.S.C. Chuang, M.V. Konduru, Y. Chi and P. Toochinda		737
C30	Nitrous Oxide – Waste to Value A. K. Uriarte		743
C31	Catalytic Wet Peroxide Oxidation over Mixed (Al-Fe) Pillared Clays J. Barrault, C. Bouchoule, JM. Tatibouët, M. Abdellaoui, A. Majesté,		
	I. Louloudi, N. Papayannakos and N.H. Gangas		749