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CHEMICAL SPECTROSCOPY.

Introduction à l'Étude de la Spectrochimie. Par Prof. G. Urbain. Pp. iii+248+ix plates. (Paris: A. Hermann & Fils, 1911.) Price 10 francs.

PROF. URBAIN has written an exceedingly interesting and valuable introduction to spectroscopy treated more especially in relation to chemistry and chemical analysis. He has based this book upon his course of lectures delivered at the Sorbonne, and with undue modesty explains that it is mainly written for those younger chemists who, in their desire to enter a field full of promise, wish rapidly to acquire the fundamental ideas necessary for the theoretical and experimental study of the subject. Prof. Urbain is singularly happy in his preface, wherein he deals with the position of the spectroscope in relation to chemistry. Quite truly he points out the very valuable services that spectroscopy has rendered to chemistry and to astronomy. As for the former, it was a very long time before the subject formed more than a very restricted adjunct to chemical analysis. In truth, spectroscopy now deals with numerous facts which have but a dim connection with chemical analysis, and it deserves to rank as one of the principal branches of physical chemistry along with electrochemistry and thermochemistry.

The discoveries that chemistry owes to spectroscopy are many. To all is familiar the detection of rubidium and caesium by Bunsen and Kirchhoff, followed by the isolation of indium, thallium, and gallium. The spectroscope, however, has also proved itself to be the only guide in that apparently insoluble labyrinth of elements, the rare earths. To the spectroscope we owe the discovery of samarium and dysprosium by Lecoq de Boisbaudran, of holmium and thulium by Soret, of neodymium and praseodymium by Auer von Welsbach, and of europium by Crookes and by Demarcay. Finally there is the brilliant work of Prof. Urbain himself, which has resulted in the separation of ytterbium into neoytterbium and lutecium, and the discovery of the new element celtium. Again, the value of the spectroscope in Ramsay's work on the rare gases is within the common knowledge of all. Modern chemistry would have been in debt to the spectroscope for its most beautiful discoveries had not M. and Mme. Curie found in radioactivity a method of investigation which, although less

general in its application, is certainly more sensitive in certain cases.

When Bunsen and Kirchhoff published their method of investigation by flame spectra, chemists naturally welcomed this with enthusiasm. Ever since that time the textbooks of analysis have religiously incorporated their methods. Very few, if any, of these books describe the modern methods of investigation, although the value of these has clearly been proved. These modern methods are only to be found in specialised books which students have not the leisure to read and the skilled chemist rarely consults.

Prof. Urbain shows how the confidence felt by chemists in spectroscopy received a severe blow when the plurality of spectra was enunciated by Plücker and Hittorf. It was felt that spectrum analysis no longer possessed that rigour and infallibility at first attributed to it; nothing, after all, was so sound as the good old methods of pure chemistry; spectrum analysis was a complex subject, and it was abandoned to the specialist. In spite of this attitude of the pure chemist, the advance of spectro-chemistry has been enormous, and the variety of the modern methods is extraordinary. Flame spectra, spark spectra, spectra of gases and of solutions, arc spectra, absorption spectra, phosphorescent spectra, and infra-red emission and absorption spectra—all have their value in particular cases. The time has surely come for this subject to take the rank which it deserves in the chemical laboratory. At present the students of chemistry have a poor idea of the part played by the spectroscope in analytical research. The faint-hearted ones hesitate to take risks in so unknown a field, while the bolder ones perhaps try a few experiments, but are soon discouraged owing to their ignorance of the technique.

With the view of removing this ignorance, Prof. Urbain has written this book, and he treats in a most admirable way all the modern methods of work. In the first four chapters he describes the character and nature of spectra and the methods of illumination. Without going fully into the spectroscope itself, he gives in detail a most excellent account of the modern methods of illumination. The fifth and sixth chapters deal with phosphorescence and absorption, to the literature of which the author himself has contributed so largely. In the seventh chapter is to be found a concise description of series of lines and their relationships.

In fine it may be said that this book forms a most admirable introduction to chemical spectroscopy, and it is to be cordially recommended

to every chemist, student, and expert alike, for it should go far to dispel that somewhat doubtful confidence which the author quite rightly complains is still felt by the pure chemist as regards this important and fascinating branch of science.

E. C. C. BALY.

THE CONSTITUTION OF THE SILICATES.

Die Silicate in chemischer und technischer Beziehung: unter Zugrundelegung der seitens der philosophischen Fakultät der Universität Göttingen preisgekrönten Hexitpentit-Theorie nebst Umwandlung derselben in eine allgemeine stereochemische Theorie. By Dr. W. Asch and Dr. D. Asch. Pp. xv+409. (Berlin: Julius Springer, 1911.) Price 16 marks.

THE present work, which is an expansion of an essay originally submitted for a prize offered by the philosophical faculty of Göttingen, is a bold and original attempt to grapple with the difficult problem of the chemistry of the silicates and related compounds. The authors have sought to give a structural explanation of the behaviour of such compounds consistent with the doctrine of valency. The "Hexite-Pentite" hypothesis, which forms the basis of the work, assumes that silicates and aluminosilicates are not, in general, derived from the simpler hydroxides, such as $\text{Si}(\text{OH})_4$ and $\text{Al}(\text{OH})_3$, but from compounds formed by the condensation of six such molecules, with elimination of water, to form a closed ring. Less frequently, five-membered rings may be produced, and complex molecules are built up by the union, according to certain definite principles, of two or more such "hexite" or "pentite" groups. By the replacement of hydroxylic hydrogen by metals, or of hydroxyl by fluorine, &c., formulæ are constructed which are capable of expressing with remarkable completeness the properties and reactions of many silicates and aluminosilicates.

The formulæ, especially in the contracted notation chiefly employed in the text, strongly recall the Kekulé theory of aromatic carbon compounds, but the analogy is not a real one, as the linking is never from silicon to silicon or aluminium, but always through an intervening oxygen atom. Praise is due to the authors for the ingenuity with which the hypothesis is applied, and for the labour expended in recalculating the enormous number of analyses given, and expressing them in terms of the new structural theory. A certain arbitrariness in the choice of many of the formulæ is unavoidable, in the absence of experimental investigations specially designed to test the points in question.

The most serious defect of the work is its disregard of physical considerations, owing to the

exclusively chemical viewpoint adopted. This one-sidedness is well seen in the lengthy and detailed treatment of Portland cement and blast-furnace slag. Definite hexite-pentite formulæ are assigned to a great variety of these artificial products on the evidence of ultimate analyses only, and the microscopical proof that such materials are heterogeneous is brushed aside in a single sentence. Thermal analysis, by means of which such great advances are being made, including the brilliant work of the Geophysical Laboratory in Washington, is not considered, and the names of Day, Shepherd, and their collaborators do not even appear in the bibliography, although this includes some 1500 references. Again, the great additions made in recent years to our knowledge of colloids and of the part played by them in the chemistry of silicates are passed over in silence or with a brief allusion, in spite of the intimate bearing of such work on the weathering of feldspars, the setting of cements, the hydration of zeolites, and similar questions, all of which are discussed from a purely structural point of view. Even to glasses and porcelain definite structural formulæ are assigned.

By replacing silicon and aluminium atoms by other elements, and by introducing stereochemical considerations, the hypothesis is extended to complex salts, metal-ammonia compounds, and salts with water of crystallisation. Some shorter chapters are devoted to further and more hazardous speculations, the hexite-pentite arrangement being applied to aliphatic organic compounds, and even to the structure of the atom and the explanation of radioactivity. These extravagances, however, do not detract from the value of the main thesis, which certainly deserves the attention of inorganic chemists and mineralogists, as possibly affording assistance in the further study of a complex and difficult subject. C. H. DESCH.

BRITISH VEGETATION.

Types of British Vegetation. By members of the Central Committee for the Survey and Study of British Vegetation. Edited by A. G. Tansley. Pp. xx+416+36 plates. (Cambridge: University Press, 1911.) Price 6s. net.

THE great impetus that has been given during recent years to the study of the British flora is largely owing to the development of that branch of botany known as ecology. This subject—the study of plants in connection with their habitat—has raised many questions, and amongst them that of plant-communities has received foremost attention, and has been zealously investigated. The committee which was formed in 1904 to