Int. J. Heat Mass Transfer. Vol. 12, pp. 127–128. Pergamon Press 1969. Printed in Great Britain

BOOK REVIEWS

B. I. KITAEV, YU. G. YAROSHENKO and V. D. SUCHKOV, **Heat Exchange in Shaft Furnaces**, (edited by P. A. YOUNG). Pergamon Press, Oxford. Price: 90*s*.

BETTER late than never is an appropriate greeting for this translation, of a book which was originally published in Russia nearly 10 years ago. The text forms a welcome addition to the meagre collection of books on the theory of shaft furnaces in general and of the blast furnace in particular. Kitaev and his co-authors have been a powerful influence in the development of our understanding of this process. Their methods of applying heat-transfer theory to explain the temperature distribution in the furnace, and to indicate how this may be affected by variations in practice, will undoubtedly form a mile-stone in the development of blast-furnace theory.

The volume, however, covers a wider field than the blast furnace. The first chapter deals with the theory of heat exchange to packed beds. After a brief introduction to the aerodynamics of such systems, heat transfer in counter-flow, concurrent-flow and stationary beds are examined. Approximate and exact solutions of the equations are given, though the development of the latter is very brief and for detailed solutions reference must be made to the original papers which are mostly in Russian. Ingenious use is made of a hydraulic integrator to deal with gas–solid heat transfer in countercurrent processes which allows for resistance to heat transfer at the gas–solid interface and inside the solid particles.

Since complicated heat-transfer calculations would nowadays be carried out on computers, the five appendices consisting of 70 pages of tables, charts and nomograms are probably excessive, especially since many of the charts are too small to be read with accuracy.

The second chapter on laboratory investigations is one of the least satisfactory. Major references are to the work of Furnas in 1930 and Saunders and Ford in 1940. Many of the other references are clearly inadequate and could have been omitted.

The readers' task would have been eased considerably by a complete list of symbols; the present one is woefully inadequate. There is also considerable difficulty in reconciling the various equations. Exponents and coefficients of allegedly similar expressions show considerable variations. The labeling of diagrams and the identification of appropriate curves are unsatisfactory. The chapter on chemical processes in counter flow is inadequate and the chapter on peat gas generators is unlikely to be of great interest.

Such deficiences as I have outlined are more than compensated by the final two chapters on heat transfer in the blast furnace, the second of which was especially written for this translation. In the last decade, the theory of heat and mass transfer in the blast furnace has blossomed, due largely to the work of Michard and his colleagues from IRSID, as well as to the continuing contributions from Kitaev. There can be no doubt that the seeds for this development are to be found in this volume, which is still very relevant, and which should be read by everyone interested in shaft furnaces.

A. V. BRADSHAW

Heat and Mass Transfer in Boundary Layers: D. B. SPALDING and S. V. PATANKAR, 138 pp. Morgan–Grampian, London (1967).

DURING the last few years Spalding and his group at Imperial College have developed a rather general method to solve boundary-layer-type flow problems. This book presents the theoretical background and compares the first theoretical results with experiments, which do not cover the whole range of applicability yet. Since the boundary-layer equations are solved by means of a finite-difference method, numerical results can be obtained only by use of a computer and it is certainly a great help to find the full computer programme (Fortran IV) in Appendix A.

The calculation method is meant for designers and research workers alike and pays special attention to gaseous turbulent boundary layers, though laminar boundary layers can be treated as well, possibly better. It claims to be applicable, with the fewest possible modifications, in all the circumstances that design and research bring to pass. The method; indeed, deserves the close attention of all those working in the field of boundary layers. The presentation of the material may be divided into five parts:

(i) A quick survey on calculation methods on the market which is badly needed, though a short historical survey is often bound to be incomplete and somewhat biased, which is all too well understood if a new method is presented.

(ii) Basic equations (conservation laws), boundary conditions, and auxiliary equations concerning exchange terms, and expressions for exchange coefficients. Special attention has been given to the physics of the region near the wall since the negligibility of the longitudinal–convection terms there allows a one-dimensional treatment and a consequent saving of computational effort. Since many important properties of a boundary layer are decisively influenced by the behaviour of the region close to the wall, this section may show fruitful lines of approach for future research.

(iii) The finite-difference solution procedure is described in detail. The coordinate system is chosen similar to von Mises, with x and a dimensionless stream function as