

BOOK REVIEWS

CHEMICALS FROM OIL

The Petroleum Chemicals Industry

By Richard Frank Goldstein and A. Lawrence Waddams. Third, revised and enlarged edition. (Spon's General and Industrial Chemistry Series.) Pp. xiv + 523. (London: E. and F. N. Spon, Ltd., 1967.) 120s. net.

THE transformations of the hydrocarbons contained in petroleum and natural gas are now the main processes in the chemical industry, in so far as carbon compounds are concerned. Whilst animal and vegetable natural products, such as the fats and waxes, are still important, and coal is still more so, yet the trend to the oil source is unmistakable. Mineral oil, already in a dominant position, is conquering more and more territory at an accelerating rate of progress. A surprising example of this is the extent to which the newer plants for the production of town and industrial gas are based on oil rather than on coal.

A petrochemicals factory has a general aspect similar to that of a petroleum refinery; a conglomeration of tall, relatively narrow towers, pipes, and boilers. The reason is that the operations are similar; petroleum refining involves tailoring the crude oil by fractionation, treatments by heat alone, or over catalysts and by use of physical methods of separation. A number of chemical changes are brought about by synthesis or degradation.

The marvellous alchemy of petrochemical productions approaches nearer and nearer the ideal simplicity cum complexity of the refinery. As progress is made, more and more of the processes can be operated continuously on a very large scale, and apart from catalysts the chemicals introduced are only air and water. Temperature and pressure are the chief variables.

As one illustration, among many possible, phenol (carbolic acid) used to be made (probably still is made in some localities) from coal-tar benzene (benzole) by reaction with sulphuric acid followed by treatment of the product with caustic soda and isolation after dilution with water and acidification. All this involved considerable handling. Nowadays, there are two processes dependent on oxidation of hydrocarbons, available from petroleum. They are summarized as: benzene + propylene \rightarrow isopropylbenzene, which + $O_2 \rightarrow$ hydroperoxide \rightarrow phenol + acetone, and toluene by oxidation \rightarrow benzoic acid \rightarrow copper salt, and by oxidation \rightarrow phenol.

The earlier editions of this book have gained an enviable reputation as the best available account of the processes used in the petrochemicals industry, and this new and considerably revised and augmented edition will be esteemed still more highly. In fact, it can safely be claimed to be the most complete and authoritative general account of the subject that is anywhere available.

The coverage extends to early 1966 and hence a number of quite new topics have been introduced. In addition, the older material has been carefully sifted and many new developments have been noted, and yet, by careful attention to what is really essential, the size of the book has been kept within such limits that it may be read with pleasure and not used exclusively as a work of reference. On the other hand, it does function successfully in this latter capacity and will be frequently consulted, especially by technologists and planners.

The fundamental basis of the book is a description of the chemistry of processes used in the industry and of the

conditions in which they may be carried out. The chemical engineering involved is not treated except for some very general implications; a few flow-diagrams are included. A chapter on chemical by-products from petroleum refining lies a little outside those based on the main chemical classification, and so does another dealing with economics and statistics.

This book, because it illuminates a whole, relatively new field of chemistry, should be studied by advanced students and research workers in universities. It will be found indispensable to those actually working in the petrochemicals industry.

R. ROBINSON

INTRODUCING LUNAR GEOLOGY

The Craters of the Moon

An Observational Approach. By Patrick Moore and Peter J. Cattermole. Pp. 160 + 16 plates. (London: Lutterworth Press, 1967.) 35s. net.

THIS book presents the results of the interpretation, by an astronomer and a geologist, of observations of the lunar surface. It is the latest addition to the discordant serious literature in this field, for the authors conclude that virtually all features of the surface result from endogenic processes. This is not too surprising; since Baldwin, in his book *The Face of the Moon*, established both the modern form of the impact theory of lunar surface formation and the current wave of controversy, interest in this problem has been growing, and the importance of internal activity is at last being widely recognized by all lunar specialists. The essentially new suggestion here is that the origin, as well as the subsequent shaping, of most of the surface features is caused by volcanic activity.

After a brief enumeration of the main types of surface feature the authors give a historical summary of the theories of crater origin. In order to justify their view that internal processes predominate they summarize, in the next two chapters, the geological principles and types of terrestrial volcanic structure to which they need to refer; here it is, perhaps, a pity that references to standard texts on geological principles are not more in evidence.

Turning again to the Moon, a short chapter is devoted to an interesting discussion of processes neither volcanic nor meteoritic which have been advanced to explain various features. There follows a concerted and well planned attack on the weak points of the impact theory, together with a discussion of the development of volcanic theories which lead the authors to the conclusion that no violent processes can be involved for the formation of the larger lunar features, and that some kind of relatively gentle internal activity must be postulated. This idea is justified by the comparison of selected lunar features with corresponding terrestrial ones, and good analogies are found in most cases, an exception being that of the "bowl" craters; here the authors prefer to think in vague terms of "... a type of vulcanism rather different from any that we have encountered on Earth", rather than attribute these craters to any other source.

Next, an indication of the lunar surface materials that may be present assuming volcanic processes is given; here also more references might usefully have been given to sources of information on the techniques of investigating the lunar surface by measuring its physical properties from the Earth.

After a consideration of the possibility that there is still some activity on the surface, the now less controversial subjects of lunar tectonics, deformations and the grid system are presented; this part of the book also describes the particular properties of the mare floors and mountainous regions. A chapter on the ray systems deals first with the inconsistencies of impact theories and then