Springer 手册精选原版系列

半导体物理性能手册

第 1 卷

HANDBOOK ON PHYSICAL PROPERTIES OF SEMICONDUCTORS

Volume 1
Group IV Semiconductors

哈爾濱工業大學出版社
HARBIN INSTITUTE OF TECHNOLOGY PRESS

Springer 手册精选原版系列

半导体物理性能手册

第 1 卷

HANDBOOK ON PHYSICAL PROPERTIES OF SEMICONDUCTORS

Volume 1
Group IV Semiconductors

Edited by
Sadao Adachi

哈爾濱工業大學出版社
HARBIN INSTITUTE OF TECHNOLOGY PRESS

黑版贸审字08-2014-012号

图书在版编目（CIP）数据

半导体物理性能手册. 第1卷：英文/（日）足立贞夫主编. —哈尔滨：哈尔滨工业大学出版社，2014.4
（Springer手册精选原版系列）
ISBN 978-7-5603-4513-0

Ⅰ.①半… Ⅱ.①足… Ⅲ.①半导体材料-物理性能-手册-英文 Ⅳ.①TN304-62

中国版本图书馆CIP数据核字（2013）第297009号

材料科学与工程 图书工作室

责任编辑 杨 桦 许雅莹 张秀华
出版发行 哈尔滨工业大学出版社
社 址 哈尔滨市南岗区复华四道街10号 邮编 150006
传 真 0451-86414749
网 址 http://hitpress.hit.edu.cn
印 刷 哈尔滨市石桥印务有限公司
开 本 787mm × 1092mm 1/16 印张 23
版 次 2014年4月第1版 2014年4月第1次印刷
书 号 ISBN 978-7-5603-4513-0
定 价 198.00元

PREFACE

The progress made in physics and technology of semiconductors depends mainly on three families of materials: the group-IV elemental, III–V, and II–VI compound semiconductors. The last five decades have seen an enormous investment in the research and application of semiconductors. Among the semiconductors most intensively studied have been silicon, germanium, and gallium arsenide. The wealth of information on such semiconductors is formidable. It is spread over a wide range of publications. Most of it exists in the form of individual research papers and reports. Some of it has been assembled into review articles, monographs, or parts of books.

The aim throughout has been to present in convenient form as large amount of accurate, reliable, and up-to-date information on the physical properties of the group-IV elemental semiconductors (diamond, Si, Ge, and α-Sn) and SiC polytypes for a variety of basic research and device applications. The data on the physical properties of each material are organized in the same way in order to facilitate searching for information. The physical properties considered in this book can be classified into 12 groups: (1) structural properties; (2) thermal properties; (3) elastic properties; (4) phonons and lattice vibronic properties; (5) collective effects and related properties; (6) energy-band structure: energy-band gaps; (7) energy-band structure: electron and hole effective mass; (8) electronic deformation potential; (9) electron affinity and Schottky barrier height; (10)

optical properties; (11) elastooptic, electrooptic, and nonlinear optical properties; and (12) carrier transport properties.

The extensive bibliography is included for those who wish to find additional information if required. I hope that the book will aid many who want to know various properties of those semiconductor materials in the course of their work. The reader will also find the series books "III–V Compound Semiconductors" and "II–VI Compound Semiconductors" useful in order to find the needed information quickly on these practically important semiconductors.

ACKNOWLEDGMENTS

The author wishes to thank the editors and authors of the following journals, symposium papers, and books for permission to reproduce previously published figures: *Academic Press* for Fig. 1.7.2; *Appl. Phys. Lett.* for Figs. 2.2.8, 2.9.8, 2.9.9, 2.10.7, 2.10.9, 2.12.8, 2.12.10, 2.12.24, 2.12.26, 2.12.30, 3.9.2, 3.12.15, 6.12.1, 6.12.6, 6.12.14, and 7.12.3; *Chem. Phys. Carbon* for Figs. 1.10.4 and 1.10.5; *Consultants Bureau* for Figs. 5.2.1 and 6.2.1; *High Temp.–High Press.* for Fig. 6.2.5; *IEEE J. Quantum Electron.* for Figs. 2.10.15 and 2.10.16; *IEEE Proc. Int. Electron Dev. Meeting* for Figs. 2.6.6 and 2.6.7; *IEEE Trans. Electron Dev.* for Figs. 6.12.10 and 6.12.11; *Inst. Phys. Conf. Ser.* for Figs. 6.9.4 and 6.12.13; *J. Appl. Phys.* for Figs.2.7.1, 2.7.3, 2.10.6, 2.10.13, 2.12.12, 2.12.16, 2.12.17, 2.12.33, 3.12.10, 3.12.16, 5.6.2, 5.12.3, 6.6.2, 6.10.9, 6.12.3, and 7.12.1; *J. Chem. Phys.* for Fig. 1.2.1; *J. Cryst. Growth* for Fig. 4.12.4; *J. Opt. Soc. Am.* for Figs. 1.10.6, 2.10.5, 3.10.6, 6.10.7, 6.10.8, 7.10.3, and 7.10.4; *J. Phys. Chem. Solids* for Figs. 1.6.2, 3.10.13, 3.12.11, 3.12.14, 4.2.3, 4.6.4, 4.10.3, 4.12.1, and 4.12.3; *J. Phys.: Condens. Matter* for Fig. 2.9.6; *J. Phys. Soc. Jpn* for Figs. 3.7.1 and 5.6.3; *J. Vac. Sci. Technol.* for Fig. 2.9.4; *Jpn. J. Appl. Phys.* for Figs. 2.3.3, 2.12.25, 2.12.28, and 6.3.1; *Mat. Res. Soc. Symp. Proc.* for Fig. 6.9.2; *Mater. Sci. Eng.* for Fig. 2.6.4; *Mater. Sci. Semicond. Proc.* for Fig. 2.12.18; *Phys. Rev.* for Figs. 1.1.1, 1.2.8, 1.4.1–1.4.4, 1.6.1, 1.6.3, 1.7.1, 1.10.7, 1.11.1, 1.12.3, 1.12.5, 1.12.8, 1.12.9, 2.1.1, 2.2.1, 2.3.2, 2.4.1–2.4.3, 2.6.2, 2.6.3, 2.10.3, 2.10.8, 2.10.12, 2.10.14,

2.11.1–2.11.5, 2.12.2, 2.12.13, 2.12.14, 2.12.19, 2.12.20, 2.12.22, 3.2.1, 3.2.6, 3.4.1–3.4.4, 3.6.1–3.6.6, 3.7.2, 3.10.3, 3.10.4, 3.10.7, 3.10.8, 3.10.10, 3.10.12, 3.11.1–3.11.3, 3.12.3, 3.12.4, 3.12.6–3.12.9, 3.12.12, 4.2.1, 4.4.1–4.4.3, 4.6.1, 4.6.3, 4.6.5, 4.10.4–4.10.7, 5.4.1, 5.4.2, 5.10.4, 5.10.5, 5.11.1, 5.12.1, 6.4.1, 6.6.1, 6.10.6, 6.10.10, 6.11.1, 6.12.2, 7.4.1, 7.6.2, 7.10.5–7.10.7, and 7.11.1; *Phys. Rev. Lett.* for Figs. 1.2.7, 2.1.2, 2.4.4, 2.9.5, 3.1.1, and 5.1.1; *Phys. Status Solidi* for Figs. 2.12.5, 2.12.6, 5.10.6, 5.10.7, 6.6.3, 6.6.4, 6.10.11, 6.10.12, 7.6.1, 7.10.8, 7.10.9, and 7.12.2; *Proc. IEEE* for Figs. 1.12.10, 5.12.4, 5.12.5, and 6.12.12; *Proc. Roy. Soc.* for Figs. 1.10.8, 6.10.13, 7.10.2, and 7.10.10; *Solid State Commun.* for Figs. 1.12.1. 1.12.6, 1.12.7, 2.4.5, 2.10.10, 3.12.13, and 5.10.3; *Solid-State Electron.* for Figs. 2.7.2, 2.9.7, 2.12.1, 2.12.4, 2.12.7, 2.12.11, 5.12.6, and 6.12.15; *Sov. Phys.–Semicond.* for Fig. 3.10.9; *Springer-Verlag* for Figs. 2.12.15 and 2.12.21; *University of South Carolina Press* for Fig. 5.6.1; and *World Scientific* for Figs. 2.3.1, 2.12.27, and 2.12.31.

Contents of Other Volumes

Handbook on Physical Properties of Semiconductors II
III–V Compound Semiconductors

Sadao Adachi, Author

Handbook on Physical Properties of Semiconductors III
II–VI Compound Semiconductors

Sadao Adachi, Author

CONTENTS