

High-Efficiency Heat Exchange Technologies for Energy Conversion and Utilization

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Abstract: Heat exchangers play an important role in many engineering processes especially energy conversion and recovery systems, such as oil refining, chemical industry, electric power generation, refrigeration, and so on. The compact and/or high-efficiency heat exchangers, for which some heat transfer enhancement technologies are usually adopted, become more and more important for sustainable developments. Usually, an enhanced heat transfer surface has a special surface geometry that provides a higher thermal performance, per unit base surface area than a plain surface. The increase in heat transfer capacity per unit volume comes at the expense of an increase in pressure drop across the heat exchanger. This pressure drop may be significant, so the heat transfer enhancement is often limited by the pumping power available. Therefore, it is always crucial to find effective ways to enhance heat transfer with minimum pressure drop penalty. In this lecture, the recent developments on heat transfer enhancement for the several kinds of heat exchangers, that is, the shell-and-tube heat exchangers (STHXs) with helical baffles (usually for liquid medium at the shell side), the high-temperature heat exchangers with inner/outer finned tubes or primary surfaces (usually for gas-gas heat exchange), and the phase-change HEXs for cascade utilization, are presented. The heat transfer enhancement mechanism, the correlations of heat transfer and pressure drop for complex surfaces/channels, and the multi-objective optimization design as well as prediction, are obtained for industrial applications. Based on the research results, several new-patented heat exchangers, such as the continuous/combined and multiple shell-pass helical baffled STHXs, the primary-surface recuperators, the high temperature heat exchangers with inner/outer finned tubes, and the phase-change GWHs are developed to save energy, reduce cost, and prolong the operation time.

Keywords: Heat transfer enhancement technologies; Energy conversion and utilization; Compact heat exchangers

About the Speaker

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Dr. Qiuwang Wang is now a full professor and vice-Dean of School of Energy and Power Engineering, Xi'an Jiaotong University. He is also the deputy Director, MOE International Joint Research Lab of Thermal Science and Engineering (IJRL-TSE) of China. He is a recipient of National Funds for Distinguished Young Scientists by NSF of China (2010) and Changjiang Scholarship Chair Professor by Ministry of Education of China (2013). His research team obtained the 2nd Grade National Award for Technological Invention of China (2015).

Dr. Wang is now the China Delegate of Assembly for International Heat Transfer Conferences (AIHTC), a member of Scientific Council of the International Centre for Heat and Mass Transfer (ICHMT), Chair of ASME Heat Transfer Division K-18, an Associate Editor of Heat Transfer Engineering Journal, and Editorial Board Members for several international journals such as Energy Conversion and Management, Applied Thermal Engineering, etc. He is the Initiator of International Workshop on Heat Transfer Advances for Energy Conservation and Pollution Control (IWHT) (since 2011, 2011-Xi'an, 2013-Xi'an, 2015-Taipei, 2017-Las Vegas, 2019-Novosibirsk). In China, he is a vice president of Chinese Society of Engineering Thermophysics in Heat and Mass Transfer.

His research interests include heat transfer enhancement and its applications to engineering problems, high-temperature/high-pressure heat transfer and fluid flow, transport phenomena in porous media, numerical simulation, prediction & optimization, etc. He has delivered more than 40 Plenary/Keynote/Invited lectures in international conferences or foreign universities. He has also been authors or co-authors of 4 books and more than 150 international journal papers. He has obtained 20 China Invent Patents and 2 US Patents.