I think the author had the responsibility to discuss the real health hazards and provide the young and inexperienced reader for whom this book is intended with a balanced respect for the dangers of ionizing radiations. Reference should have been made at least to the publication of the Ministry of Labour *Code of Practice, for the Protection of Persons Exposed to Ionizing Radiations in Research and Teaching* (HMSO, 1968) and to *Recommendations of the International Commission on Radiological Protection* (Pergamon Press). These publications are the basis for present day legislation which is being put into force all over the world.

The rest of the book comes up to the standards expected, with numerous examples of radioactive tracer applications in both academic and industrial chemistry. The choice of the examples is a difficult task and depends clearly on the interests of the author. Topics have been selected, so it seems, on the basis of curriculae for the teaching of chemistry, and consequently this monograph is of value to undergraduates. I doubt whether many graduates wishing to enter the field will use this monograph, because each of the many topics is discussed only very briefly and a graduate interested in tracer techniques is amply served by the literature of his own specialty which no doubt provides him with plenty of appropriate examples of tracer techniques.

Three valuable appendices cover the important properties of commonly used nuclides. M. EBERT

IRRADIATED FUELS

Irradiation Effects in Nuclear Fuels

By J. A. L. Robertson. (Prepared under the direction of the American Nuclear Society for the Division of Technical Information, US Atomic Energy Commission.) Pp. x+309. (Gordon and Breach: New York and London, 1969.) n.p.

THE irradiation effects in nuclear fuels is a subject on which few books have been written. The present monograph is easily read and covers many of the phenomena in irradiated fuels. A wide range of fuels are considered, including those likely to be used in future power reactor systems.

The subject is introduced by a description of the requirements of a nuclear fuel. The mechanisms of irradiation damage and experimental measurements of burn-up are also described. The units used for burn-up depend on whether a reactor physicist or designer is involved and, because no single unit is universally accepted, a table of burn-up conversion factors is given for clarity. Points with any ambiguity are discussed in a similar manner and numbers are put into equations at appropriate places to give explicit meaning to the text.

The second section deals with uranium and plutonium-rich alloys. The topics discussed in this section include dimensional stability of fuels, irradiation growth, creep, swelling and phase changes. The effects of alloying additions, such as molybdenum, to reduce some of the undesirable results of irradiation are described in some detail together with physical, mechanical, metallurgical and corrosion properties of fuels. Thumb-nail sketches are used to amplify the text in appropriate places such as in describing equilibrium diagrams. These are particularly good in a book intended for engineers because engineers tend to discuss problems in this way.

One of the most common reactor fuels in use today is uranium oxide. The author devotes one third of the book to this type of fuel, and designers of present day reactor systems will find this section particularly useful because of the large amount of quantitative as well as qualitative information presented. The description of the effects of irradiation on oxide fuels was treated in a similar manner to that given in the previous section. Discussion on physical properties and fabrication methods of irradiated fuels has been kept to a minimum. Mixed oxide fuels are mentioned including ThO_2–UO_2 and, for the fast reactor engineers, PuO_2 UO_2 fuels.

Another very common type of reactor fuel in present day use is the carbide fuel. Uranium carbide is treated in some detail and frequent comparisons of properties and irradiation effects are made with uranium oxide. Also discussed are other fissionable compounds such as uranium nitride, sulphide and silicides.

The final section is devoted to dilute and dispersion fuels. Fuels for future reactor systems are described such as cermet fuels which could be suitable for marine reactors or fast reactor cores. Coated particle fuels of the type now being considered for British high temperature gas cooled reactors are described.

The general conclusion is that most fuels have qualitative similarities but the real differences are quantitative. C. B. BESANT

DITERPENE CHEMISTRY

The Tetracyclic Diterpenes

By J. R. Hanson. (International Series of Monographs in Organic Chemistry, Vol. 9.) Pp. vii+133. (Pergamon Press: London and New York, November 1968.) 60*s*.

THIS volume fulfils a much needed gap in the literature of the diterpenoids. The brief introduction is followed by an account of the kaurene-phyllocladene diterpenoids, and then a most useful chapter on the gibberellins. A short summary of the chemistry of the stachene diterpenes comes next. The following two chapters summarize the diterpenoid and aconite alkaloids. The final chapters discuss the synthesis and biosynthesis of the tetracyclic diterpenoids. A most useful appendix is included which lists the main physical constants of naturally occurring diterpenes. The book provides a much felt need in the literature of diterpene chemistry because it is now almost twenty years since any review in depth has appeared, the last edition of Simonsen summarizing the group having appeared in 1951, and the review of de Mayo, 1959, covers certain aspects of this field. The author is an active worker in the diterpenoid field, and the monograph bears the stamp of authority and will be a welcome addition to the library shelves, not only of terpenoid chemistry, but also of those who desire an authoritative account of this group of compounds. J. F. MCGHIE

Correspondence

Moon Dust and Coal Ash

SIR,—The similarity of the description of moon dust particles and that of pulverized coal ash (pfa) has not been missed by Messrs Hart and Raask (*Nature*, 223, 763; 1969). Earlier studies[1-3] have provided a classification of the various types of pfa particles in terms of chemical composition, size, density and the parent coal minerals from which they are derived. Certainly, glassy microspheres predominate in ashes characteristic of high boiler firing temperatures, but essentially their composition is the same as that of the thin-walled cenospheres. Both types of particle and indeed a whole range of silicate particles intermediate in form are derived from the major clay minerals in coal. The essential differences in this range are density (related to proportion of entrapped gases) and in degree of crystallinity (microcrystals of