Chapter

Introductory Chapter: Heat and Mass Transfer - Advances in Science and Technology Applications

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1. Introduction

Heat and mass transfer is the core science for many industrial processes as well as technical and scientific devices. Automotive, aerospace, power generation (both by conventional fossil-based technologies and also by renewable energies), industrial equipment and rotating machinery, materials and chemical processing, and many other industries are involving heat and mass transfer processes.Consequently, both heat transfer and mass transfer are disciplines of the highest significance in technology and industry and obviously also in research and academia. As an example, over 10,000 journal publications are published every year with the latest scientific developments.

This book, titled *Heat and Mass Transfer: Advances in Science and Technology Applications*, intends to provide researchers and practitioners with a valuable compendium of significant advances in the field of heat and mass transfer, focusing both on the scientific and research fields and also on applications within industrial scenarios. There is a clear rationality in presenting both heat and mass transfer within a single book, as it must be considered that both processes are governed by very similar mathematical equations, particularly in the case of diffusion and convection (however, heat radiation is not having a similar process in mass transfer).

The book includes 19 chapters, arranged in a set of 8 sections according to the logic and significance of its contents. The book comprises sections focused on industrial applications, such as heat transfer in industrial processes or heat transfer in power generation. An extensive collection of chapters dealing with heat and mass transfer process relevant to industry is included, such as steam boilers, heat exchanger optimization, cryogenics, concentrated solar power (CSP), additive manufacturing processes for metals, supercritical CO_2 precipitation, falling film evaporators, or non-Newtonian fluids in mixing vessels. Other sections such as thermodynamics or theoretical approaches for heat transfer problems are involving chapters more focused on scientific aspects, with topics covering bio-convective linear stability, diffusion of Fe_2B layers on steels, Rayleigh convection in viscoelastic fluids, irreversible thermodynamics, or calculation of thermal properties, among others. The book also contains sections covering heat and mass transfer in new and emerging technologies, multiphase flows and phase change, and mass transfer processes.

Experimental setups and results are covered within the book, but as modeling and simulation techniques are increasingly contributing to the development of

heat and mass transfer research and applications, several chapters are involving theoretical and numerical modeling and simulation developments and examples, also including computational fluid dynamic (CFD) applications. The application of optimization methods such as response surface methodology (RSM) and genetic algorithm (GA) is also covered within the book. At the end of each chapter, a rich number of references are included for ensuring the continuity and further reading on each particular topic.

Some of the classic and well-known references covering both introductory and advanced topics are the books from Incropera et al. [1] or Rohsenow et al. [2]. A recognized handbook also covering many aspects in mass transfer is written by Cheremisinof and Adams [3] as well as the book by Bird, Stewart, and Lightfoot on transport phenomena [4]. For heat and mass transfer topics in chemical engineering, the handbook from Perry and Green [5] is also recommended.

I sincerely believe that the content of the book will be of interest to researchers, practitioners, and graduate students within the many disciplines and applications involved.

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