Preface

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The 7th Irsee Symposium entitled “New Insights in Selective Oxidation Catalysis, Electrocatalysis, and Catalysis of Biomass”, sponsored by the Robert Karl Grasselli Foundation, took place at the Schwäbisches Bildungszentrum in Irsee, Germany between 4 and 7 June 2015.

The main intent of the symposium was, as has by now become the custom of these meetings, to gather a small group of experts in the field of selective oxidation catalysis and related fields, and to provide for them a platform for discussion of their latest findings. Kloster Irsee serves as an ideal place for this event, providing an informal atmosphere with pleasant pastoral surroundings.

The scope of the symposium was expanded beyond selective oxidation catalysis to include electrocatalytic processes and biomass-based catalytic processes. The proceedings of the discussions are recorded in this special edition of Topics in Catalysis.

Selective oxidation catalysis is currently undergoing a fascinating renaissance; the concepts which led in the past to breakthrough technology rested on firm scientific ground in combination with ingenious intuition. These concepts are currently being confirmed theoretically and greatly improved with the aid of modern measuring techniques. Many of these new approaches are reflected in the

publications presented herein. One can expect that these advances will lead to new and improved catalytic systems and processes, and should therefore be nurtured.

A significant number of presentations dealt with further understanding of the MoVNbTeO_x catalyst, particularly the M1 phase, in the selective oxidation of propane to acrylic acid or ammoxidation to acrylonitrile, and oxydehydrogenation of ethane to ethylene. The structure of the M1 system is now quite well understood, based on diffraction, spectroscopic, and electron microscopic studies, and the reaction mechanistic consequences drawn therefrom are continually being updated and refined.

A new theoretical study of propane ammoxidation over the M1 phase provocatively proposes that it is the Te=O site that activates the paraffin by abstracting the first methylene hydrogen of propane, rather than the metal oxo-moiety, namely V⁵⁺=O, as has been generally agreed upon up to now. Time will tell if the new proposed mechanism will withstand the scrutiny of future mechanistic studies in this area.

Studies on the function of excess Nb in the M1 phase are discussed with emphasis on catalytic consequences derived therefrom. An in depth overview of the oxidation catalytic science is dissected and analyzed, and new insights are presented that may lead to further in-depth understanding of oxidative catalytic processes. New synthetic methods for synthesis of new complex oxide materials using structure-directing agents are presented. Several papers dealt with sophisticated instrumental techniques for characterizing oxidation catalysts.

On a more practical basis, mechanistic studies were undertaken to better understand the partial oxidation of (meth)acrolein to the corresponding carboxylic acids; other studies identified the optimum performing VPO catalyst for the oxidation of n-butane to maleic anhydride; process

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Participants of the Symposium on New Insights in Selective Oxidation Catalysis, Electrocatalysis and Catalysis of Biomass, 4–7 June 2015, Kloster Irsee, Germany. *Left to right—1st row:* Ferruccio Trifirò, William A. Goddard III, Anne M. Gaffney, Douglas J. Buttrey, Ive Hermans, Robert K. Grasselli, Eva-Maria Hauck-

Grasselli, Johannes A. Lercher, Manos Mavrikakis, Arne Andersson, Gabriele Centi. *2nd row:* Gerhard Mestl, Herbert Vogel, Peter Vernoux, Wataru Ueda, Jean-Marc M. Millet, Peter Strasser, Robert Schlögl, Fabrizio Cavani, Jose M. López Nieto

improvements in the oxidation of methanol to formaldehyde were also discussed.

Several papers dealt with the oxydehydrogenation of ethane to ethylene and propane to propylene. An intriguing new study was presented describing the effect of the location and distribution of Al sites in ZSM-5 on the formation of Cu-oxo clusters which govern the reaction path of methane to methanol reaction.

The symposium then shifted to presentations in the area of oxidative electrocatalysis and concluded with oxidative processes using biomass as feed materials. In particular, the production of acrylonitrile from glyoxal, glutamic acid, and 3-hydroxypropionic acid was reviewed. None of the

biomass-based acrylonitrile processes are competitive with the SOHIO propylene-based world-leading industrial process. Much work is needed in this area.

Experts from eight nations participated in our symposium at Kloster Irsee, Germany. We thank all of them for coming and for contributing to the free discussion and exchange of ideas on their interesting work so that we all became enriched from this experience and are sharing the proceedings in this special issue of Topics in Catalysis.

We thank also Dr. A.F. Volpe (RKG Foundation Comptroller) and Dr. J.D. Burrington (RKG Foundation Secretary) for their part in helping organize this successful symposium.