Int. J. Heat Mass Transfer. Vol. 11, pp. 381–383. Pergamon Press 1968. Printed in Great Britain

BOOK REVIEWS

L. S. Tong, Boiling Heat Transfer and Two-Phase Flow, 242 pp. John Wiley, New York (1966). Price 112*s*.

SINCE the sharp increase in interest in boiling heat transfer a decade ago, stimulated by the advent of pressurised-water, boiling-water and other nuclear reactor systems, much of the literature on this subject has been in the form of review articles in journals and, at most, a chapter or two in thermodynamics text books. Dr. Tong (of Westinghouse A.P.D.) has produced what is, to quote the dust cover "the first book to completely cover the entire field"; its publication therefore is an event of some importance. It is also a reflection of the increasing specialisation of technology; no doubt only a half-decade will pass before an entire book is devoted to but one aspect of boiling now allotted one chapter in Dr. Tong's book.

The author manages to cover a very wide range of topics in only 200 pages. In spite of compression, the author's style and grammar are refreshing, particularly at the opening of each chapter. For example, the opening remarks in Chapters 1 and 3 are good, the former including the important distinction between two main groups of correlation: one based on gross operational parameters of a boiling system, the other on phenomenologically meaningful "microscopic" parameters. In a short book it is sometimes difficult to achieve a satisfactory balance, but the author generally succeeds. Thus the flow-boiling crisis is covered from the two-term Jens' equation to the twenty-six-term Jacobs and Merrill equation, and the relationship of pool boiling to flow boiling is discussed (pp. 147 and 194). Specific note is made where more data and theoretical research are required (e.g. on pp. 67 and 118). On the other hand nucleation and bubble growth are allotted seven pages whereas only two pages are allotted to bubble departure diameter, and Breen and Westwater's treatment of pool film boiling might have been expanded. Surprisingly few printing errors were noted by the reviewer (nine altogether).

The author often indicates several different routes to the solution of a problem; this is useful as it demonstrates to the student that there are no unique solutions to problems in boiling heat transfer, and thus emphasises the necessity to select carefully the most suitable solution for any given application. However, a multiplicity of symbols is needed to cater for the multiplicity of solutions with their idealised models (this is reflected in the book's symbol list); greater rationalisation of the symbols throughout the book would have helped to avoid possible confusion in the student.

The book could serve as a useful introduction for designers new to the field, but its brevity limits its usefulness at the advanced-design stage. Designers should, of course, refer to the original reference once a suitable technique has been located, in order to obtain the original author's interpretation and to confirm that the work was quoted correctly. Some guidance is given to designers for identifying which correlation or technique is to be preferred (e.g. p. 126). The author also considers parametric distortion in some detail (pp. 137, 179–200) and designers are well advised to 'beware of parametric distortion' in applying correlations to design!

In other respects concerning design the book is less helpful. Several times the author states that "empirical data obtained in the range of interest are suggested for use in design" (p. 66) or "experimental verification on the actual geometry is still required" (p. 169) or "for design purposes, one must therefore resort to empirical correlations" (p. 155). Helpful comment could have been included on how data already in existence might aid the designer, when the design channel is not identical with the experimental channel. A comment on design-optimisation techniques through the use of computers would also have been desirable.

Various points which occurred to the reviewer include the following.

On pp. 57–58 the work of Tippitts on flow patterns in a boiling channel is described in some detail, but the channel size and heating pattern are omitted, although this important information has been included in reporting Jiji's work (p. 74).

Little value has been gained by inclusion of Chang's analysis based on the dynamic force balance on a bubble adhering to a vertical wall (pp. 138–140). Thus equation (6-2.5) states that the sum of the *vertically* acting buoyancy and inertia forces is equal to the *horizontally* acting surface-tension force (as shown in Fig. 6.1); as the remainder of the analysis depends upon the somewhat doubtful validity of this equation it could have been entirely omitted.

The author's theoretical approach to the sub-cooled flow-boiling crisis (pp. 140–145) assumes that mixing between the superheated liquid boundary layer and the sub-cooled liquid core is prevented by a postulated viscous bubble layer separating the two. Contrast this with Bernath's empirical correlation for sub-cooled flow boiling crisis (pp. 156–157) which assumes total turbulent mixing (i.e. homogeneous flow). Both approaches appear successful but are based on diametrically opposed models; this is interesting as it appears to suggest that choice of model for such analyses is but of secondary importance.

The author distinguishes very clearly between the "local-condition concept" and the "system-parameter concept", as used in various correlations for the flow-boiling crisis (pp. 184–190).

To summarize the reviewer's impressions, the book is a very readable and enlightening introduction to the subject, although it might be of restricted use to the designer (insufficient detail) and of limited appeal to the student (at 6*d* per page).

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