

**METALLOGRAPHY: AN
INTRODUCTION TO THE STUDY
OF THE
STRUCTURE OF METALS, CHIEFLY
BY THE AID OF THE MICROSCOPE**

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Metallography: An Introduction to the Study of the Structure of Metals, Chiefly by the Aid of the Microscope by Arthur H. Hiorns

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ARTHUR H. HIORNS

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THE AID OF THE MICROSCOPE

BY

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PREFACE.

THE demand for practical instruction in all branches of a subject in our Technical Schools is increasing, and the introduction of experimental work is so moulding the character of the teaching, that the teacher must keep himself conversant with the new developments that are constantly arising in consequence of the progress of scientific knowledge.

In accordance with these views the author has made a special study of the intimate structure of metals during the last few years, and found great pleasure in following the researches of those who may be rightly termed the pioneers in metallography, such as Sorby, Martens, Osmond, Stead, Roberts-Austen, Arnold, Andrews, and several others, whose patient and laborious efforts have brought to light such a precious fund of knowledge that many of the hitherto unsolved problems have now received a satisfactory explanation.

As far as the author is aware of, no book on the subject has before been published in the English language; and as metallography is yet in its infancy, it is not sufficiently developed to permit of its being placed on a strictly logical scientific basis. This is therefore only an attempt to lay the principles of the subject before students and workers who are interested in the properties and applications of metals, and to offer a series of original illustrations which it is hoped will assist in making the meaning clearer.

Although the photographs are the best the author has been able to produce with the apparatus at his disposal, they give but an imperfect idea of the delicate structures which are revealed by direct vision through the microscope, even when a cheap instrument is employed; for to get a proper idea of any section a number of views of the different parts are requisite, and these should be examined with different powers, from the pocket lens up to the highest possible magnifications of the microscope. For the purposes of this book, most of the photographs have been taken with an inch and a quarter-inch objectives, giving an amplification of 120 and 220 diameters respectively.

The introductory chapter gives a brief account of the history and development of metallography, including a statement of the nature of alloys as generally recognised by eminent metallurgists, apart from microscopic considerations.

As the minute structure of metals can only be correctly investigated on a perfectly polished specimen, free from scratches, the subject of polishing naturally claims an important place, and such appliances as can be used by the humblest worker, as well as more elaborate and labour-saving machinery, are briefly enumerated, especially those methods adopted by the great masters of the subject. Closely connected with this are the operations of etching, oxidising, and colouring, which are most important aids to structure revelation.

A concise description of a suitable microscope with appliances for illuminating the sections is given. The subject of Photo-Micrography is also dealt with, and simple directions given for photographing the prepared specimens, together with the kind of plates used by the author and the most suitable paper for printing.

The structures of the different varieties of iron, steel, and cast iron are described in considerable detail, for the reason that they form the most comprehensive and

important of metallic materials, and have been more completely investigated than those of other metals. The other metals included in the present work are chiefly those of industrial importance, and consist of Copper; Copper-Tin alloys and special Bronzes; Brass; German Silver; Gold; Silver; and Miscellaneous Alloys.

A Glossary of terms used in Metallography is added as a help to the student in grasping the meaning of technical words used in the text, especially as different investigators have found it necessary to coin some new words to express previously unknown phenomena that they have observed.

The author wishes to record his great indebtedness to Mr. J. E. Stead, who most generously placed all his published researches at his disposal, and volunteered the loan of any of his original photographs. The author further records the valuable assistance he has received from Mr. C. R. Clark in executing the photographs; from Mr. J. H. Stansbie in reading the proof-sheets; and from the various original papers duly acknowledged in the separate pages.

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