Presenting Author: Ileana Malavasi ***Preferred Format: Oral***
E-mail: ileana.malavasi@unibg.it ***Main Topic: wettability effect on heat transfer***

Appearance of a low superheat "quasi-Leidenfrost" regime for boiling on superhydrophobic surfaces

I. Malavasi[a], B. Bourdon[b], P. Di Marco[c], J. de Coninck[b], M. Marengo[a,d]

[a] *Department of Engineering and Applied Science, University of Bergamo, Viale Marconi 5, 24044 Dalmine, Italy*
[b] *Laboratoire de Physique des Surfaces et des Interfaces, Université de Mons, Av. Maistriau 19 B, 7000 Mons, Belgium*
[c] *Università di Pisa – DESTEC, Largo L. Lazzarino, 1, 56122, Pisa, Italy*
[d] *University of Brighton, School of Computing, Engineering and Mathematics, Lewes Road, BN2 4GJ, Brighton, UK*

Pool boiling experiments were performed with degassed water on stainless steel substrates with different surface topography and wettability. Boiling curves were determined and high-speed visualizations of the boiling processes were performed. The onset of nucleate boiling (ONB) has been measured and the influence of roughness and wettability has been quantified. Boiling curve shape is different between hydrophilic and superhydrophobic case (Fig. 1): on superhydrophobic surfaces the ONB is reached at lower superheat and boiling presents a quasi-Leidenfrost regime without showing the typical "S" shape of the boiling curve, i.e. without passing through a CHF point. Bubbles are easier to form on superhydrophobic surfaces, therefore the nucleation temperature is smaller, and bubbles are larger and stable. The ONB appears after less than 5°C of superheat on superhydrophobic surfaces, while on hydrophilic surfaces with the same surface roughness the required superheat is above 8°C. Furthermore, superhydrophobic samples, although presenting different roughness, present the same boiling curve, meaning that the wettability has a predominant role on the surface roughness when the contact angle exceeds a certain value.

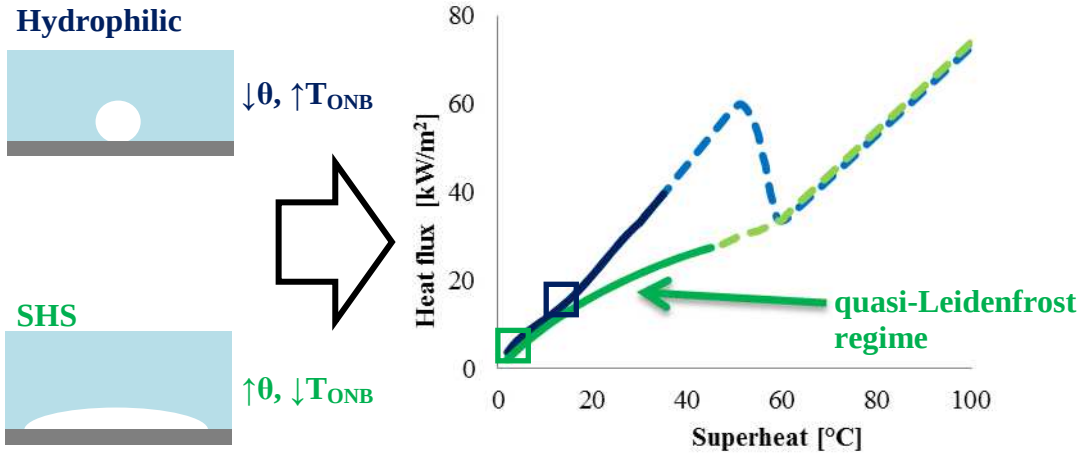

Fig. 1 Schematic representation of the bubble formation on hydrophilic and superhydrophobic surfaces with the corresponding boiling curve. Continuous lines represent the experimental curves found for hydrophilic (blue line) and SHS (green line) cases. Dashed lines represent the boiling curves hypothesized if the experimentation could have been extended at higher wall superheat, which was prohibited by the maximum allowable temperature of the Captec flux sensor. The ONB for the respective cases is highlighted by the square box.