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Pool boiling on horizontal tube, evaluation of ten correlations

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The heat transfer coefficient during the pool boiling on the outside of a horizontal tube can be predicted by correlations. Our choice was based on ten correlations known from the literature. The experimental data were recovered from the recent work, for different fluids used. An evaluation was made of agreement between each of the correlations and the experimental data. The results of the present study firstly showed a good reliability for the correlations of Labuntsov [10], Stephan and Abdeslam [11] with deviations of 20% and 27%, respectively. Also, the results revealed acceptable agreements for the correlations of Kruzhlin [6], Mc Nelly [7] and Touhami [15] with deviations of 26%, 29% and 29% respectively. The remaining correlations showed very high deviations from the experimental data. Finally, improvements have been made in the correlations of Shekriladze [12] and Mostinski [9], and a new correlation was proposed giving convincing results.

Nomenclature

a thermal diffusivity, m^2/s
B correlation coefficient [11]
c_p heat capacity, J/kg K
D diameter of the tube, m
F_p pressure function [7]
g gravity acceleration, m/s^2
h heat transfer coefficient, W/m^2K

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K correlation coefficient [10]
l_c capillary length, m
L latent heat of vaporization, J/kg
Nu Nusselt number
P pressure, N/m^2
Pr Prandtl number
q heat flux, W/m^2
r correlation coefficient
r_o radius of the nucleation site, m
R_a arithmetic roughness, nm
Re Reynolds number
R_i individual perfect gas constant, J/kg K
R_q Quadratic roughness, nm
T temperature, K

Greek symbols

β angle contact, degree
Δ difference
ε quadratic roughness, µm
λ thermal conductivity, W/m K
μ dynamic viscosity, Pa s
ν kinematic viscosity, m^2/s
ρ density, Kg/m^3
σ surface tension, N/m

Subscripts

c critic
cal calculated
d departure
exp experimental
l liquid
v vapor
w wall
r reduced
sat saturated

1. Introduction

The production of steam is a very important process in industrial installations. This process exists in thermal power plants, the food industry, the manufacture of chemical and pharmaceutical products, and other systems. Steam produced by boiling manifests on the inner or outer surface of tubes mounted vertically, horizontally or in other arrangement. But generally, there are only five pieces of equipment where boiling takes place outside horizontal tubes, namely steam boilers with smoke tubes, evaporators with shells and horizontal tubes, boilers of the kettle type, and internal and external thermosyphon boilers.

Heat transfer by boiling has always attracted particular attention, because it allows a large amount of heat to be transferred for a low temperature gradient. Where, this phenomenon is involved during heat transfer accompanied by phase change, remains a physical epiphenomenon difficult for modeling. It is widely known through experiments that it is sensitive to several parameters such as heat flux, saturation pressure, thermo-physical properties of the fluid, and characteristics of the heating surface (geometry, orientation, dimensions, roughness, and the thermo-physical properties of the material). The need to design the equipment with heat transfer through boiling requires methods for evaluating the heat transfer coefficient, which is currently predicted by correlations drawn from the literature. The modeling is based on a physical approach, supplemented by an empirical method and verified by experimental data from the literature. Many correlations giving the heat transfer coefficient during the boiling for pure liquids have been published, where some of these formulas have been widely used for the prediction of heat transfer coefficients in several industrial applications.

Extensive research has been done by Pioro et al. [1] to evaluate the heat transfer execution during boiling. They analyzed several correlations, and reported that the heat transfer coefficient is determined by several parameters such as heat flux, saturation pressure, and thermo physical proprieties of working fluids. In addition, they advised that these correlations need more elaboration by considering other parameters such as the surface of the material in contact with the fluid.

Sathyabhama and Hegde [2] evaluated eight correlations available in literature using ammonia as the working fluid. They concluded that there are some reliable correlations for the prediction of the heat transfer phenomenon through boiling; while others correlations require corrections. In the same line, Baki and Aris [3] carried out an experimental study of the boiling of R141b on a horizontal tube. Their results were compared with others drawn from the literature. They showed that the empirical correlations still require corrective work [4, 5].

In this context, and in order to select the most accurate correlations for the prediction of heat transfer coefficients through boiling, several recent and earlier correlations have been examined in this paper. The protocol for assessing the reliability of these correlations is based on the error of the deviation compared to experimental data taken from the literature.

2. Correlations and data review

2.1. Correlations review

There are many correlations that present a solid reference in the field of heat transfer through boiling. Over time, the development of measuring devices has allowed researchers to develop other empirical formulas compared to the old ones. But, as we mentioned above, all correlations need corrections and introduction of other physical or geometrical parameters [6–15].

Table 1 includes and chronologically presents the correlations that are examined and evaluated in the present paper. All these correlations can be used to

Table 1. Correlations of the heat transfer coefficient prediction under the pool-boiling

Authors	Correlation	
Kruzhilin [6]	$\frac{hl_c}{\lambda} = 0.082\left(\frac{Lq}{g\,(T_{\text{sat}}+273.15)\,\lambda}\,\frac{\rho_v}{\rho_l-\rho_v}\right)^{0.7} \cdot \left(\frac{(T_{\text{sat}}+273.15)\,c_P\sigma\rho_l}{L^2\rho_v^2 l_c}\right)^{0.33}\text{Pr}^{-0.45}$	(1)
Mc Nelly [7]	$h = 0.225\left(\frac{qc_p}{L}\right)^{0.69}\left(\frac{p\lambda}{\sigma}\right)^{0.31}\left(\frac{\rho_l}{\rho_v}-1\right)^{0.32}$	(2)
Foster and Zuber [8]	$\frac{q}{(T_w-T_l)\,\lambda}\left(\frac{\Delta T c_p\rho_l\sqrt{\pi a}}{L\rho_v}\sqrt{\frac{2\sigma}{\Delta p}}\sqrt[4]{\frac{\rho_l}{\Delta p}}\right) = 0.0015\left[\frac{\rho_l}{\mu}\left(\frac{\Delta T c_p\rho_l\sqrt{\pi a}}{L\rho_v}\right)^2\right]^{0.62}\left[\frac{\mu c_p}{\lambda}\right]^{0.33}$	(3)
Mostinski [9]	$h = 0.106P_{\text{cr}}^{0.69}q^{2/3}F_p$ and $F_p = 1.8(p_r)^{0.17}+4(p_r)^{1.2}+10(p_r)^{10}$	(4)
Labuntsov [10]	$h = 0.075\left[1+10\left(\frac{\rho_v}{\rho_l-\rho_v}\right)^{0.67}\right]\left(\frac{\lambda^2}{\nu\sigma T_{\text{sat}}}\right)^{0.33}q^{0.67}$	(5)
Stephan and Abdelsalam [11]	$\frac{qD_d}{\Delta T\lambda} = 0.23\left(\frac{qD_d}{\lambda T_{\text{sat}}}\right)^{0.674}\left(\frac{\rho_v}{\rho_l}\right)^{0.297}\left(\frac{LD_d^2}{a^2}\right)^{0.371}\left(\frac{\rho_l-\rho_v}{\rho_l}\right)^{-1.73}\left(\frac{a^2\rho_l}{\sigma D_d}\right)^{0.35}$ with $D_d = 0.0146\beta\left(\frac{2\sigma}{g\,(\rho_l-\rho_v)}\right)^{0.5}$	(6)
Shekriladze [12]	$\text{Nu} = \frac{hr_0}{\lambda} = 0.88\times10^{-2}K^{0.7}\text{Re}^{0.25}$ with $K = \left(\frac{qr_0^2\rho_v L}{\sigma\lambda T_{\text{sat}}}\right)$ and $\text{Re} = \left(\frac{c_pT_{\text{sat}}\sigma\rho_l}{L^{\frac{3}{2}}\rho_v^2\nu}\right)$	(7)
Yagov [13]	$q = 3.43\cdot10^{-4}\frac{\lambda^2\Delta T^3}{\nu\sigma T_{\text{sat}}}\left(1+\frac{L\Delta T}{2R_iT_{\text{sat}}^2}\right)\left(1+\sqrt{1+800B}+400B\right)$ and $B = \frac{L\,(\rho_v\nu)^{3/2}}{\sigma\,(\lambda T_{\text{sat}})^{1/2}}$	(8)
Fasel and Romana [14]	$h = \frac{3.253\sigma^{0.125}L^{0.125}q^{0.876}}{T_{\text{sat}}a^{0.145}}$	(9)
Touhami et al. [15]	$\frac{hD}{\lambda} = 0.5\left(\frac{qD}{\mu L}\right)^{0.67}\left(\frac{\mu c_P}{\lambda}\right)^{0.4}\left(\frac{p}{P_c}\right)^{-0.1}\left(\frac{\varepsilon}{D}\right)^{0.07}\left(\frac{l_c}{D}\right)^{-0.2}$	(10)

calculate the heat transfer coefficient directly or indirectly through the heat flux or the Nusselt number. Where, the predicted values are generally determined as a function of the heat flux. The thermo-physical characteristics of the fluid and the pressure are assembled in the form of dimensionless groups and brought to a given power.

The units used in these equations are from the international system of unities (SI), except for the correlation of Mostinski [9] where the pressure is in bar. The same applies to the correlation of Touhami et al. [15] by changing the coefficient 0.5 by 8.49×10^3, the units used will be in SI, or maintaining the same correlation, h will be in kW/m^{2}K and C_p in (kJ/kgK).

2.2. Data review

A set of experimental data was retrieved from the literature by Touhami et al. [15], taken up, and summarized in Table 2, totaling more than 1000 points, which relate to the pool boiling outside a horizontal tube. Three substances are considered, water [14–26], hydrocarbons [29–31] and refrigerants [32–35]. In this review, the diameter of the horizontal tube is varying from 4 to 51 mm and the absolute pressure is changing from 0.2 to 106.87 bars. The heat flux covers a range of 0 to 670 kW/m^2, the heat transfer coefficient is varying from 0 to 76 kW/m^{2}K.

The most prominent shades of the tube are copper and stainless steel. The thermo-physical properties of the various fluids have been retrieved from the NIST (National Institute of Standards and Technology) website.

2.3. Procedure of evaluation

A comparison of the experimental data with that predicted by each of the selected correlations is presented in the following figures; in order to make a comparative assessment. A visuel analysis of the points in the figures and a statistical study was made; a definition of error (Er), mean error (ME), standard deviation (Sd), and correlation coefficient (r) were retained respectively as follows:

$$\mathrm{Er} = \left| \frac{h_{\mathrm{cal}} - h_{\mathrm{exp}}}{h_{\mathrm{cal}}} \right|, \tag{11}$$

$$\mathrm{ME} = \sum_{i=1}^{n} \frac{\mathrm{Error}_i}{n}, \tag{12}$$

$$\mathrm{Sd} = \sqrt{\sum_{i=1}^{n} \frac{(\mathrm{Error}_i - \mathrm{Mean\ Error})^2}{n}}, \tag{13}$$

$$r = \frac{\mathrm{covariance}_{h_{\mathrm{exp}}} h_{\mathrm{cal}}}{\mathrm{variance}_{h_{\mathrm{exp}}} \cdot \mathrm{variance}_{h_{\mathrm{cal}}}}. \tag{14}$$

Table 2. Correlations of the heat transfer coefficient prediction under the pool-boiling

Authors	Fluid	Materiel tube	Diameter [mm]	Length [mm]	Roughness [nm]	Heat flux [kW/m^2]	Heat transfer coefficient [kW/m^{2}K]	Pressure bar	Number of points
Kang [16]	Water	Stainless-steel	9.7–19.05–25.4	300–530	Rq 15.1–60.9	0–154	0–16	1.01325	302
Kang [17]	Water	Stainless-steel	51	300	smooth	19-104	3-16	1.01325	5
Mehta [18]	Water	Copper alloy 101	15	20	–	29–670	8–38	1.01325	13
Das [19]	Water	Stainless-steel	4–6.5–20	ND	Rq 458	20–157	3–18	1.01325	22
Narayan [20]	Water	Stainless-steel	33	170	Ra 48	13–54	2–6	1.01325	5
Gorenflo [21]	Water	Copper	4.35	67	Ra 1910	19–121	2–13	1.04–4.42	13
Liu [22]	Water	Copper	18	100	smooth	1–380	1–76	1.01325	18
Qiu [23]	Water	Copper	18	100	smooth	10–101	2–10	1.01325	08
Rajulu [24]	Water	Brass	33	218	–	18–41	2–5	1.01325	05
Alavi Fazel [25]	Water	Stainless-steel	10.67	99.1	–	4–372	1–24	1.01325	14
Peyghambarzadeh [26]	Water	Stainless-steel	10.67	99.1	–	7–232	1–16	1.01325	14
Baumik [27]	Water	Stainless-steel	32	150	–	15–43	1–4	0.20–0.97	36
Elrod [28]	Water	Monel, Inconel, Carbon Steel	19.05	177.80	Rq 15000–62000	0–17	0–3	36.89–106.87	42
Chen [29]	Propane, isobutane	Carbon steel	19	115	Ra 1100 smooth	1–131	0–17	0.47–8.36	126
Jung [30]	Propylene, propane, isobutane, butane	Stainless-steel	19	152	Rp 3000	9–81	0–13	1.34–7.18	40
Zheng [31]	Ammonia	Carbon steel	19.1	600	–	9–60	2–4	5.58	6
Trisaksri [32]	R141b	Copper	28.5	90	Ra 3140	5–70	1–10	2-5	36
Jabardo [33]	R134a, R123	Copper, Brass, Stainless-steel	19	255	Ra 70–3000	1–117	0–20	2–5	252
Jung [34]	HCFC22, HFC134a, HFC125, HFC32	Stainless-steel	19	152	Rp 3000	9–81	2–17	3–11	32
Rocha [35]	R134a	Copper	21	42	Rp 220	0–97	0–17	8.6–12.2	55

3. Evaluation of correlations

Fig. 1 present the evaluation and comparison between experimental results summarized in Table 2 and the correlations of Kruzhilin [6], Mc Nelly [7], Foster and Zuber [8], Mostinski [9], Labuntsov [10], Stephan and Abdelsalam [11], Shekriladze [12], Yagov [13], Fasel and Romana [14], and Touhami et al. [15], respectively.

The correlation of Kruzhilin [6] gives the heat transfer coefficient directly as a function of the heat flux and the thermo-physical parameters. The predicted values are compared with the experimental data and presented in Fig. 1a. The obtained points are mostly concentrated above the median line, indicating that the predicted values are underestimated, the mean error (*ME*) is of the order of 34% with a standard deviation (*Sd*) of 26%. Another important indicator is the correlation coefficient (r) that measures the affinity between the calculated values and those from the experiment, and it is equal to 0.87 for this case.

From Fig. 1b, the correlation [7] of Mc Nelly allows calculating the heat transfer coefficient as a function of the heat flux and some thermo-physical parameters. The results presented in Fig. 1b show a concentration of the points around the median line with a mean error (*ME*) of 32%, a standard deviation (*Sd*) of 29% and a correlation coefficient (r) of 0.85.

The correlation of Foster and Zuber introduces [8] two parameters ΔT and Δp, that is the overheating of the liquid with respect to the saturation temperature and the corresponding overpressure with respect to the saturation pressure. These two values are not available from the data collected in the boiling experiments. In order to calculate the heat transfer coefficient, we have assumed that the temperature difference (ΔT) will be the one determined between the wall temperature and the temperature of the saturated liquid. Where, the difference of the pressure Δp will be deduced from the formula: $\Delta p = \Delta T \dfrac{L\rho_v}{T_{\text{sat}}}$ since one is on the saturation line. The points obtained in Fig. 1c are scattered and do not make it possible to correctly predict the experimental values.

The heat transfer coefficient is directly determined with the Mostinski correlation [9]. It depends on the heat flow, the critical pressure of the fluid and a parametric function of the reduced pressure. The calculated values are overestimated compared to the experimental data. The points plotted in Fig. 1d show concentrations of two sub-sets of points below but parallel to the median line. The first set relates to hydrocarbons and refrigerants the second corresponds to the values calculated for the water.

The *ME* and the *Sd* remain high. On the other hand, the correlation coefficient (r) is greater than 0.7, so the correlation could be adapted for water and other fluids by adjusting the value 0.106 by appropriate coefficients. Similarly, the correlation of Labuntsov [10] allows calculating the heat transfer coefficient as a function of the heat flux and the thermo-physical parameters of the fluid.

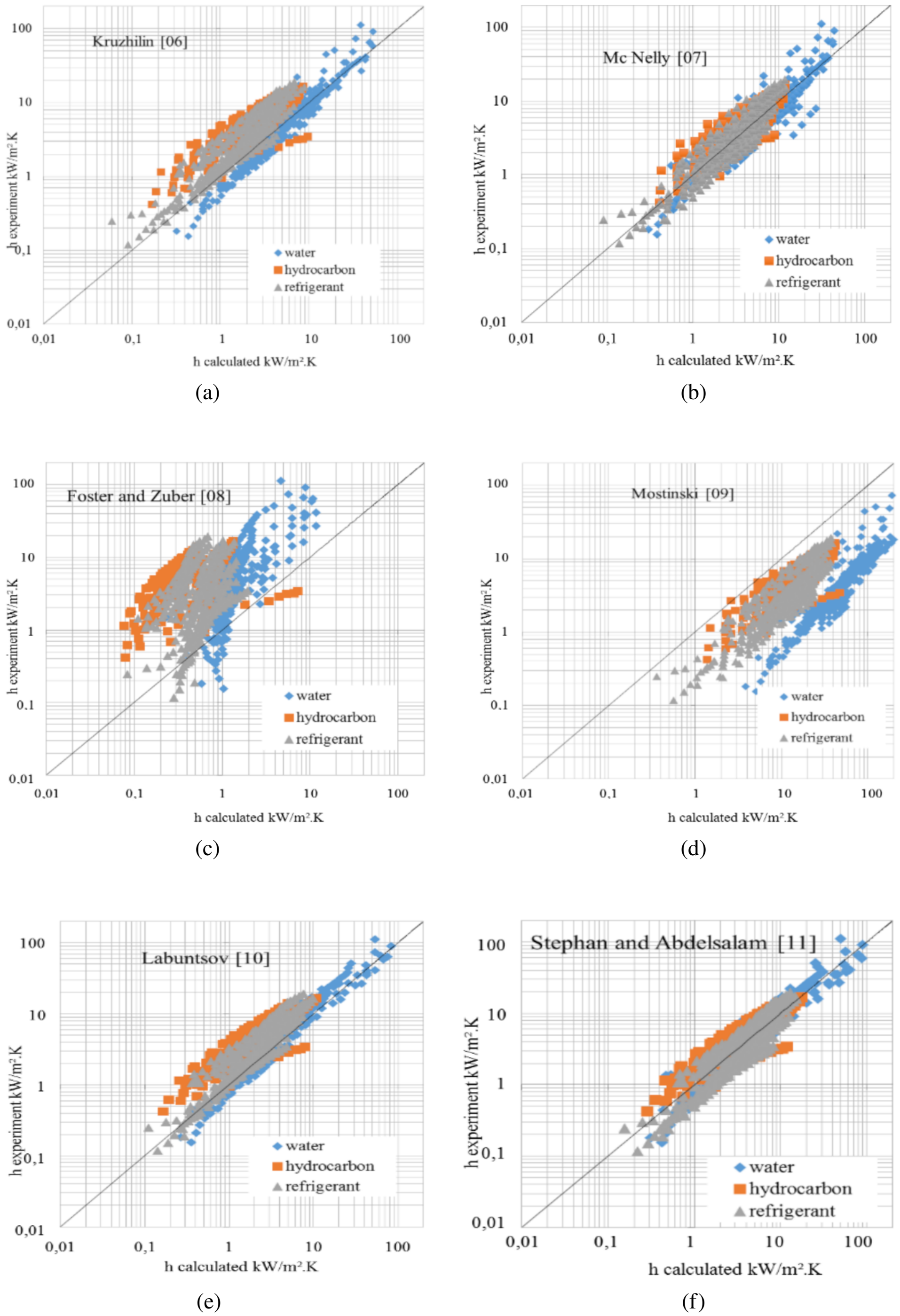

Kruzhilin [06]
Mc Nelly [07]
Foster and Zuber [08]
Mostinski [09]
Labuntsov [10]
Stephan and Abdelsalam [11]
water
hydrocarbon
refrigerant
h experiment kW/m².K
h calculated kW/m².K
(a)
(b)
(c)
(d)
(e)
(f)

Fig. 1

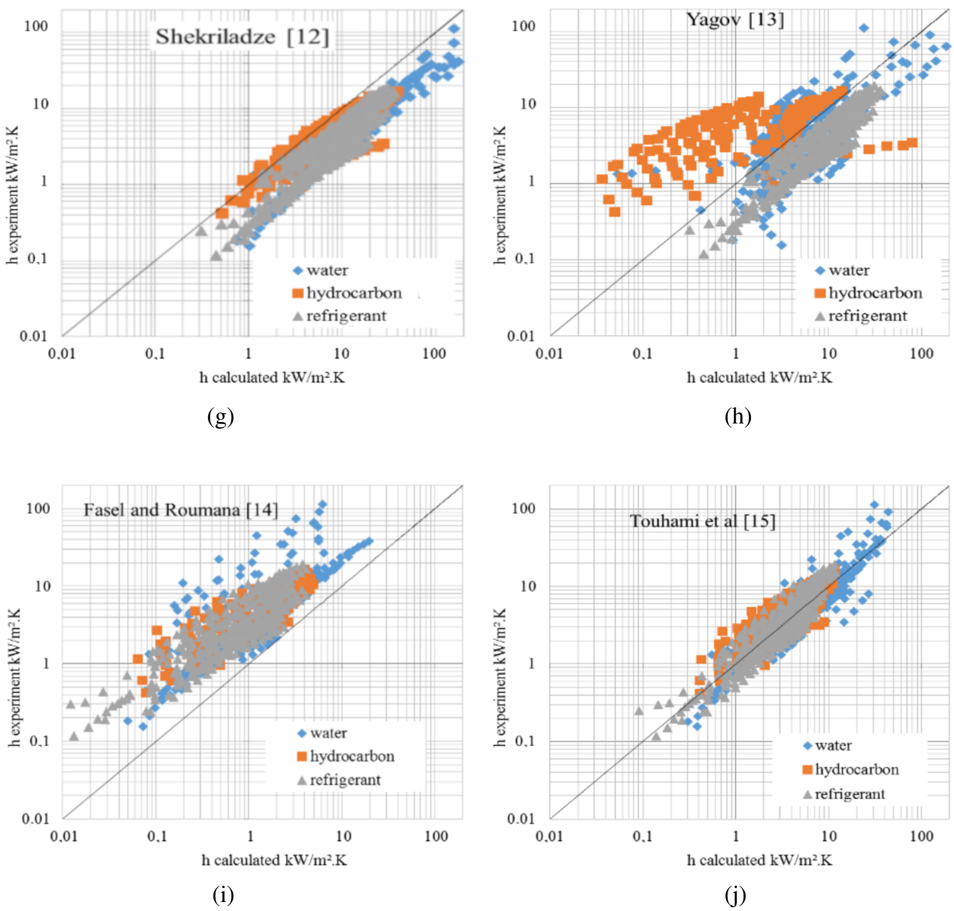


Fig. 1. Evaluation of correlations: (a) Kruzhilin [6], (b) Mc Nelly [7], (c) Foster and Zuber [8], (d) Mostinski [9], (e) Labuntsov [10], (f) Stephan and Abdelsalam [11], (g) Shekriladze [12], (h) Yagov [13], (i) Fasel and Romana [14], (j) Touhami et al. [15]

The summarized values were compared with the experimental data, which indicates a concentration of points slightly above the median line especially for refrigerants and hydrocarbons. From Fig. 1e, the *ME* for all points is 32%, the *Sd* is equal to 20%, and a striking fact is that the correlation coefficient (r) is 0.92 showing a direct affinity between the values of experiments and the predicted ones.

The Stephan and Abdelsalam [11] correlation is appropriate for all fluids, and it directly calculates the heat transfer coefficient as a function of fives dimensionless groups dependent on the departure diameter of the bubble, the thermo-physical characteristics of the fluid and the heat flux. The points found and exposed in Fig. 1f show a concentration around the centerline, with a slight downward shift of the water values; the *ME* is 30% and that of the *Sd* is 27%, the correlation coefficient (r) is 0.91.

The Shekriladze correlation [12] links the Nusselt number with a coefficient (K) and the Reynolds number (Re) of boiling, which are dimensionless groups depending on the thermo-physical parameters. As shown in Fig. 1g, the obtained points show a concentration on a line below the median line, the predicted values are therefore overestimated. Where, the *ME* and *Sd* remain highs, but the correlation coefficient is very high and tends to 0.92.

The predicted values can be improved and the error reduced by changing the coefficient $0.88 \cdot 10^{-2}$ by another one more appropriate. The values found with the Yagov correlation [13] show a scatter of points in Fig. 1h with relatively high *ME* and *Sd*. The heat transfer coefficient is indirectly determined from the correlation, which gives the heat flux as a function of the temperature difference and the thermo-physical parameters.

The correlation of Fasel and Romana [14] directly gives the heat transfer coefficient as a function of some thermo-physical parameters and the heat flux. The points grouped in Fig. 1i, show a dispersion around the line above of the median line with *ME* of about 70% and *Sd* of 10%, and the correlation coefficient (r) is found to be 0.62. The points presented in Fig. 1j show a concentration around the median line. The *ME* of the set of points is 32% with *Sd* of 29%, where the correlation coefficient (r) is equal to 0.85. The predicted values were determined with the correlation of Touhami et al. [15] which gives the heat transfer coefficient as a function of the thermo-physical parameters, the heat flux, the reduced pressure, the roughness and the diameter of the heating element.

3.1. Comparison between correlations

An analysis of the statistical results is presented in Table 3, and indicates that the correlation of Labuntsov [10] gives better results compared with those of the experiment, followed by the correlation of Stephan and Abdelsalam [11], then, it

Table 3. Grouping statistical results of evaluation

Correlation	ME	Sd	r
Kruzhilin [6]	34%	26%	0.87
Mc Nelly [7]	32%	29%	0.85
Foster and Zuber [8]	75%	29%	0.65
Mostinski [9]	653%	513%	0.74
Labuntsov [10]	32%	20%	0.92
Stephan and Abdeslam [11]	30%	27%	0.91
Shekriladze [12]	160%	92%	0.92
Yagov [13]	119%	155%	0.62
Fasel and Romana [14]	70%	14%	0.62
Touhami et al. [15]	32%	29%	0.85

comes the correlations of Kruzhilin [6], Mc Nelly [7] and Touhami et al. [15] which can suitably predict the heat transfer coefficient.

The correlation of Shekriladze [12] can be improved since it has a good correlation coefficient (r). Correlation of Mostinski [9] can be split in two formulas; one for the refrigerants and the hydrocarbons and the second for the water. In view of their high *ME* and *Sd*, the remaining correlations of Foster and Zuber [8], Fasel and Romana [14] and Yagov [13] are not suitable for the prediction of the heat transfer coefficient through boiling, for the studied case.

3.2. Modification of Shekriladze [12] and Mostinski [9] correlations

The analysis of Fig. 1g shows that the points are all aligned parallel but below the median line, which indicates that the predicted values are higher than the experimental values. A rectification of these points is possible by replacing the coefficient of the correlation of Shekriladze [12] by a lower coefficient. The values will be determined by iteration so as to minimize the average error; we then find the coefficient of 0.31 instead of 0.88.

$$\mathrm{Nu} = \frac{hr_0}{\lambda} = 0.31 \cdot 10^{-2} K^{0.7} \mathrm{Re}^{0.25}$$
$$\text{with} \quad K = \left(\frac{qr_0^2 \rho_v L}{\sigma \lambda T_{\mathrm{sat}}}\right) \quad \text{and} \quad \mathrm{Re} = \left(\frac{c_p T_{\mathrm{sat}} \sigma \rho_l}{L^{\frac{3}{2}} \rho_v^2 \nu}\right). \tag{15}$$

After this modification, better results are obtained since the ME of the new correlation is equal to 27% and the Sd becomes 20%, while the correlation coefficient (r) remains the same as the original correlation ($r = 0.92$). Where, the new points indicated in Fig. 2 show a concentration around the median line.

Analysis of the 1d curve shows two sets of points below the midline, one set of water values points, and another set of hydrocarbon and refrigerant point

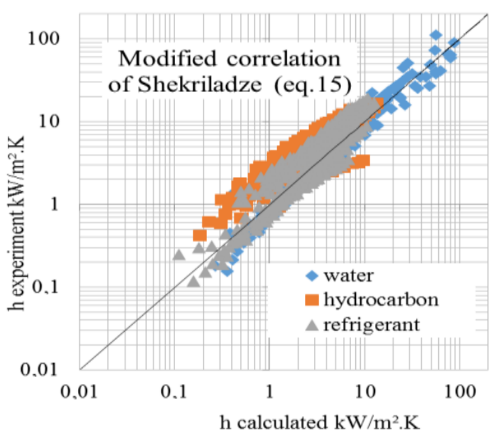


Fig. 2. Evaluation of modified correlation of Shekriladze

values. The Mostinski correlation [9] overestimates the predicted values compared to the experimental data. The same approach as in the previous case is adopted, one coefficient is chosen to predict the values of water and another coefficient to determine the values of hydrocarbons and refrigerants. We then obtain two correlations; one applicable for water:

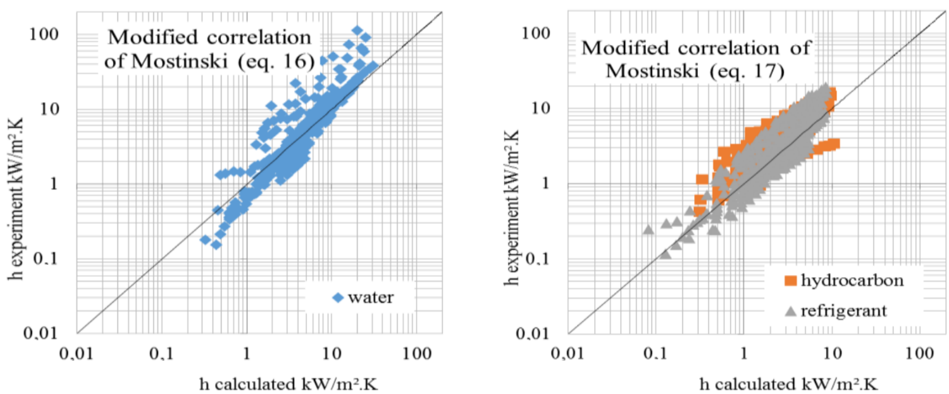
$$h = 0.009 P_{\mathrm{cr}}^{0.69} q^{2/3} F_p \quad \text{and} \quad F_p = 1.8(p_r)^{0.17} + 4(p_r)^{1.2} + 10(p_r)^{10}. \tag{16}$$

From Fig. 3a, and after modification of Mostinski correlation (Eq. (16)), the *ME* decreases to 27%, the *Sd* tends to 26%, while the correlation coefficient (r) is significantly improved and it tends to 0.79.

And, the second proposed correlation for other fluids (hydrocarbons and refrigerants) is expressed as:

$$h = 0.024 P_{\mathrm{cr}}^{0.69} q^{2/3} F_p \quad \text{and} \quad F_p = 1.8(p_r)^{0.17} + 4(p_r)^{1.2} + 10(p_r)^{10}. \tag{17}$$

From Fig. 3b, the evaluation of this correlation gives 36% of *ME*, 25% of *Sd* and $r = 0.82$.



(a) (b)

Fig. 3. Evaluation of modified correlation of Mostinski, (a) for water, (b) for hydrocarbons and refrigerants

3.3. Proposed new correlation

Starting from the general forced convection relation $\mathrm{Nu} = C(\mathrm{Re})^n(\mathrm{Pr})^m$, with $n = 0.67$, and $m = 0.4$; which is presented in the form of equality between the Nusselt number and the product of the Reynolds number (Re) and the Prandtl number (Pr), we add a dimensionless group (lc/D) for better smoothing, knowing that the densities and the tension of steam have effects on boiling. The coefficients 40 and -0.3 were determined by iteration in order to minimize the average deviation and cause the correlation coefficient to tend towards 1.

$$\mathrm{Nu} = 40\left(\frac{qD}{\mu L}\right)^{0.67}\left(\frac{\mu cp}{\lambda}\right)^{0.4}\left(\frac{lc}{D}\right)^{-0.3}. \tag{18}$$

The calculated data with the new correlation (Eq. (18)) are presented in Fig. 4. The points are concentrate around the median line with an average deviation of 33% and a correlation coefficient of 0.90; the results of the new correlation are very significant.

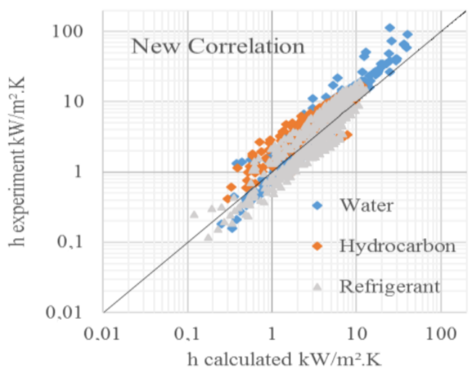


Fig. 4. Evaluation of the proposed correlation (Eq. (18))

4. Conclusion

In order to select the reliable correlations used for the prediction of heat transfer coefficients during boiling through the outside of a horizontal tube, an analytical study and statistical evaluation were presented in this paper. The strategy of evaluation was based on the comparison between available experimental data and ten chosen correlations from literature. Some significant conclusions are drawn, as follows:

The correlation of Labuntsov [10] ensures 32% of *ME* 0.92 of correlation coefficient (r), while the correlation of Stephan and Abdelsalam [11] ensures 30% of *ME*, and 0.91 of correlation coefficient (r). This means that these two correlations merit to be used for predicting the heat transfer coefficient during boiling. In addition, the correlations of Kruzhilin [6], Mc Nelly [7] and Touhami et al. [15] are relatively acceptable for the same task, where their *ME* and r are about 32% and 0.85, respectively.

The correlations of Shekriladze [12] and Mostinski [9], after modification, ensure a satisfactory agreement with the experimental data.

In view of high *ME* and reduced r, the correlations of Foster and Zuber [8], Yagov [13] and Fasel and Romana [14] are not suitable for predicting the heat transfer coefficient during boiling.

A new correlation (Eq. (18)) was proposed in this study, which can be used for predicting the heat transfer coefficient during boiling and gives a satisfactory agreement with experiments.

The statistical analysis shows that all the correlations of heat transfer coefficient during the pool-boiling need to be corrected by introducing other physical and geometrical parameters.

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