Book Reviews

Snow Crystals: Natural and Artificial. Ukichiro Nakaya. Harvard Univ. Press, Cambridge, 1954. xii + 510 pp. Illus. $10.

This book is an account of more than 20 years of physical investigations on snow that were conducted at Hokkaido University in Sapporo, Japan, on nearby Mount Asari, and on a slope of Mount Takachi, near the center of Hokkaido Island. The author presents a general classification of snow crystals, recognizing seven distinct phyla. These vary from needles and columns, through fernlike crystals developed in one plane, to combinations of column and plane crystals, columnar crystals with extended side planes, rimed crystals (those with cloud particles attached), and a miscellaneous category of irregular crystals. He describes how this relatively simple approach to the study of snow crystals compelled him to seek knowledge of their physical properties, which in turn forced him into their artificial production in order to understand how they grow in nature.

As if working at extremely cold temperatures and struggling under adverse conditions of war were not enough, fortune tossed a bomb at the publisher's printing office during the last days of World War II and destroyed all the copper plates and the original type. The fact that the work was finally published, first in Japanese, and then in English, and lavishly illustrated with snow crystal photographs that are models of artistry as well as of excellent science, is due to the generous assistance of many individuals and organizations in the United States and in Japan. Nakaya credits a great many people, but he pays special tribute to the help and encouragement given by Charles F. Brooks of Harvard University and by H. C. Kelly and B. C. Dees, now with the National Science Foundation. His own university and the American Academy of Arts and Sciences were among the institutions that provided financial support.

In addition to the solution of many photomicrographic problems, his early work involved measurements of the mass and velocity of the fall of individual crystals in order to find the relationship between these quantities and crystal size and form. Finally, studies were made of the electric nature of snow particles and the frequency of ocurrence for each type of crystal form. Of particular significance was the discovery that plane crystals of hexagonal symmetry and fernlike appearance, although best known, are not the most typical or the most common. They constitute only a small part of the naturally formed types. The author and his band of assistants found the irregular types far more abundant.

This book sheds new light on the long-standing mystery that has surrounded the conditions controlling the formation of symmetrical forms. The mass of single crystals, their thickness, rate of fall, and electric charges are measured, tabulated, and discussed. A cold chamber developed in the laboratory for producing artificial crystals shows considerable ingenuity. Mixing a cold air current with a warm wet air current is not at all difficult. But suspending crystals in the air for long periods of time, in order to consider the question of crystal development apart from that of nucleus formation, is something else again. This was solved in the Hokkaido University Cold Temperature Laboratory by suspending filaments of rabbit hair or silk in the crystal-growing chamber. It was found that all types of crystals could be grown on these filaments by varying the physical conditions.

Nakaya does not, however, delve very deeply into questions of nucleation, the formation of early crystal stages from microscopic and submicroscopic nuclei. For knowledge in this field he recommends the work of Irving Langmuir and Vincent J. Schaefer that was accomplished under "Project Cirrus." Their work "solved the question of formation of an ice cloud by seeding, and our experiments are confined to the problem of development of the snow-crystal proper from the ice-cloud particle," Nakaya explains.

Laymen may find some sections of this source book rather tough sledding, highly technical, and extremely detailed. But for scientists working in meteorology and allied fields, these very sections will provide a gold mine of needed data. No one can open the volume without some gain, however, for much of the text is simple and easily understood. Featured in the illustrations are more than 1500 beautiful crystals, a source of much inspiration for readers with artistic or designing abilities.

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Chemistry of the Defect Solid State. A. L. G. Rees. Methuen, London; Wiley, New York, 1954. viii + 136 pp. Illus. $2.

Into the space of 136 small pages, which include 42 diagrams, six tables, and a bibliography, the author has compressed a large amount of information on the nature of lattice defects and on their effects on physicochemical processes. The material is very well organized into seven chapters dealing with the nature of crystalline defects, elements of the theory of the defect solid state, outline of experimental methods for the study of defects, chemical consequences of defect structures, tarnishing and decomposition reactions, heterogeneous catalysis, and outstanding problems. A bibliography of 66 references is appended.

Much of the material can be followed by readers who are almost unacquainted with the field. For example, the qualitative description of the quantum theory of the defect solid state is very lucidly presented. Other topics are treated too sketchily because of severe space