KEYNOTE LECTURE

STUDY OF FLOW BOILING OF R-245FA AT HIGH SATURATION TEMPERATURE: A TOOL FOR AN IMPROVED UNDERSTANDING OF THE THERMOHYDRAULICS OF BOILING REFRIGERANTS IN MICRO-, MINI- AND MACROCHANNELS

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Jocelyn Bonjour is a Professor of Heat Transfer and Air-Conditioning at INSA Lyon (National Institute of Applied Sciences) since 2005. He is the head of the Phase Change Heat Transfer group at CETHIL (Centre for Thermal Sciences in Lyon). He received his PhD at INSA de Lyon in 1996, and was formerly Assistant Professor at the French Institute of Refrigeration (IFFI), Paris, France and at Nantes Polytechnic School and is currently the secretary of the Commission B1 ("Thermodynamics and Transport Processes") of International Institute of Refrigeration. The core area of his research is linked to liquid-vapour phase change heat transfer and covers the fundamentals of boiling (e.g., boiling in: micro-channels, in presence of oil, under electric fields), the application of phase-change in capillary-driven heat pipes for electronic thermal management, and in air-conditioning systems. A specific interest for thermodynamics, energy and exergy analysis, and constructal theory is also a part of his interests.

ABSTRACT

Organic Rankine Cycle (ORC) has kindled a renewed interest to recover waste heat energy from IC engines and for energy recovery from other thermo-mechanical energy conversion systems to achieve higher efficiency. In a typical ORC cycle, the thermodynamic conditions of working fluid at the evaporator (evaporating temperature of 100°C and more, i.e. high reduced temperature) are fairly different from standard relevant refrigeration or air-conditioning systems. Thus, it becomes essential to understand the flow boiling characteristics (pressure drop, heat transfer coefficients) of refrigerants (R-245fa) in a tube of 3 mm I.D., at conditions typical to that of ORC system (saturation temperature ranging from 60°C to 120°C). This talk will elaborate an experimental test facility specifically designed to realize the above needs. The influence of main flow parameters (saturation temperature, mass flow rate) on the pressure drop and heat transfer mechanisms will be highlighted. Apart from the applicative motivation of ORC, these experimental results for flow boiling at high saturation temperature, reinvestigates the current understanding about thermo-hydraulics of flow boiling of synthetic refrigerants. The results also shed light on the concept of macro to microscale transition in flow boiling.