

CAHN
HAASEN
Editors

PHYSICAL METALLURGY

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PHYSICAL METALLURGY

Third, revised and enlarged edition

Edited by

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PART I



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PHYSICAL METALLURGY

PART I

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PREFACE TO THE THIRD EDITION

The first edition of this book was published in 1965 and the second in 1970. The book continued to sell well during the 1970s and, once it was out of print, pressure developed for a new edition to be prepared. The subject had grown greatly during the 1970s and R.W.C. hesitated to undertake the task alone. He is immensely grateful to P.H. for converting into a pleasure what would otherwise have been an intolerable burden!

The second edition contained twenty-two chapters. In the present edition, eight of these twenty-two have been thoroughly revised by the same authors as before, while the others have been entrusted to new contributors, some being divided into pairs of chapters. In addition, seven chapters have been commissioned on new themes. The difficult decision was taken to leave out the chapter on superpure metals and to replace it by one focused on solute segregation to interfaces and surfaces – a topic which has made major strides during the past decade and which is of great practical significance. A name index has also been added.

Research in physical metallurgy has become worldwide and this is reflected in the fact that the contributors to this edition live in no fewer than seven countries. We are proud to have been able to edit a truly international text, both of us having worked in several countries ourselves. We would like here to express our thanks to all our contributors for their hard and effective work, their promptness and their angelic patience with editorial pressures!

The length of the book has inevitably increased, by 50% over the second edition, which was itself 20% longer than the first edition. Even to contain the increase within these numbers has entailed draconian limitations and difficult choices; these were unavoidable if the book was not to be priced out of its market. Everything possible has been done by the editors and the publisher to keep the price to a minimum (to enable readers to take the advice of G.CHR. LICHTENBERG [1775]: “He who has two pairs of trousers should pawn one and buy this book”).

Two kinds of chapters have been allowed priority in allocating space: those covering very active fields and those concerned with the most basic topics such as phase transformations, including solidification (a central theme of physical metallurgy), defects and diffusion. Also, this time we have devoted more space to

experimental methods and their underlying principles, microscopy in particular. Since there is a plethora of texts available on the standard aspects of X-ray diffraction, the chapter on X-ray and neutron scattering has been designed to emphasize less familiar aspects. Because of space limitations, we regretfully decided that we could not include a chapter on corrosion.

This revised and enlarged edition can properly be regarded as to all intents and purposes a new book.

Sometimes it was difficult to draw a sharp dividing line between physical metallurgy and process metallurgy, but we have done our best to observe the distinction and to restrict the book to its intended theme. Again, reference is inevitably made occasionally to nonmetallics, especially when they serve as model materials for metallic systems.

As before, the book is designed primarily for graduate students beginning research or undertaking advanced courses, and as a basis for more experienced research workers who require an overview of fields comparatively new to them, or with which they wish to renew contact after a gap of some years.

We should like to thank Ir. J. Soutberg and Drs. A.P. de Ruiter of the North-Holland Publishing Company for their major editorial and administrative contributions to the production of this edition, and in particular we acknowledge the good-humoured resolve of Drs. W.H. Wimmers, former managing director of the Company, to bring this third edition to fruition. We are grateful to Dr. Bormann for preparing the subject index. We thank the hundreds of research workers who kindly gave permission for reproduction of their published illustrations: all are acknowledged in the figure captions.

Of the authors who contributed to the first edition, one is no longer alive: Robert Franklin Mehl, who wrote the introductory historical chapter. What he wrote has been left untouched in the present edition, but one of us has written a short supplement to bring the treatment up to date, and has updated the bibliography. Robert Mehl was one of the founders of the modern science of physical metallurgy, both through his direct scientific contributions and through his leadership and encouragement of many eminent metallurgists who at one time worked with him. We dedicate this third edition to his memory.

April 1983

Robert W. CAHN, Paris
Peter HAASEN, Göttingen

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