

Part 2, on "Tracking and Communication", includes a detailed description of the 'Microlock' radio instrumentation system for satellites. The third section, on the environment of a space vehicle, has several expert surveys of particular topics, such as F. L. Whipple's paper on the "Meteoric Risk to Space Vehicles" and H. V. Neher's terse  $1\frac{1}{2}$  pages on cosmic rays. In Part 4 the possible propulsion systems for space travel are fully discussed. Part 5 is devoted to orbits, and includes a 39-page paper by H. Oberth, on "A Precise Attitude Control for Artificial Satellites". Part 6 is entitled "Human Factors", and covers space medicine and legal problems.

The individual papers in the volume differ greatly in their length, tone, technicality and worth. The book can be recommended for its many good technical papers, most of which have stood the test of time well; but there are a few half-page contributions which scarcely deserve permanent reproduction in book form, and the frontispiece, a full-page photograph of the brigadier-general commanding the Air Force Office of Scientific Research, seems rather out of place in a technical book. D. G. KING-HELE

## EXPLOSIONS IN SOLIDS

### Fast Reactions in Solids

By F. P. Bowden and A. D. Yoffe. Pp. ix+164. (London: Butterworths Scientific Publications; New York: Academic Press, Inc., 1958.) 40s.; 7 dollars.

THIS book is a sequel to the authors' earlier (1952) monograph "The Initiation and Growth of Explosion in Liquids and Solids". It deals with subsequent work on the same problems and more particularly with the mechanism by which a crystalline explosive decomposes when subjected to heat, light shock or nuclear radiation. Like its predecessor, the book does not attempt to give a comprehensive treatment of the whole field but rather to focus attention on salient developments in the study of explosives and especially on those areas to which the work of the authors and their colleagues has contributed. In this it is most successful and it is a stimulating and attractive volume.

Chapter 1 is a brief (4 pages) introduction and sketches the plan of the book. Chapter 2, which gives an account (13 pages) of the slow decomposition of crystals, is based mainly on silver azide. Chapter 3 is longer (25 pages) and more diversified. Under the general title of thermal explosions it gathers a varied, though not always clearly organized and interrelated, collection of theory, simple calculation and experiment. It is an important chapter to the remainder of the book, for the ideas of thermal explosion theory outlined here are repeatedly applied in this and subsequent chapters. The importance of a molten zone to reaction propagation is also introduced. In Chapter 4, the structure and stability of the inorganic azides are reviewed (12 pages) in terms of electron sharing between the metal atom and the azide group; this concept is one of the important new points of view this book adopts. Chapter 5 (31 pages) on initiation of explosion by shock is closest in theme to the previous monograph. An account is given of recent work on initiation by impact, flying particles and shock waves, by friction and by ultrasonic vibration. Mechanical initiation is thermal in origin; but 'mechanical' factors such as the disintegration

of liquids and solids play a part. Chapter 6 (25 pages) reaches a basically similar conclusion about initiation of explosion by flash photolysis. The azides are again the principal subject and the concepts of Chapters 3 and 4 are applied in interpretation. Decomposition and ignition by nuclear particles and high-energy radiations are dealt with in Chapter 7 (11 pages). High-energy particles provide a convenient method of introducing large amounts of energy into molecularly small regions of the crystals, and the experimental evidence so far is that the activation of a small number of adjacent molecules may not be enough to cause explosion. In Chapter 8 (7 pages) the mysterious, spontaneous explosions which occur during crystallization of lead and mercurous azide are described and discussed. The first part (7 pages) of Chapter 9 on the fast growth of explosion deals with thin films and the deflagrations and "low velocity detonations" which occur. The second part (9 pages), which contains some very striking photographic records, discusses small single crystals undergoing explosive decomposition.

This is the arrangement of the text. Each chapter after the first has its own 'conclusion' summarizing in broad generality the trends the authors feel significant and it is often helpful to read these before their chapters. Perhaps the reader would have been helped still more had the principal subdivisions of the chapters been listed with the contents. The text is prefaced by a useful list of names and formulae of most of the explosives discussed and followed by a set of eight appendixes which are up-to-date short tables of various properties. There are good author and subject indexes.

It is not the duty of a monograph of this nature which concentrates on recent work in a changing field to supply an extensive background; the appearance last year of M. A. Cook's formidable "Science of High Explosives" helps to meet this need. This book is modern and reliable and the few errors other than trivial misprints that exist, such as the apparent application of le Chatelier's principle to a non-equilibrium process, the occasional use of 'inorganic compound' where 'ionic solid' is intended and of the erroneous  $\text{Cu}_2(\text{N}_3)_2$  and  $\text{Au}_2(\text{N}_3)_2$ , may arise from compression and from production of such an up-to-date monograph. Above all, the experimental work from the authors' laboratory has a lucid quality which permits it to speak for itself without laborious argument. Perhaps 'photogenic' is an apter word to do greater justice to the brilliant photographs which have been obtained and which so admirably illustrate the text. PETER GRAY

## APPLICATIONS OF STATISTICS IN PHYSICS

### Statistical Physics

By L. D. Landau and E. M. Lifshitz. (Course of Theoretical Physics, Vol. 5.) Translated from the Russian by E. Peierls and R. F. Peierls. Pp. x+484. (London: Pergamon Press, Ltd., 1958.) 80s. net.

IN abandoning the general practice of considering classical statistics, quantum statistics and thermodynamics as virtually separate subjects, the authors have produced a book in which the three have been combined with considerable success. Although no