PREFACE

The idea for this book arose out of the International Workshop on Fundamental Aspects of Post-Dryout Heat Transfer, which was held in Salt Lake City, Utah in April, 1984. The keynote lecturers at that meeting were invited to write chapters for *Post-Dryout Heat Transfer*, taking their lecture material as a starting point and developing and updating that material to provide a unique collection of articles covering the subject of post-dryout heat transfer in a broad and systematic way.

The study of post-dryout heat transfer has received great impetus from its importance in the determination of maximum clad temperature in nuclear reactor loss-of-coolant accidents (LOCAs), but the deterioration of heat transfer in boiling, which is associated with the dryout phenomenon, is of wide importance in other industrial sectors. Thus, chemical process equipment, conventional power generation systems and refrigeration plants can all manifest the phenomena dealt with in this volume.

The first chapter (by J. C. Chen and G. Costigan) deals with post-dryout heat transfer in dispersed flow. Most often, in flow boiling systems, the dryout event occurs in dispersed annular flow when the film is evaporated and entrained away. This leads to a post-dryout situation in which the remaining droplets flow as a dispersion in the channel. In Chapter 1, the experimental evidence for this situation is reviewed, as are the many methods that have been used for the prediction of the wall temperature profile.

Once the surface is dried out (and consequently hot), the rewetting (or quenching) of the surface by reinstatement of flow or by reducing the heat flux is a highly complex transient process. Chapter 2 (by R. A. Nelson and K. O. Pasamehmetoglu) deals in detail with this important process, starting with a discussion of the various regimes occurring and then discussing conservation equations and their applications. A particularly important aspect of the problem is the interpretation and use of transient data. The use of the "boiling surface" concept is described in detail.

Although most studies of post-dryout heat transfer have been with tubular geometry, the situation actually encountered in a nuclear reactor is that of a rod bundle. Chapter 3 (by L. E. Hochreiter, M. J. Loftus, F. J. Ehrbachert, P. Ihle and K. Rust) discusses this case and deals with both the intact bundle phenomena associated with spacer grids and also with the effects of bundle deformation following a LOCA ("clad ballooning").

By various visualisation techniques, it is becoming possible to observe the nature of the two-phase flow occurring in the post-dryout region. Chapter 4 (by

M. Ishii) reviews this information and its physical and analytical interpretation. Of particular significance here is the breakdown of the liquid core in film boiling by wave growth mechanisms.

In the subcooled and low quality regions, it is possible to have "inverted annular flow" in which the liquid flows as a core in the centre of the channel, separated from the channel wall by a thin vapor layer. Chapter 5 (by D. C. Groeneveld) deals with this case and discusses the various prediction methods that can be applied to it.

In the final chapter of the book (by K. Tuzla, C. Unal, and J. C. Chen), a new series of experiments is described in which measurements of thermodynamic non-equilibrium were made by means of probes in the channel (which was a nine-rod bundle).

As will be seen from the above description, this book gives rather comprehensive coverage of the subject of post-dryout heat transfer and should be of archival value to those working on the subject.

The editors would like to thank the contributing authors for their efforts in making this volume possible. They would also like to thank Mrs. B. Granito, who prepared the manuscript.

The Editors

Post-Dryout Heat Transfer *is part of the Multiphase Science and Technology series. Volumes I through VI are published by the Hemisphere Publishing Corporation.*