# AN INVESTIGATION OF THE FUNDAMENTAL ASPECTS OF FLOW BOILING OF ORGANIC FLUIDS UNDER REDUCED PRESSURES NEAR TO THE CRITICAL POINT

Work Plan: Doctoral Fellowship

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## Abstract

The present research proposal consists of an investigation of nucleate boiling under pressure conditions close to the critical point (reduced pressures higher than 0.7). It involves performing flow boiling experiments in a rectangular horizontal channel (hydraulic diameter of 5mm) and evaluating through infrared thermography fundamental aspects of nucleate boiling such as bubble nucleation site density, bubble departure frequency, bubble growth and waiting periods and the contributions of microlayer evaporation, evaporation at the triple contact line and single-phase convection to the overall heat flux. In the study of such aspects, special attention will be given to conditions of low to intermediate vapor qualities, focusing on bubbly and elongated bubbles flows. Based on these results, it is expected the development of heat transfer models based on the "Heat Flux Portioning Approach". The investigation will be based on images of the heating surface obtained with the help of an IR camera (FLIR X6580sc, 4500fps/ 640x512 pixels) and images of the boiling process captured through a high-speed video camera (Phantom V2012, 22600fps, 1280x800pixels). Spatial Filter Velocimetry technique (SFV) will be used to analyze the flow velocity field from the high-speed images obtained during the boiling process. Experiments will be performed for mass velocities from 200 to 400 kg/m$^2$s and R245fa and R1336mzz(z).

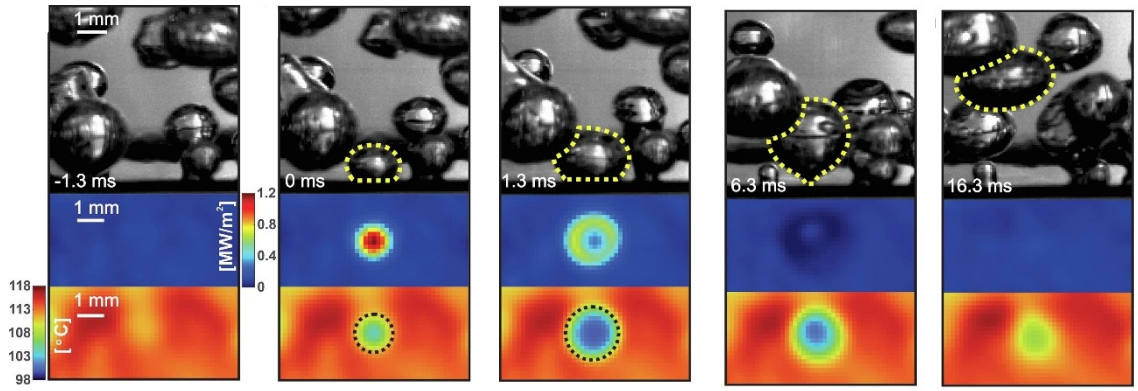


**Figure 1.** Example of the bubble life cycle at an average heat flux of 100 kW/m$^2$ captured with synchronized video camera and IR camera (modified from Zupancic et al. [1]).

## References

[1] Zupancic, M., Gregorcic, P., Bucci, M., Wang, C., Aguiar, G.M., Bucci, M. The wall heat flux partitioning during the pool boiling of water on thin metallic foils, *Applied Thermal Eng.*, vol. 200, p. 117638, 2022.