STEEL METALLURGY FOR THE NON-METALLURGIST

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Preface

This book is an attempt to explain the metallurgical aspects of steel and its heat treatment to non-metallurgists, starting, from simple concepts taught in high-school-level chemistry classes and then building to more complex concepts involved in heat treatment of nearly all types of steel as well as cast iron. It was inspired by the author having worked with practicing bladesmiths for the past 15 to 20 years.

Most of the chapters in the book contain a summary at the end. These summaries provide a short review of the contents of each chapter. It may be useful to read these summaries before and perhaps after reading the chapter contents.

The Materials Information Society, ASM International, has published a book, *Heat Treater's Guide: Practices and Procedures for Irons and Steels*, 2nd ed., 1995, that contains a wealth of information on available steels and is extremely useful to those who work and heat treat steel. A major goal of this book is to provide the necessary background that will permit a metal worker, not trained in metallurgy, to understand how to use the information in the ASM book, as well as other Handbooks published by ASM International.

I would like to acknowledge the help of two bladesmiths who have contributed to this book in several ways: Alfred Pendray and Howard Clark. Both men have helped me understand the level of work being done by U.S. bladesmiths, and they have also contributed to some of the experiments used in this book. They are also responsible for the production of this book, because of their encouragement to write it. In addition, I would like to acknowledge many useful discussions with fellow metallurgist William Dauksch, retired vice president of Nucor Steel, and my colleague, Prof. Brian Gleeson, who made many useful suggestions on the stainless steel chapter.

I am particularly indebted to Iowa State University and their Materials Science and Engineering Department for providing me with the opportunity to teach metallurgical engineering students about steel for over two decades, as well as to the Ames Laboratory, DoE, that provided access to optical and electron microscopes and supported most of my research activity. Many of the pictures and all of the methods of presentation in this book result from my experience teaching both laboratory and lecture courses to students and doing research at Iowa State University and its Ames Laboratory.

Ames, Iowa, February 2007

About the Author

Dr. John Verhoeven is a Distinguished Emeritus Professor in the Engineering College at Iowa State University. He earned a B.S. in chemical engineering in 1957 and his M.S. and Ph.D. in metallurgical engineering in 1959 and 1963, all from the University of Michigan. His professional career was spent at Iowa State University teaching metallurgy in the Department of Materials Science and Engineering and doing research at the Ames Laboratory of the U.S. Department of Energy.

Dr Verhoeven's research was in the primary area of physical metallurgy. He has over 200 research publications in refereed journals and owns eighteen patents. He received three Advanced Sustained Research Awards from the DoE, in 1981, 1987 and 1988. He is a fellow of the ASM.

Dr Verhoeven's teaching led to the publication of a textbook, *The Fundamentals of Physical Metallurgy*, John Wiley, 1975, which was used widely in the late 1970s and 1980s. At Iowa State, he was awarded the Outstanding Teaching Award in the Engineering College in 1976 and in the Metallurgical Engineering Program in 1980, and the Iowa Legislature outstanding teaching award in the Engineering College at ISU for sustained outstanding teaching, November 1991. He was appointed an Anson Marston Distinguished Professor of Engineering in 1985.

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