Abstract

In this research, an experimental study for the effect of forced vibrations on pool boiling heat transfer coefficient has been made in a glass chamber cylinder shape (75 mm bore and 300 mm length) and an electrical heater inside it (12 mm diameter and 80 mm length) to heat the distilled water at different values of heat flux (27.521 kW/m^2-53.08 kW/m^2) utilized to perform this work. The experimental study is carried out at a range of frequency (2-40 Hz) and at a range of amplitude (1.8-3.5 mm).

The result obtained showed that the pool boiling heat transfer coefficient is increasing with increasing the vibration frequency within a range of (2-14 Hz), compared with that heat transfer without frequency. And, the maximum enhancement ratio is about 250% at 5 Hz and q"=27.521 kW/m^2, 231% at 6 Hz and q"=36.727 kW/m^2, 181% at 6 Hz and q"=41.83 kW/m^2 and 93% at 8 Hz and q"=53.08 kW/m^2. In general, it is found that the difference in the temperature has been maintained at the highest value of vibration frequency range of (14-40 Hz), and the value of heat transfer coefficient is significantly increasing with increasing the vibration Reynolds number (Rev).

The effect of vibration frequency has improved not only the boiling heat transfer coefficient, but also led to improve the amount of heat drawn by the cooling water (condensation) by increasing the amount of falling drops.

The following empirical relations have been obtained between the experimental heat transfer coefficient with vibration (h_v) and some of important parameters, such as excess temperature (ΔT_{exsses}) in ^oC, input heat flux (q") in (W/m^2), and vibration frequency (f) in Hz:

$hv=0.246912\times f0.16534\times \Delta T -0.92429\times q"1.0727$

And, the second correlation is (hv) with Reynolds vibration effect (Rev) and input heat flux (q") in (kW/m^2)

$hv=499.747\times Rev0.3576\times q"-2.14$