Preface

Five years ago, a first book entitled *Microscale and Nanoscale Heat Transfer* was put together, and eventually published in 2007 as number 107 in the Springer TAP series. The aim was to bring together a group of scientists with a common interest in heat transfer problems on the micro- and nanoscales. Since then, it has become clear that these problems constitute a key feature of the nanoscience adventure. Apart from the fact that energy has become a major theme today, for which solutions are required across the board, including in the area of nanotechnology, nanoscale heat transfer is now a major issue for very high level international research groups who are moving beyond the limits set by their predecessors and whose reports are now being published in high-profile, wide-readership journals such as Nature and Science. Knowledge in this area has thus progressed, and its applications are ever more diverse.

Although the present manuscript has been put together by a similar scientific community to the one that produced the first volume, i.e., a research group under the aegis of the French National Research Administration (CNRS), referring essentially to the departments of engineering and information science, the book is not merely an extension of the first volume, since a large part of it is devoted to a whole range of new applications.

The field of applications is divided into two main parts. The first corresponds to Part I of the book and concerns nanomaterials and their heat transfer properties. This part is itself divided into two themes. The first, Chaps. 1–3, is a somewhat theoretical review of the physics of nanostructures, while the second, Chaps. 4–8, deals with the effective properties of composites. Part II concerns microsystems and three types of application: thermoelectric energy conversion systems in Chap. 9, in vitro and in vivo biological systems in Chaps. 10 and 11, respectively, and microelectronic systems in Chap. 12.

Following this is a third and final part relating to advanced thermal measurement techniques. Some of these are recent developments of methods already introduced in the previous volume, while others correspond to fundamentally new systems. This part contains two chapters devoted to optical metrology (Chaps. 13 and 14), three describing different forms of local probe microscopy (Chaps. 15–17), and finally a chapter on low-temperature thermometry (Chap. 18).

This book brings together a quite remarkable overview of the state of the art, producing a continuous spectrum of subjects that broadly covers all the various fields of application of nanoscale heat transfer from solid state physics to biology. Such a perspective should be useful for doctoral students wishing to obtain their own general awareness of the specific themes discussed here. But it should also provide a way for practising research scientists to enter this particularly rich area of investigation, deepening and broadening their own skills or making their own contribution to the field.

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Tokyo, March 2009 *Sebastian Volz*

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