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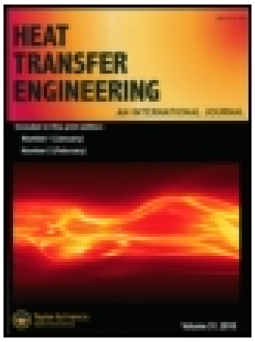


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GUEST EDITORIAL

# FRONTIERS AND PROGRESS IN MULTIPHASE FLOW AND HEAT TRANSFER

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Multiphase flow and heat transfer are critical in both traditional and newly emerging engineering fields. Understanding the fundamentals and mechanisms of multiphase flow and heat transfer is continuously needed in order to develop the relevant technology for engineering applications. With the rapid development of various relevant interdisciplinary subjects and technologies, the research of multiphase flow and heat transfer is growing very fast nowadays than ever before. For instance, due to the rapid development in fabrication techniques, the miniaturization of devices and components is ever increasing in a wide range of engineering applications. Applications of microscale and nanoscale two-phase flow and thermal phenomena involved in traditional industries and highly specialized fields such as microfabricated fluidic systems, microelectronics, micro heat transfer and high heat flux cooling have been becoming particularly important since the late 20th century. However, microscale and nanoscale two-phase flow and heat transfer phenomena are quite different from those in macroscale and conventional systems. Over the past decades, quite a few studies have been conducted to understand the very complicated two-phase and heat transfer phenomena and to propose the relevant new mechanisms, models and theory. However, there are still many issues to be clarified from both theoretical and applied aspects of this important field. Furthermore, interdisciplinary research areas relevant to multiphase flow and heat transfer are also rapidly developing. As a new research frontier of nanotechnology, the research of nanofluid two-phase flow and thermal physics is rapidly growing over the past decade. However, it has also posed new challenges because there are contradictory results in the available research. The fundamentals and mechanisms of nanofluid two-phase flow and heat transfer are far from understanding and therefore the relevant research is urgently needed. Furthermore, how to put the two-phase flow and heat transfer with nanofluids into practical engineering application is another big issue because there are contradictory results in the existing experimental studies and the physical mechanisms are not well understood. All the newly emerging research areas require the understanding of fundamentals, mechanisms and applications of the microscale and nanoscale two-phase flow and thermal transport phenomena.

This special issue is aimed to present recent frontier and progress research in multiphase flow and heat transfer covering both microscale, nanoscale and macroscale research topics from several research groups all over the world. There are seven articles covering various topics: (1) Fundamental issues, technology development and challenges of boiling heat transfer, critical heat flux and two-phase flow phenomena with nanofluids; (2) The effect of transient power hotspots on the heat transfer coefficient during flow boiling inside single microscale channels; (3) Heat transfer characteristics and flow visualization during flow boiling of acetone in semi-open multi-microchannels; (4) Convective heat transfer in a heat generating porous layer saturated by a non-Newtonian nanofluid; (5) Thermal transport in sheared nanoparticle suspensions: effect of temperature; (6) Flow boiling heat transfer of R134a in a helically coiled tube; and (7) Void fraction measurement of gas-liquid two-phase flow based on empirical mode decomposition and artificial neural networks.

It is our great wish that this special issue can exchange recent frontier research in both newly emerging and traditional subjects of multiphase flow and heat transfer to our community. Finally, we would like to express our gratitude to all authors who have contributed to this special issue.



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**Lixin Cheng** is a principal lecturer at Sheffield Hallam University, UK. He obtained his Ph.D. in Thermal Energy Engineering at the State Key Laboratory of Multiphase Flow at Xi'an Jiaotong University, China in 1998. He has extensive international working and collaboration experience for 18 years. He worked as an associate professor at Aarhus University, Denmark in 2013-2015, a senior lecturer at the University of Portsmouth, UK in 2011-2013, and a lecturer at the University of Aberdeen, UK in 2009-2011. He worked as a scientific collaborator in the Laboratory of Heat and Mass Transfer

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