BOOK REVIEW

PHYSIKALISCHE CHEMIE DER SILIKATE by WILHELM EITEL. (Originally published by J. A. Barth, Leipzig, 1941.) Lithoprinted by Edwards Brothers, Inc., Ann Arbor, Michigan, 1944. Second completely revised edition. iv+826 pages (1944). Price $21.00.

This book by Eitel treats of the physical chemistry of silica and the silicates in a very comprehensive manner, as is shown by the world-wide coverage of the literature and an author's index of approximately 2325 entries. The contributions from laboratories in the United States form an important part of this book. Foremost in Eitel's treatment is the work of the Geophysical Laboratory of the Carnegie Institution of Washington. Other laboratories which have furnished much data for this book are the Kaiser-Wilhelm-Institut für Silikatsforschung, Berlin-Dahlem, where Eitel was the director; the U. S. Bureau of Standards; and the Portland Cement Fellowship, also at the Bureau of Standards.

A brief chapter on the geochemistry of silica and the silicates introduces the book and this is followed by a fourfold division of its contents.

Part I is concerned with the states of aggregation of silicates and this is based on the results of crystal structure studies. The crystalline nature and the related properties of the clay minerals are reviewed. Thereafter, various properties of silicate melts are discussed including viscosity, diffusion, surface tension, electrochemical properties, and density. Some of the experimental data were obtained on fused rocks. The constitution of silicate melts and glasses is examined in terms of the modern theory developed by Zernike and Prins, Zachariasen, and Warren. The physical properties of silicates in the colloidal state are considered next and such topics as grain size, dialysis, charge relations of silicic acid sols, optical properties of sols, x-ray and electron diffraction studies on colloids, silica gels, adsorption, base exchange, and diffusion in gels are discussed and illustrated.

Part II, on the thermochemistry of the silicates, is treated more briefly, owing largely to the lack of reliable data. Various calorimetric devices, for the measurement of specific heat, heats of formation, and heats of reaction are described. The methods of applying the Nermst Heat Theorem to silicates are outlined and illustrated with the A-U-diagrams for cristobalite-quartz; silica glass-quartz; kyanite-sillimanite, and $\alpha CaSiO_3$—$\beta CaSiO_3$.

Part III presents the techniques for investigating the phase relationships in dry silicate systems. The quenching method and the heating and cooling curve methods for examining silicate melts are described and illustrated. Various supplementary techniques for fixing inversion temperatures by optical, x-ray, dilatometric and specific heat measurements are given. This is followed by brief descriptions with phase diagrams and literature references for equilibrium in systems involving silica (or a silicate) as one component.

Part IV covers systems of silicates and a volatile constituent i.e., water, carbon dioxide or fluorine. A description of the methods of hydrothermal synthesis and the apparatus is given. Syntheses discussed include clay minerals, micas, the spilite reaction, hydrous magnesium silicates, and hydrous calcium silicates. Other topics reviewed are solubility of water in silicate melts, dehydration studies, the zeolite group of minerals and base exchange. Part IV is concluded by a brief treatment of reactions in the solid state.

Part V is devoted to silicate systems of technical importance. Fundamental data obtained on technical products composed of silicates have been summarized. Thus the study of glasses has yielded fundamental data on the devitrification characteristics of silicate melts, the escape of gases from glasses, the melting reactions in glass mixtures, viscosity relations of commercial glasses, opacity in glasses, and the chemical resistance of glass.

The study of slags by J. H. L. Vogt was of the utmost importance in orienting the program of experimental petrology. Eitel gives brief reviews of sulfide-silicate immiscibility, the quaternary system SiO_2-Al_2O_3-CaO-MgO, and Tammann's idealized diagram Fe_2SiO_4-Fe-FeS with its implication in the theory of the earth's interior.

A general summary of the system: clay-water is given and includes such physical properties as thixotropy, viscosity, and dehydration studies. A short review is presented of the minerals formed by the firing of clays and aluminosilicates, also of ceramic products in the systems MgO-SiO_2; MgO-Al_2O_3-SiO_2; MgO-TiO_2; MgO-TiO_2-ZrO_2, and the refractories of the silica group.

This book is concluded by a section on cements which gives the description of the results of microscopic and x-ray studies on clinker constituents, the relation of clinker formation to phase rule studies; the modifications introduced by the presence of iron oxides, alkalies, fluorides, etc., in cements; the hydration of cements.

This compilation by Eitel is notable for the selection of so many reliable data. A minimum of work of poorer quality is included to round out the picture of those systems or compositions not otherwise treated. The reviewer thinks that Eitel has treated his subject successfully.

The petrologist will find this book of much value to him as a reference work for it supplies a background of the available physico-chemical data of the silicates. The data and summaries given will help to increase his knowledge of the character and nature of a magmatic liquid, its crystallization and of the influence of the physical properties of silicate melts on the manner of intrusion of a magma.

This book is a lithoprinted edition of the original book printed by Barth of Leipzig. The text is very satisfactorily reproduced as are also most of the figures. Certain figures, however, are not complete—for example on p. 247, figure 223, the letter "r" at the end of the diagonal line from "s" is missing. Likewise on p. 252, in figure 226, the number 1 is missing at the terminus of the lower curve.

The reviewer recommends this book to petrologists and to mineralogists interested in silica and the silicates.

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