



ME Distinguished Lecture

Transient spray cooling and the Leidenfrost temperature

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ABSTRACT

In this seminar the hydrodynamics and thermodynamics involved in drops impacting onto hot surfaces will be examined for a large range of drop Reynolds and Weber numbers as well as for a large range of surface temperatures, typical of industrial spray cooling situations as encountered in quenching or cooling of high performance electronics. Building on high-speed visualization of drop and spray impact onto hot surfaces and using local measurements of heat flux and drop impact parameters, analytical models are formulated for the main regimes of thermodynamic interaction – natural convection, nucleate boiling, thermal atomization, film boiling. These models are then applied to predict transient spray cooling scenarios, in which hot surfaces are cooled from temperatures exceeding the Leidenfrost limit. These predictions are validated and refined using corresponding experiments in which all necessary measurement quantities are captured. Particular attention is paid to the determination of the Leidenfrost temperature, which is shown to be largely independent of spray parameters and primarily dependent on the thermal properties of the substrate.

ABOUT THE SPEAKER

Cameron Tropea graduated from the University of Toronto in Engineering Sciences, followed by a Masters degree in Mechanical Engineering (1977). He completed his Dr.-Ing. in Civil Engineering at the Technical University of Karlsruhe (1982) and his Habilitation in Fluid Mechanics at the University of Erlangen-Nürnberg (1991) where he was appointed as Professor of Fluid Mechanics until 1997. This was followed by an appointment to his current position at the Institute of Fluid Mechanics and Aerodynamics at the Technische Universität Darmstadt. Currently Editor-in-Chief of the Springer journal Experiments in Fluids and past Director of the Center of Smart Interfaces (CSI) in the period 2007-2014, his research interests include Optical Measurement Techniques in Fluid Mechanics, Interfacial Transport Phenomena, Atomization and Spray Processes and Unsteady Aerodynamics. He has recently been appointed a member of the Scientific Commission of the Council of Science and Humanities in Germany.



Feb. 25, 2020, 3:30 pm, AR Auditorium
Refreshments after the seminar