

# Book notes

**Steels: microstructure and properties, 3rd edn by H. K. D. H. Bhadeshia and R. W. K. Honeycombe**  
xii + 344pp., Butterworth-Heinemann, 2006, ISBN 978-0-750-68084-4, £50

The third edition of this classic text provides a welcome update on the previous editions of 1981 (Honeycombe) and 1995 (Honeycombe and Bhadeshia). Retaining the clarity of exposition characteristic of its predecessors, the latest edition provides an excellent introduction to the underlying principles determining the microstructures and properties of engineering steels. Although aimed primarily at students, it is likely also to be a valuable resource to technologists and engineers requiring a basic understanding of the physical metallurgy of steels.

After an introduction to the allotropes and phase transformations of pure iron and the principal strengthening mechanisms, the effect of carbon addition and the reconstructive transformations in the Fe–C system are described; the effect of other alloying additions is then considered. This leads on to chapters on the formation of martensite, the bainite reaction and acicular ferrite. The text reflects the significant progress made since the second edition in both the understanding of the transformations mechanisms leading to these complex microstructures and the successful application of these principles in engineering steels. For example, hard, tough high strength bainitic steels have been developed for applications such as rails and armour, while acicular ferritic microstructures are employed increasingly widely to improve the properties of weldmetals and structural steels. Throughout this first section of the book, the focus is strongly on how the kinetics of transformation determine final phase distribution and composition.

The basics of hardenability and heat treatment, including the tempering of martensite, are then covered, followed by a chapter on thermomechanical processing, another area where major developments have occurred since the last edition. Particularly important here have been the developments of commercial TRIP and TWIP steels, which exhibit enhanced ductility at high strength, and the drive to ever finer grain sizes; coverage has again been extended to include these aspects.

A chapter on embrittlement and fracture of steels is followed by three concluding sections on important specialist topics: stainless steels; weld microstructures; and the modelling of microstructures and properties.

Updated bibliographies are provided for each chapter, and accompanied exercises and worked examples supporting the published text are available online.

As the introduction points out, 'steel is the 'gold-standard' against which emerging structural materials are compared', a dominance that arises from the immense diversity of microstructures and properties that can be generated with appropriate composition and processing. This book provides an invaluable primer to the research and engineering advances that have led to the current range of engineering steels and will contribute to their further development.

**Ironmaking: the history and archaeology of the iron industry by Richard Hayman**

160pp., Tempus Publishing ([www.tempus-publishing.com](http://www.tempus-publishing.com)), 2005, ISBN 0-7524-3374-1, £19

This survey of the technological and social history of the iron industry focuses on developments from the start of the Industrial Revolution, when coke replaced charcoal as the principal fuel source, to the decline of the wrought iron industry in the late nineteenth century. In effect, this period encompasses the production of iron in bloomeries and blast furnaces (charcoal, then coke fired), followed by fining or puddling to produce malleable iron, processes that were eventually superseded by the conversion of pig iron to steel by pneumatic or open hearth processes.

The author stresses the need for a critical approach to the general tendency to treat these developments as a linear progression of technologies. Often, technological developments were established slowly and were used in conjunction with earlier technology, with which they interacted. Further, the developments had little influence on workplace and business culture, which remained very similar in the mid nineteenth century to that prevailing a century earlier – ironmasters basing their

operations on a core of skilled operators, and the industry retained a strong regional character. A specific aim is to rehabilitate the workmen, 'whose importance has been underestimated by technological historians, if not by social historians'. Before Bessemer, 'ironmaking was a more empirical and collaborative activity ... [T]he experience of a handful of dominant figures did not reflect the experiences of most ironmasters or iron workmen. Ironmaking was not simply an economic or technical activity, it was a sub-culture in its own right ...'. Due attention is also given to the role of the merchant and the influence of the market in technological change.

The book also includes a brief overview of the development of ironmaking from prehistoric times and concludes with a chapter on archaeology and conservation. It is pleasingly designed and produced to a high standard, as befits the excellent collection of illustrations.

**Merthyr Tydfil – Iron Metropolis: life in a Welsh industrial town by Keith Strange**

192pp., Tempus Publishing ([www.tempus-publishing.com](http://www.tempus-publishing.com)), 2006, ISBN 0-7524-3451-9, £18

Over the century from 1750, Merthyr Tydfil grew from a hamlet to become the largest town in Wales, with a population exceeding that of Cardiff and Swansea combined. This growth was driven by the expansion of the Welsh iron industry, of which Merthyr was the capital, the Iron Metropolis. As the first industrial town of any size in Wales, Merthyr was the focus of extensive interest from both officialdom and visitors, to whom no tour of Wales was complete without a visit. This attention generated extensive comment on the perceived benefits and drawbacks of industrialisation.

Concentrating on the middle decades of the nineteenth century, these sources are drawn upon to provide a comprehensive review of life in Merthyr at the peak of iron production. The first section surveys the 'realities': employment, housing, health and poverty; the second, the 'responses': protest (including Chartism), crime, drink and prostitution, religion, education, benefit societies and emigration.

**Mark Hull**