



Heat Transfer Correlations in Pool Boiling

- Boiling regimes differ considerably in their character
 - ➔ different heat transfer relations need to be used for different boiling regimes.
- In the *natural convection boiling* regime heat transfer rates can be accurately determined using natural convection relations.



Heat Transfer Correlations in Pool Boiling – Nucleate Boiling

- No general theoretical relations for heat transfer in the nucleate boiling regime is available.
- Experimental based correlations are used.
- The rate of heat transfer strongly depends on the nature of nucleation and the type and the condition of the heated surface.
- A widely used correlation proposed in 1952 by

Rohsenow:

$$q_s'' = \mu_l h_{fg} \left[\frac{g(\rho_l - \rho_v)}{\sigma} \right]^{1/2} \left(\frac{c_{p,l} \Delta T_e}{C_{s,f} h_{fg} Pr_l^n} \right)^3$$

Heat Transfer Correlations in Pool Boiling – Nucleate Boiling

- The values in Rohsenow equation can be used for *any geometry* since it is found that the rate of heat transfer during nucleate boiling is essentially independent of the geometry and orientation of the heated surface.
- The correlation is applicable to *clean* and relatively *smooth* surfaces.
- Error for the heat transfer rate for a given excess temperature: 100%.
- Error for the excess temperature for a given heat transfer rate for the heat transfer rate and by 30%.



**DEPARTMENT OF MECHANICAL ENGINEERING, 16ME306/ Heat and Mass Transfer – UNIT III -
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Topic - Correlations in boiling

References:

1. Kothandaraman C.P “Fundamentals of Heat and Mass Transfer” New Age International, New Delhi, 4th Edition 2012 (Unit I, II, III, IV, V).
2. Frank P. Incropera and David P. DeWitt, “Fundamentals of Heat and Mass Transfer”, John Wiley and Sons, New Jersey, 6th Edition 1998 (Unit I, II, III, IV, V)
3. MIT open courseware - <https://ocw.mit.edu/courses/mechanical-engineering>

Other web sources