

Heterogeneous Catalysis

The author's motivation for writing a textbook on heterogeneous catalysis was to provide the experience of a recognized expert for the young generation of chemists in a form that they would best appreciate, by making full use of the tools offered by the internet for learning and for literature work: Wikipedia, e-journals, searching into the past and towards the present, the rating of publications through citation indices, etc. A variety of student tasks requiring literature work on various topics is an integral part of the book, which makes its structure very open. An experienced teacher who might disagree with the author about details of emphasis can nevertheless use the book for a course with his or her own priorities. This is new and a real achievement. However, the book certainly reflects the author's teaching priorities, because it has to be useful also in the hands of less advanced tutors or of the students themselves.

The introduction to the book gives interesting insights into the history of heterogeneous catalysis, but is largely confined to just that—the description of catalysis as a kinetic phenomenon does not appear until page 52. Before that, the author deals with the basic principles of adsorption. The chapter on “How a Catalyst Works” gives an introductory treatment of the elementary processes of heterogeneous catalysis, followed by information about metal catalysts (supported and unsupported) and a short mention of oxide and sulfide catalysts. In the chapter on catalyst preparation, the author emphasizes the importance of porosity and particle size, introduces some important support materials, and describes how active agents can be deposited onto them. The preparation of bulk-phase catalysts is described and methods for the characterization of catalysts are treated in a very short section; here, even important techniques are rather mentioned than explained, instead, the reader is referred to other textbooks. Another chapter is devoted to laboratory reactors, their use to study the kinetics of catalytic reactions, to rate laws and important reaction mechanisms. In the chapter on catalytic reactors on the technical scale, the roles of mass and heat transfer under real conditions are explained as well. The book is completed by an overview of technical applications of heterogeneous catalysis. The text is written in a rather informal and pleasing style, further lightened by occasional personal reminiscences.

The book is specifically intended for undergraduate students. I come from an academic tradition in which the teaching of heterogeneous

catalysis to undergraduates has generally been limited to the basic concepts and important applications, whereas much of the kind of material contained in this book was reserved for advanced (postgraduate) courses. Therefore, I would feel uneasy with the manner of treatment of some topics: for example, discussing impregnation onto supports without paying attention to the isoelectric point, teaching about the Thiele modulus without reference to species balances, discussing catalysis by metals without explaining the importance of the electronic structure, the level of the d-band center, and the role of exposed sites, or explaining the Mars–van Krevelen mechanism without mentioning the importance of solid-state oxygen mobility. These simplifications may be appropriate in courses structured in ways nearer to those for which the book has been written, but they also define its readership.

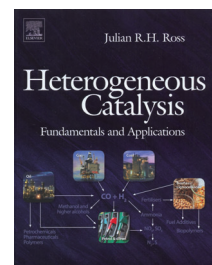
Unfortunately, this review cannot avoid mentioning that the excellent didactic quality of the text is marred by a considerable number of mistakes and ambiguities. As examples, this was the first textbook in which I read that ΔG is equal to $\Delta H + T\Delta S$, and that in equilibrium the ratio between the forward and reverse rates (not the rate constants!) is the equilibrium constant. I did not find a proper definition of the reaction rate for a heterogeneous reaction—if we use $(-dc_i/dt)$, how is the catalyst mass or surface taken into account? I did not find a clear differentiation between the concepts “rate” and “activity”: activity is rate at a particular temperature—the widely used term “low-temperature activity” is just nonsense, and analogous phrases should not appear in a textbook. At other places, the immediate switch between batch and continuous-tank reactor regimes (... just some more pipe-work?) might mislead the students with regard to the fundamentally different behavior of these reactors. Together with a significant number of typographical errors, these defects impair the value of this book, written by a highly respected colleague, especially to those for whom it is intended—the undergraduate students.

At this point it is time to ask the publisher why a thorough proofreading was apparently omitted, which should have removed most of the flaws that are now present. Also, the graphical layout of the text, which switches from block-justified to ragged margin, and vice versa, not just occasionally, but repeatedly through 217 pages of text, creates the impression that Elsevier did not devote even a minimum of care to this interesting and promising book project.

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