Inorganic azides

Energetic Materials. Vol. 1: Physics and Chemistry of the Inorganic Azides. Pp. 503. $59.40. Vol. 2: Technology of the Inorganic Azides. Pp. 296. $90. Edited by H. D. Fair and R. F. Walker (Plenum: New York and London, 1977).

THESE volumes review recent research and development work in the physics, chemistry, and technology of the inorganic azides. Summarising fundamental advances over the past two decades, emphasis is placed on investigations supported by the United States Army through its Office of the Chief of Research and Development and its Materiel Command. The contributing authors are, for the most part, members of the Energetic Materials Division (formerly Picatinny Arsenal), Armament Research and Development Command, New Jersey.

The wide variation in crystal bonding characteristics and stability of the inorganic azides present problems of unique interest in solid state physics and chemistry. In the reactive state, the inorganic azides exhibit a remarkable range of reactivities from low order decomposition, deflagration, to high order detonation. These properties have led to the commercial development of azides in a wide field, including particularly gas-generating devices and explosives, as well as photographic emulsions.

One of the central and fundamental problems in the study of azides lies in the development of valid equations of state applicable to the explosive decomposition of these materials. This requires the elucidation of interatomic forces from data on vibrational levels obtained from crystal spectra. Considerable success along these lines obtained with the solid alkali metal halides, using dynamic models, has very recently been applied to the inorganic azides, using laser Raman and thermal neutron spectroscopy. The results of these studies have contributed greatly to our understanding of lattice and phase transition dynamics in the crytalline metal azides. Another important area concerns the calculation of activation energies of decomposition, and the correlation of these with ground and excited energy levels in the azide crystal.

These major aspects are reviewed comprehensively in Volume 1, which deals with azides across the whole range of the Periodic Table, with particular reference to azide crystals and crystal structure; molecular vibrations in lattices; electronic structure of the solid state; and all aspects of decomposition, initiation and propagation in solid metal azides.

Volume 2 is devoted to the technology of those metal azides used in detonators, and as such is largely concerned with lead and silver azides. The aspects covered comprise manufacturing techniques and process control; analysis of azides; handling and safety; sensitiveness and the roles of azides in detonating trains. The section on electrostatic sensitivity and dielectric properties of lead azide and other primary explosives is of great current interest. The final section on the initiation of detonating trains by azides, also merits comment. In these situations lead azide functions commonly both as acceptor and as donor. These two processes together determine the pulse time and shape of the impulse integral on which the detonation threshold of the secondary charge depends. Recent high precision data are presented on these phenomena.

In conclusion, these volumes offer an extremely comprehensive, well-documented review of the most significant aspects of the science and technology of the inorganic azides. This work will be of inestimable value, particularly to those concerned with the development of military and commercial explosives. **J. H. Turnbull**

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Aerosol research and technology

Smoke, Dust and Haze: Fundamentals of Aerosol Behaviour. By S. K. Friedlander. Pp. xvii+317. (Wiley: New York and London, 1977.) $19.50; £11.35.

AEROSOL research and technology is, like most modern fields of interest, complex and interdisciplinary. Whereas transport, deposition, collision and coagulation are merely governed by physical laws, the formation of particles is largely a chemical problem. Meteorological processes such as rain-out, wash-out, and boundary layer physics are involved as well as engineering aspects for the design of sampling and measuring devices.

The available literature is specialised on certain aspects of the complex field, and there is a strong need for a comprehensive presentation especially for those who want to get into this field. Friedlander's book is likely to close a great deal of this gap. Written as a classroom text for graduate students in environmental engineering it mainly covers the physical and engineering aspects of aerosol behaviour.

The first third of the book is devoted to particle transport and deposition. Excellent fundamentals of problems, such as diffusion and deposition for different flow parameters, filter efficiencies, electrical precipitation, inertial and turbulent deposition, are given.

The second third deals with fundamentals of particle generation and growth. Collision and coagulation processes, thermodynamic processes, such as condensation, formation and stability of droplets and clusters, and a brief outline on gas-to-particle conversions, are presented.

In the last part, a general dynamic equation for the continuous distribution function is set up taking into account all processes of particle formation, growth, diffusion, coagulation, convection, and sedimentation discussed before. Special cases, in particular the dynamics of turbulent stack plumes, are discussed and compared with observational data. The techniques for setting up predictive models for air quality–emission source relationship are briefly described.

A short chapter on optical properties is confined to light scattering and visibility. For the complete problem of radiative transfer the reader is referred to the specialist literature. In another short chapter on experimental methods, descriptions of sampling, filtration, particle counters, the cascade impactor, devices for chemical analysis, and aerosol generators, are given.

The book is clearly written and beautifully made. At the end of every chapter carefully selected examples and problems provide excellent applications of the fundamentals treated. Friedlander concentrates mainly on the physical aspects of aerosol behaviour. Important chemical processes such as gas-to-particle conversion through heterogenous reactions and meteorological aspects of particle transport and precipitation are only briefly outlined for completeness. It would be highly desirable to see equally well produced books covering the chemical and meteorological aspects being published.

This book is more than a textbook for graduate students in environmental engineering. It should be on the bookshelf of every scientist and engineer directly or indirectly involved in aerosol research and technology. **P. Fabian**

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