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Book Review

Proceedings of the Third International Congress on Catalysis. Edited by W. M. H. Sachtler, G. C. A. Schuit and P. Zwietering. North-Holland Publishing Co., Amsterdam, 1965. 2 Vols., xxii + 1445 pp. Price f.160.-; £16.-,-.

These two volumes record the 95 papers and six plenary lectures presented at the third of these quadrennial congresses when the committee perforce restricted contributions to "The Mechanism of Heterogeneous Catalysis," especially molecular descriptions (79 papers) and selectivity (16). In these decades of "big science" such assemblies and publications are not only inevitable but necessary to crystallize and communicate current attitudes. A lecture by Dr. H. Hoog stresses the great importance of the catalytic process, present and potential, to "big industry" and thus ultimately to modern life; 33 papers have at least one author from an industrial laboratory, and there was a large industrial audience, but none of the contributions is of pedestrian technological character.

Homogeneous chemistry is eschewed but its spirit stalks these solid pages and materializes only in the substantial figures of Prof. R. S. Nyholm ("Structure and Reactivity of Transition Metal Complexes") and Prof. J. Halpern ("Developments in Homogeneous Catalysis"). Predictably, the majority of the papers is divided about equally between researches on the properties of metal, transitional metal oxide, and acidic oxide catalysts. There is relatively little about basic oxides, sulfides, halides, Ziegler-Natta-Phillips catalysts or multifunctional contacts of the metal–acidic oxide type; this reflects the scarcity of truly basic investigations into the less used or complex systems.

Acidic oxides, because of their fundamental and practical importance, receive much attention in both their ground and irradiated states for features which are typical (Lewis and Bronsted acidity) and atypical (redox activity). In this context the zeolites (three papers and lively discussions) emerge as species whose properties may illuminate the still-vexing questions—"Lewis and (or) Bronsted acid?"; "Polarization, proton shift, or electron transfer?"

The papers on semiconducting oxides are still sharply divided between those dealing only with the solid and its surface and those dealing with the catalyzed reaction. The few exceptions make extensive use of optical and microwave spectroscopy which are now almost essential and tending to oust the less penetrating techniques (e.g., electrical conductivity). Indeed, not only the techniques (Prof. V. V. Voevodsky "Applications of ESR in Heterogeneous Catalysis") but also the descriptions and theories of modern chemistry have a marked influence, especially in the reports which point to the existence of chemisorbed allylic residues in olefin oxidations and to the presence of particular valency states in chromia dehydrogenation catalysts and in oxide catalysts for olefin polymerization (Cr, Mo). The older style of rough correlation (related to Balandin's "volcano" plots), between catalytic activity and bond strength (e.g., between oxidation activity, or selectivity, and metal–oxygen bond strength), gains a further measure of support; one may have reservations about the ultimate significance of this approach but there can be no doubt of its practical value in catalyst design.

Despite the impressive collection of papers on metal catalysts, there are no revelations, rather a few more pieces for the jig-saw puzzle. Catalysis at the molecular level remains obscure but the clouds are thinning and something like coordination chemistry is showing through; this is evident from Erlich's lecture ("Chemisorption on Solids") and from the allusions and references to complexes as intermediates in the reactions of unsaturated hydrocarbons with hydrogen.

This accumulated effort should lead to adequate procedures for catalyst design and Prof. G. C. Boreskov ("Theoretical Bases of Selection, Preparation and Use of Industrial Catalysts") makes a move in this direction, although practitioners may still bogle at the gap between themselves and the theorist.

These volumes are for the sophomore rather than the freshman but their contents bring the assiduous reader right to the frontiers of our present understanding.

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