中国科学院力学研究所
高温气体动力学国家重点实验室

学术报告：**Nanofluids as an Advanced Coolant for High Heat Flux Nuclear Fusion Reactors**

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摘要：
Nanofluids is a new class of coolants, engineered by dispersing and stably suspending nanoparticles with typical sizes of the order of 1–100 nm in conventional liquid coolants (base fluids). During the last two decades, Nanofluids have attracted significant interest due to reports of unexpectedly superior heat transfer properties over those of conventional fluids. It appears that the addition of a small amount of nano-sized particles (around 1-2% by vol.) can deliver a dramatic improvement in the thermal properties of the base fluid (from 5% up to 200% for certain heat transfer modes). However, insufficient understanding of the formulation and underlying physical mechanisms of heat transfer in Nanofluids has led to an increased controversy and inconsistency among the numerous theoretical, numerical and experimental studies. Therefore, before using Nanofluids for commercial applications, understanding the physical mechanisms of flow and heat transfer is required. The talk will present different aspects of the behaviour of Nanofluids, as follows: (a) Statistical review of reported observations of changes of the heat transfer coefficient for different heat transfer modes and assess the statistical significance of the findings; (b) A possible explanation for the increase of the heat transfer coefficient through a study of dispersion of nanoparticles in liquids using Molecular Dynamics Simulations; (c) Experimental study of the liquid flow behaviour in Hypervapotron heat exchangers, relevant to forced convection heat transfer; (d) Experimental study of heat transfer under Natural Convection, including optimisation of stability of Nanofluids; (e) Initiation of experimental studies of boiling heat transfer. The talk will end with suggestions for future studies.

报告人介绍：
Prof. Y. Hardalupas, DIC, PhD, FInstP. Professor of Multiphase Flows, Imperial College London, Mechanical Engineering Department. He received Mechanical Engineering degree from National Technical University of Athens, Greece in 1984. After completing his PhD at Imperial College London, he was awarded an EPSRC Advanced Research Fellowship on experimental research on combustion of liquid and solid fuels in 1994. He joined the academic staff at Mechanical Engineering Department of Imperial College in 1997 and was promoted to Professor in 2009. He was awarded an industrial secondment to Ricardo Consulting Engineers in 1999, sponsored by the Royal Academy of Engineering, for development of computational models for atomization of liquid fuels in IC engines. Fellow of the Institute of Physics, Associate fellow and member of the technical committee of Propellants and Combustion of the American Institute of Aeronautics and Astronautics (AIAA). He chairs the Combustion Physics Group of the Institute of Physics and serves at the editorial board of *Experiments in Fluids*, *J. of Combustion* and *Int. J. of Spray and Combustion Dynamics* and at the advisory committees of several international conferences. Author of more than 250 peer reviewed papers. His research grant and industrial contract support have been from Engineering Physical Sciences Research Council (EPSRC), European Union, Ford, Honda, Shell, Nissan, BP, Rolls-Royce, Siemens, Mitsubishi, P&G, Unilever, AFOSR, Culham Centre Fusion Energy (CCFE), Continental GmbH, Delphi. In addition to his contributions in the areas of combustion, heat and mass transfer, liquid atomization and sprays, the development of novel optical techniques has led to patents for novel instruments on powder sizing, planar droplet sizing and nanoparticle sizing.

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