



Preface

The present edition of Catalysis Today continues the tradition of publishing the highlights from the International Conference on Structured Catalysts and Reactors (ICOSCAR), a tradition that was established at ICOSCAR-1 in 2001 [1] and later confirmed at ICOSCAR-2, held again in Delft in 2005 [2].

Spatially structured catalysts/reactors are in fact at the heart of two emerging paradigms of the future generation Chemical Engineering, namely process intensification and multiscale modeling.

The opportunities for process intensification offered by precise structuring of the reaction domain are already being actively explored in many different areas. Concerning the macro/meso-scale, it is now widely recognized, not only on a conceptual basis, that monoliths, foams and other structured reactors in general can ensure the degrees of freedom needed to optimize effectiveness and uniformity of intra- and inter-phase processes, as well as the related specific surface areas and driving forces, in comparison to conventional random systems [3]. This concept is nicely illustrated by a number of contributions to ICOSCAR-3 dealing with the application of structured catalysts to chemical processes, and particularly to energy-related processes: one keynote paper as well as two other presentations are focused on the enhancement of the critical heat transport in Fischer–Tropsch fixed-bed reactors by adoption of structured internals of various nature. Following early reports in the previous ICOSCAR edition [4], we can now clearly identify a growing interest in the potential associated with engineering the heat management in structured reactors. Novel proposals, including, e.g. the application of internally illuminated monoliths to the intensification of photo catalytic processes, are also among the highlights of the papers included in this edition of Catalysis Today.

Structuring the catalyst at the micro/nano-scale can be a valuable method to enhance the process efficiency and selectivity, too. This is also demonstrated herein by a number of contributions creatively addressing the development and the application of catalysts with optimized pore structures, so as to take proper advantage of the interplay of diffusion and reaction.

Consideration of the molecular scale brings us eventually to the stimulating aspect of the relationship between *structural* and *functional* features of catalysts and reactors. It is an emerging area, which is well represented herein by another keynote paper dealing with the development of zeolitic washcoats for micro-structured reactors, as well as by more papers focusing on the catalytic activation of structured supports and aiming at a rationalization of the so far largely empirical washcoating methods.

Moving to a second paradigm, analysis and design of structured catalysts/reactors appears to be more and more naturally associated with multiscale modeling. In this respect a growing topical subject of the contributions to ICOSCAR-3 is represented by mathematical modeling of structured catalysts for the after treatment of vehicle exhausts. Here, in fact, numerical simulation has become an essential factor in view of shortening development cycles and reducing development costs: however, the need to accurately capture demanding transients under highly variable conditions calls for the integration of detailed descriptions of the reaction kinetics, as faithful as possible to the catalytic mechanism, with careful accounts of mass/heat/momentum transport processes in the structured systems. Papers in this specific area, among others, illustrate sophisticated models of NOx traps devices and investigations of novel structured catalysts for the SCR–DeNOx process. Other papers give account of similar experimental and modeling studies of microstructured systems for catalytic combustion, fuel reforming and water–gas shift.

In summary, the content of this special issue confirms the broad interests and the inventiveness of the scientific and technical community working on structured catalysts and reactors. We are confident that the related activities herein reported will set the stage for even more significant findings and breakthroughs in the near future.

Finally, the guest editors wish to thank the authors who submitted manuscripts with such a short time frame, and all the catalyst scientists and engineers who contributed to the sessions of ICOSCAR-3.

References

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