

Preface

This issue collects a selection of contributions presented at the First Conference of the European Union Co-ordination Action “Co-ordination of Nanostructured Catalytic Oxides Research and Development in Europe”: CONCORDE, that under the title “Understanding the dynamic and transient behaviour of oxide catalysts in working conditions and the relationships with their catalytic performances” was held at Louvain-la-Neuve (Belgium), January 26–28, 2005

1. Objectives of CONCORDE

The aim of CONCORDE is to improve the efficiency of the presently dispersed and disconnected research activities in the field of oxide catalysts and to accelerate their transfer to the European chemical industry to improve its competitiveness. The object of CONCORDE is to co-ordinate these activities on advanced metal oxide nanomaterials for catalytic applications on a true European scale, as a tool to boost the efficiency of the European research activities on these multifunctional materials *and on their application to reactions relevant for a sustainable and environmentally friendly chemistry and for environmental protection*. One final outcome of CONCORDE will be to prepare a roadmap for medium and long-term research to become a reference in the field.

The co-ordination of RTD activities of CONCORDE is focused on the major advanced topics of research on metal oxide catalysts, lumped in five main areas:

- Advanced preparation methodologies.
- New insight in the catalytic, structural and surface chemistry of metal oxides.
- Improve development and identification of new metal oxide catalysts.
- Improve catalytic performances and discover new applications.
- Catalytic reaction and catalyst preparation engineering.

2. The first CONCORDE conference

The conference was organised as part of the general program of workshops and conferences of CONCORDE. The objective of the conferences was to acquire and define the basic and

applied knowledge on dynamic and transient phenomena on oxide-based, metallic and mesoporous catalysts and nanostructures.

The conferences (three working days) was intended to offer an updating at the edge of the research on dynamic, transient and “in situ” or “at work” aspects in catalysts and their relation with catalytic activity, to improve specialisation and knowledge dissemination within and outside the Consortium. Participation was around 100 attendees from CONCORDE members and around 50 from outside the CONCORDE Consortium.

3. Scientific objectives

The scientific aim of the conference was to discuss questions on the following topics:

1. The role of surface oxygen, hydrogen or other species mobility.
2. Nano versus bulk oxide dynamic reconstruction of catalysts.
3. Nature and stability of intermediates.
4. Reactivity of surface species, the role of the nature and structure of the active sites at the nano-scale in the mechanisms and reaction kinetics.
5. Modification of kinetics by surface dynamic phenomena.
6. “In situ” and “operando” experiments to explain catalytic behaviours of catalysts under reaction conditions, etc.

Results highlighting these aspects in selective oxidation, oxidative dehydrogenation, ammoxidation and in general redox reactions such as catalytic combustion, reforming and selective oxidation to obtain hydrogen, etc., were considered.

The programme was focused on highlighting new directions and allowed a long time for discussion. Special care was given to give young researchers the opportunity to present results of their investigations. The programme consisted of 5 selected lectures, 4 keynote lectures, 26 oral presentations and 35 posters. Practically all the topics of the conference were debated: the origin of selectivity in partial oxidation reactions, the bulk oxygen mobility and its effect in oxidation reactions, the reactivity of different oxygen species, the dynamic aspects on oxidation reactions, the role of carbon dioxide as oxidant, the CO₂ dissociation, the relation between reactivity of surface

species, the structure–reactivity relationship, the electronic factor and related redox processes in oxide catalysts, the tuning of nanostructure under operandi conditions, the relation between structural dynamics, reaction conditions and catalytic performances, the kinetic modelling in oxidative gas phase conditions, kinetics of the reduction and reoxidation, the promotion effect acidic microporous on oxide catalysts, the effect of the nature of support on oxidation reactions, in situ operando experiments under catalytic reaction conditions using UV–vis microspectroscopy, DRIFTS, combined infrared/Raman and EPR spectroscopies, the nature of intermediates, the role of the reaction products in the stabilization of the catalytic sites, the organization of oxygen vacancies at the surface of sub-oxides under reducing working conditions, transient behaviour of dense membranes, micro-kinetics and mass transfer, surface reaction mechanisms by $^{16}\text{O}/^{18}\text{O}$ and H/D isotopic exchange, dynamic of adsorption-oxidation processes, real-time spectroscopic process control and reaction pathways mechanisms. Several catalysts systems were discussed: bulk or supported oxides (vanadia, molybdenum, niobia, manganese, tellurium, bismuth, zirconia, ceria, chromium, yttrium and titania), perovskites, zeolitic and mesoporous, microporous, hexaaluminates, noble metal, nitrides, etc. The Organising Committee of the Conference was formed by: Prof. F. Cavani (Italy), Dr. V. Cortés Corberán (Spain), Prof. E. Gaigneaux (Belgium), Prof. D. Kondarides (Greece), Dr. G. Mestl (Germany), Dr. J.M. Millet (France), Dr. S. Perathoner (Italy), Prof. P. Ruiz (Belgium) and Prof. X. Verykios (Greece).

Manuscripts were revised by two referees. The revised version was checked by the Guest editors.

We hope that the results of this conference will be a contribution to understand the nanometric aspects of the catalytic mechanisms of reaction and to confirm that oxide catalysts and catalysts in general have a fundamental, crucial

and determinant role to play for a sustainable and environmentally friendly development.

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