

Book Reviews

Soviet Research in Catalysis. Chemistry collection No. 3. Consultants Bureau, New York, 1958. 7 vols. 1672 pp. \$200.

This series of seven volumes has been compiled by the Consultant's Bureau from its translations of Russian articles on catalysis covering the period 1947 through 1955. The collection comprises 1672 pages (262 papers). All of the articles appear to have been taken from one or another of three Russian journals—the *Journal of Applied Chemistry (U.S.S.R.)*, the *Bulletin of the Academy of Sciences of the U.S.S.R.*, and the *Journal of General Chemistry (U.S.S.R.)*.

The seven volumes, for the most part, are restricted to heterogeneous catalysis; a few articles on homogeneous catalysis are also included. The subject matter extends all the way from basic theoretical papers on adsorption and catalysis through factual papers reporting experimental results and others giving interpretations and mechanisms. The topics covered are reduction, hydrogenation and dehydrogenation, Fischer-Tropsch synthesis, oxidation, dehydration, alkylation, isomerization, cracking, polymerization, Friedel-Crafts reactions, and Ziegler-type catalysts.

The quality of the articles ranges from excellent down to mediocre or poor. It is my impression that the quality is probably no better and no worse than that of a similar random selection from an eight-year collection of material on catalysis from the literature of other countries. There are, however, a few distinctly superior articles by workers who are respected throughout the world as leaders in their fields. Those interested in catalysis will welcome especially the English translations of such articles in the present series. Taken as a whole, the volumes constitute a very small sampling of the activities of those carrying on catalytic research in the Soviet Union over the period 1947 through 1955.

The individual volumes may be briefly summarized and characterized as follows.

Volume 1, *Theoretical and Sundry Associated Effects*. Fourteen of the papers cover the theory of adsorption and studies on the physical properties of

porous catalysts. Included are two excellent papers by Volkenshtein giving a nonmathematical summary of the beautiful work that he has published under the general title of "Electronic Processes in Chemisorption." Other articles in this general category consider the flow of gases through porous beds, measurements of surface area and pore distributions, kinetics of catalytic reactions involving diffusion into capillaries of solids, adsorptive properties of charcoal, capillary condensation, and examination of catalyst surfaces during reaction by means of the electron microscope.

Nine of the papers refer to the reduction rate and phase characteristics of silicotungstates, alkali tungstates, and alkali molybdates. The remaining articles cover the use of carbon-14 as a tracer, phosphorescence, and the theory of chromatography in the liquid phase on heterogeneous surfaces.

Volume 2, *General*. This volume is well named inasmuch as it covers topics in almost every field of catalysis. About 10 percent of the papers refer to basic aspects of adsorption, catalyst structure, and surface studies on catalysts. These include an excellent paper by N. P. Keier on the use of isotopes in studying the distribution of active centers on nickel catalysts. Approximately 30 percent of the papers refer to the decomposition and dehydrogenation of alcohols over copper and chromium oxide catalysts and to the dehydrogenation of branched cyclohexanes over platinum supported on carbon. Fifteen percent of the papers are concerned with the decomposition of aromatic and cyclic compounds over silica-alumina and clay-cracking catalysts. The subject matter of the remaining papers is divided about equally among catalytic oxidation, dehydration, amination, condensation, and polymerization.

Volume 3, *General*. This volume is even more general than volume 2. No more than 10 percent of the papers refer to any one particular field. The contributions are about equally divided among mechanism studies involving the use of deuterium or oxygen-18; hydrogenation and dehydrogenation; cracking or rearrangements on clay and silica-alumina; adsorption and catalyst structure; amination reactions and reactions in liquid am-

monia; oxidation; rearrangements over halide catalysts; polymerization and condensation; dehydration; and, finally, homogeneous catalytic reactions. One of the papers on the last-named subject was concerned with the accelerating effect produced by ethylene oxide on the thermal cracking of hydrocarbons; the other considered the mechanism of nitration catalyzed by mercury salts. In addition to these topics some of the papers presented miscellaneous special syntheses that can be carried out in the presence of solid catalysts.

Volume 4, *General, Reduction, Oxidation, Fischer-Tropsch*. Sixty percent of the papers in this volume are in the "General" category. They include discussion of the use of alumina-silica catalysts for the decomposition and transformation of various compounds containing sulfur and nitrogen; halogenation reactions and reactions catalyzed by BF_3 ; ketone synthesis from alcohols and acids; and amination reactions involving either ammonia or aniline as reactants. One of the more interesting papers is by Roginsky; it considers, from the standpoint of the electronic structure of solids, the catalytic decomposition of hydrogen peroxide on various oxides.

Two papers under the heading "Reductions" refer to reduction of hydrocarbons containing conjugated double bonds by sodium in liquid ammonia.

The eight papers on catalytic oxidation include a paper by Roginsky and his coworkers on the catalytic oxidation of olefins over silver and vanadium pentoxide. Five papers by Margolis seem to be basic oxidation papers; they include a detailed consideration of the additions of impurities or "modifiers" on the temperature coefficient, the kinetics, and the mechanisms of catalytic oxidation over standard partial oxidation catalysts.

Three of the Fischer-Tropsch papers cover the condensation of carbon monoxide with cyclohexene, methyl propene, propylene, or normal butene. These three papers are by one of the well-known experts in this field, Ya Y. Eidus. Unfortunately the catalysts used are given only by numbers. The remaining paper relates to some hydrocarbon synthesis studies in which alcohols were added in order to explore the part that they might play in the synthesis reactions over iron and cobalt.

Volume 5, *Hydrogenation, Dehydrogenation, Cracking*. The papers on hydrogenation and dehydrogenation are about equally divided among those relating to the mechanism and theory of catalytic hydrogenation or dehydrogenation and those containing factual results for particular systems subjected to either hydrogenation or dehydrogenation. About one-third of the papers contain discussions of hydrogenation or

dehydrogenation of aromatic or six-membered rings. Another large fraction includes a study of the catalytic hydrogenation of systems containing conjugated double bonds and systems in which the preferential hydrogenation of triple bonds with respect to the hydrogenation of other groups is of interest. Keier gives an excellent discussion of the adsorption centers on nickel catalysts for the hydrogenation of acetylene. Eidus contributes one of the few discussions that has been published on the mechanism of isosynthesis.

Only two of the ten papers on cracking cover what one might call basic work. Most of them give only factual accounts of catalytic cracking over silica-alumina, clay, or aluminum chloride catalysts.

Volume 6, *Isomerization, Alkylation, Dehydration*. The 20 papers on isomerization are about equally divided among factual papers and those which include both data and a discussion of possible mechanisms and theories. Reactants include the terpenes, paraffins, olefins, and five- and six-membered rings. Catalysts studied include silica gel, clays, chromia-alumina catalysts, AlCl_3 , and titanate acid. One interesting reaction was the isomerization of 1,2-hexadiene into mono- and di-substituted acetylenes.

The alkylation reactions were concerned mostly with the alkylation of various aromatic compounds with olefins and alcohols. Several papers discuss the adding of alkyl groups to ammonia and other nitrogen-containing compounds. Magnesium oxide was especially active for these latter reactions. The other alkylation catalysts were rather standard ones; they included silica-alumina catalysts, phosphoric acid, BF_3 compounds, AlCl_3 , and $\text{HSO}_4\text{-AlCl}_2$.

About one-half of the 11 papers on catalytic dehydration were by Y. A. Gorin and his colleagues and were concerned with the study of the Lebedev catalyst for converting alcohols into dienes having twice as many carbon atoms as the alcohols. Other dehydrations of alcohols and of formic acid were studied over typical catalysts, including silica gel, clay, alumina, and sulfuric acid. Several dehydrations in which gaseous H_2S and ammonia molecules help to effect dehydration were studied.

Volume 7, *Polymerization, Friedel-Crafts, Ziegler*. This is the shortest of all the volumes and contains three papers on polymerization, 16 on Friedel-Crafts reactions, and four that are classed under the title "Ziegler." The condensation of styrene oxide and ammonia over aluminum oxide, the dimerization of isobutene over quartz at low pressure, and the polymerization of oleic acid over BF_3 and phosphoric acid are the topics covered in the polymerization section. The Friedel-Crafts papers include four or five which

deal exclusively with the mechanism of the action of aluminum chloride in such reactions. Other catalysts that are discussed include zinc chloride, antimony chloride, and ferric chloride. The four papers that are classed as "Ziegler" do not, in fact, contain any reference to the work of Ziegler. Two of them refer to the preparation of trichloroalkoxytitanes and trialkoxytitanium chloride. The other two are concerned, respectively, with the polymerization of styrene over ferric chloride and stannic chloride catalysts and the formation of various organoantimony compounds.

In conclusion, a few remarks should be made in regard to some of the important aspects of catalysis that are not included in this series. In no sense does this collection represent a treatise on the general subject of catalysis. Vast areas are completely omitted. For example, no mention is made of the catalytic synthesis of ammonia, the synthesis of methanol, the catalytic oxidation of ammonia, or the synthesis of higher alcohols. Furthermore, one of the most basic topics in the theory of catalysis, the influence of the electronic structure of solids on the catalytic activity, is hardly mentioned, in spite of the fact that this topic has been uppermost in the catalytic literature since about 1949.

It seems evident, in view of what has been said above, that the present series will be useful chiefly for reference to specific types of work that are treated in some detail and that it is not a comprehensive survey of the basic ideas of catalysis or their general application.

The books are paper-bound and rather fragile. The printing is satisfactory, but a few of the drawings and diagrams are a little difficult to read.

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Marine Ecology. Hilary B. Moore. Wiley, New York; Chapman and Hall, London, 1958. xi + 493 pp. Illus. \$9.50.

Since the publication of James Johnstone's *Conditions of Life in the Sea* in 1908, there has been no single-volume exposition of marine ecology in English. Ecologists have nevertheless been busy these last 50 years, and a fantastically large literature has accumulated. It is a brave man who attempts to summarize this single-handedly, and Hilary Moore has in effect disarmed his critics in advance by pointing out that his book is a summary of his own specialized field in marine ecology, and by urging, in his concluding statement, other specialists to go and do likewise. Let us hope, then,

that other publishers will not consider that this book has exhausted the field.

Moore is primarily an autecologist, and this book concerns the basic environmental factors of the sea and the natural histories of individual marine organisms. The opening sections deal with physical, chemical, and biological factors. These are followed by sections on the various marine habitats (including estuaries), and then there is a similar arrangement of sections on the organisms of the various habitats. A useful innovation is the classified list of genera, keyed to the index, which makes it possible for the reader to find the major classification of some 403 generic names without seeking them out in monographs.

Moore considers that only a very few basic principles of ecology have been established, and that an attempt to apply these to the sea would be to some extent misleading. Hence he does not discuss such matters as the theory of communities or of the ecosystem but addresses himself to "the needs of the student in the field." Some may feel that discussions of sampling techniques and statistics, or at least some indication of source material on these subjects, would enhance the use of the book for field workers. Others will feel that for formal instructional purposes it will be necessary to assign further readings on ecological theory in other works. The term *climax*, for example, is introduced without discussion.

In his fields of competence—the critical natural history of marine organisms and plankton—Moore has produced a book that will be widely useful, especially to workers who are not as familiar with the literature of northern Atlantic species and conditions (which constitutes the major part of the literature summarized) as they may be with that of their own regions. It is particularly useful to have the major aspects of the fisheries literature treated, since this is, after all, one of the principal branches of marine ecology. The sections dealing with intertidal and pelagic organisms are especially rich in illustrative examples, and throughout the book there is a nice balance between discussion of the complexities of interrelationships and simplification by examples, but that on coral reefs, like all such short treatments, does not do the subject justice. Chemical factors are treated rather skimpily, but adequate summaries may be found elsewhere (as the author indicates). The chemical cycles of the sea, to which Johnstone devoted some attention in his pioneer work, are not considered in detail here—another indication, perhaps, of how much more complex marine ecology has become in the past 50 years. As it is, there is a surprising amount of information in this comparatively short book, and all workers in marine biology will find it in-