Eleventh International Conference on
TWO-PHASE SYSTEMS FOR GROUND AND SPACE APPLICATIONS
Marseilles, FRANCE, September 26-29, 2016

Wall-temperature distributions on thin metal foils in saturated and subcooled pool boiling

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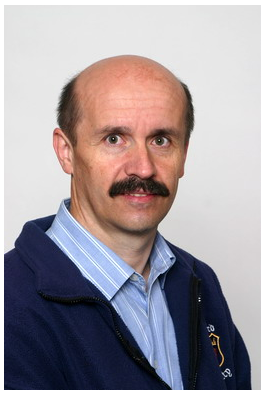

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Bibliography

Iztok Golobic is a professor and head of Laboratory for Thermal Technology, Faculty of Mechanical Engineering, University of Ljubljana, Slovenia. His research is in the areas of heat and mass transfer, process engineering, pool boiling, pool boiling critical heat flux, heat pipe, enhanced heat transfer, thermodynamic properties of fluids and waste heat recovery. Iztok Golobic received his B.S., M.S. and PhD. in mechanical engineering from University of Ljubljana. He has supervised almost 180 engineer's, master's and doctoral theses in the research area heat and mass transfer and process engineering. His recent research has focused on nucleate boiling process, boiling in microchannels and waste water technology. Iztok Golobic is president of Slovene Association of Mechanical Engineers and vice president of Slovene Association of Engineers.

Abstract

Boiling on thin Joule heated metal foils is one of the few approaches that allow studying transient temperature fields underneath the growing vapor bubbles. In our experiments, we use synchronized high-speed video and high-speed infrared cameras to visualize the departing bubbles with the corresponding local wall-temperature measurements. In terms of boiling performance evaluation, recent study [1] showed that wall-temperature distributions are good alternative to classical boiling curves. These distributions are calculated form spatio-temporal thermographs and provide spectra of information, such as the maximum, minimum and mean wall superheat and the standard deviation of the wall temperature (see Fig. 1). Main objective of the lecture is to present the effect of fluid type and subcooling on pool boiling performance. Differences in boiling behavior will be explained through wall-temperature probability density distributions, nucleation frequencies and density of active nucleation sites over al large span of heat fluxes. The results should provide a better insight into the complex phenomena of nucleate pool boiling for high-surface-tension fluids (water) and low surface-tension fluids (FC-72) at different subcooling rates, which could be in future compared with the data obtained in microgravity conditions. Among that, wall-temperature distributions are also useful for comparing the experimental data with numerical simulation results.

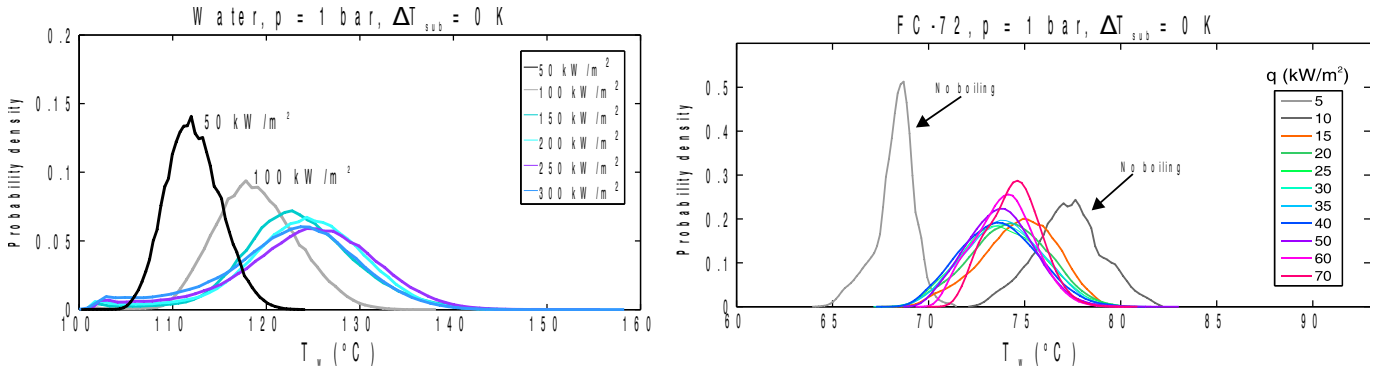

Fig. 1 Wall-temperature distributions for saturated pool boiling of water (left-hand side) an FC-72 (right-hand side) on 25-µm stainless-steel foil (S316).

[1] I. Golobič, M. Zupančič, Wall-temperature distributions of nucleate pool boiling surfaces vs. boiling curves: A new approach, *Int. J. Heat Mass Transfer,* 99, 541-547 (2016).