

UNIVERSITY OF MACAU
FACULTY OF SCIENCE AND TECHNOLOGY
DEPARTMENT OF ELECTROMECHANICAL ENGINEERING

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**“Microscale Transport Characteristics in
Micro-Energy Systems”**

by

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Abstract

Advances in micro-fabrication technologies have led to the recent miniaturization of many energy systems such as microchannel heat sinks, micro-evaporators, micro-condensers, micro-fuel cells, and micro-chemical reactors etc. For optimal design of these micro-systems, it is important to understand microscale transport processes occurring in these systems. As the characteristic length of the system becomes smaller, gravitational force is negligible compared with surface tension force, and interfacial effects such as wettability and roughness effects play major roles in many transport processes. For flow boiling in microchannels, the size effect leads to large-amplitude temperature and pressure oscillations which may result in early burnout. Methods of enhancing nuclear boiling and delaying critical heat flux by modifications of surface wettability and microstructures are discussed. For condensation flow in microchannels, stratified flow no longer appears and intermittent flow becomes the predominant condensation flow pattern. Recent advances in numerical simulation of boiling and condensation heat transfer in microchannels by the lattice Boltzmann (LB) method will be summarized. Pore-level simulations based on LB method on water droplet formation in gas diffusion leading to flooding problems in fuel cells will be presented.

Biography

Dr. Ping Cheng, a member of Chinese Academy of Sciences, is presently a Chair Professor of School of Mechanical Engineering at Shanghai Jiaotong University (SJTU). Prof. Cheng was born in Guangzhou and spent his childhood in Macau where he graduated from Pui-Ching Middle School (培正中学). He obtained his B.S. degree in Mechanical Engineering from Oklahoma State University, his M.S. degree in Mechanical Engineering from MIT, and his Ph.D. in Aeronautics and Astronautics from Stanford University. Prior to his present position, he served as Chairman of Mechanical Department at University of Hawaii (1989-1994) and as 2nd Head of Mechanical Engineering Department at Hong Kong University of Science and Technology (1995-2002).

Prof. Cheng has done seminal research work in porous-media heat transfer with applications to geothermal energy recovery and fuel cells, radiative gasdynamics with applications to re-entry of space vehicles, and in microscale heat transfer with applications to cooling of electronic chips. He has published over 200 SCI journal papers that have been cited more than 6000 times according to Science Citation Index (SCI), achieving an H-factor of 41. A Fellow of both American Society of Mechanical Engineers (ASME) and American Institute of Aeronautics and Astronautics (AIAA), Prof. Cheng has received four top international honors, including (i) 2005 ASME/AIChE Max Jakob Memorial Award (the highest honor in the field of heat transfer), (ii) 1996 ASME Heat Transfer Memorial Award, (iii) 2003 AIAA Thermophysics Award, and (iv) 2006 ASME Heat Transfer Classic Paper Award. He was also a recipient of 2006年上海市科学技术一等奖 and 2007年国家自然科学二等奖. He was bestowed the 2009年上海交通大学校长奖 and 2011年上海交通大学杰出校友奖 for his contributions in SJTU's heat transfer program.

Prof. Cheng is also very active in professional service, serving as Editors for International J. of Heat & Mass Transfer and International Communications on Heat & Mass Transfer. He is also on the editorial boards of 14 other international heat transfer and energy journals. He will be Conference Chair of the 16th International Heat Transfer Conference to be held in Beijing on Aug.10-18, 2018.

ALL ARE WELCOME!