Two Phase Flows

(Section 13)

SUBCOOLED BOILING HEAT TRANSFER

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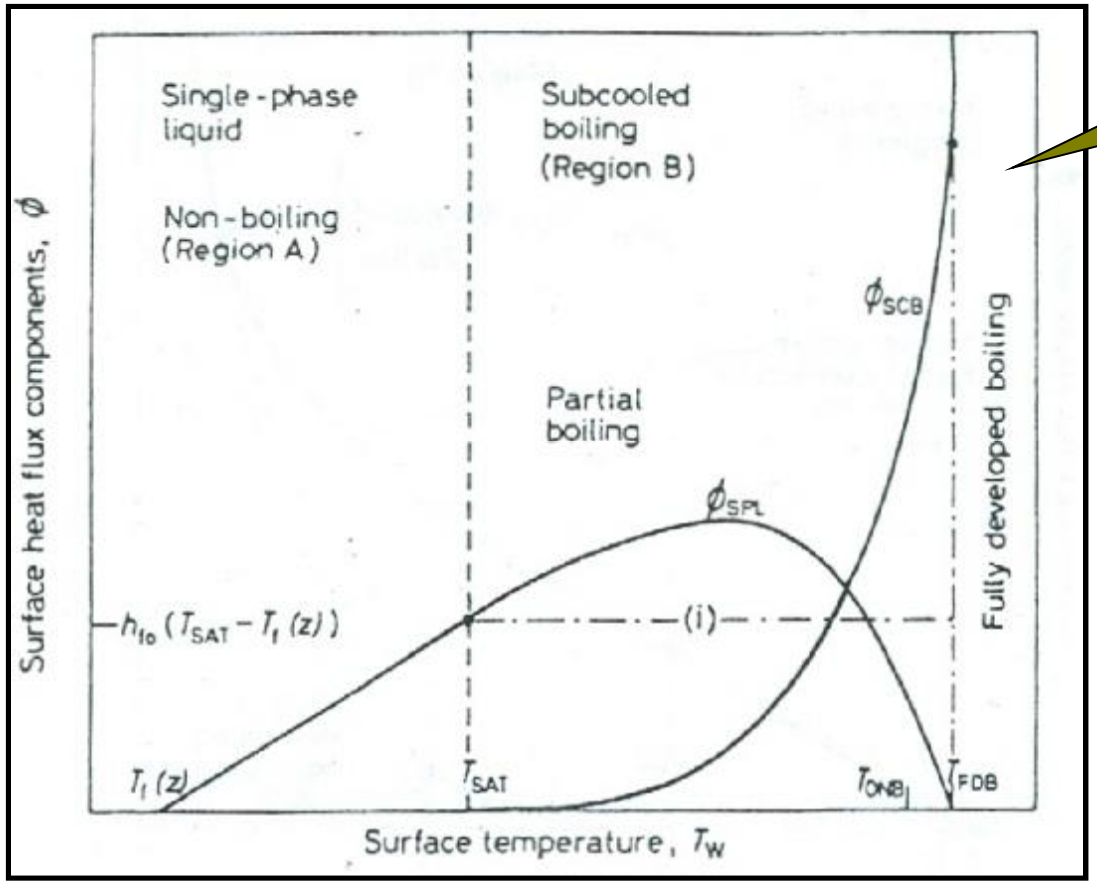
Assignment

Exercise set 7

Chapter 4, Collier and Thome:
All Problems

Due to: …

Partial subcooled boiling



Bowring model

$$f_E = 1.4 f_D$$

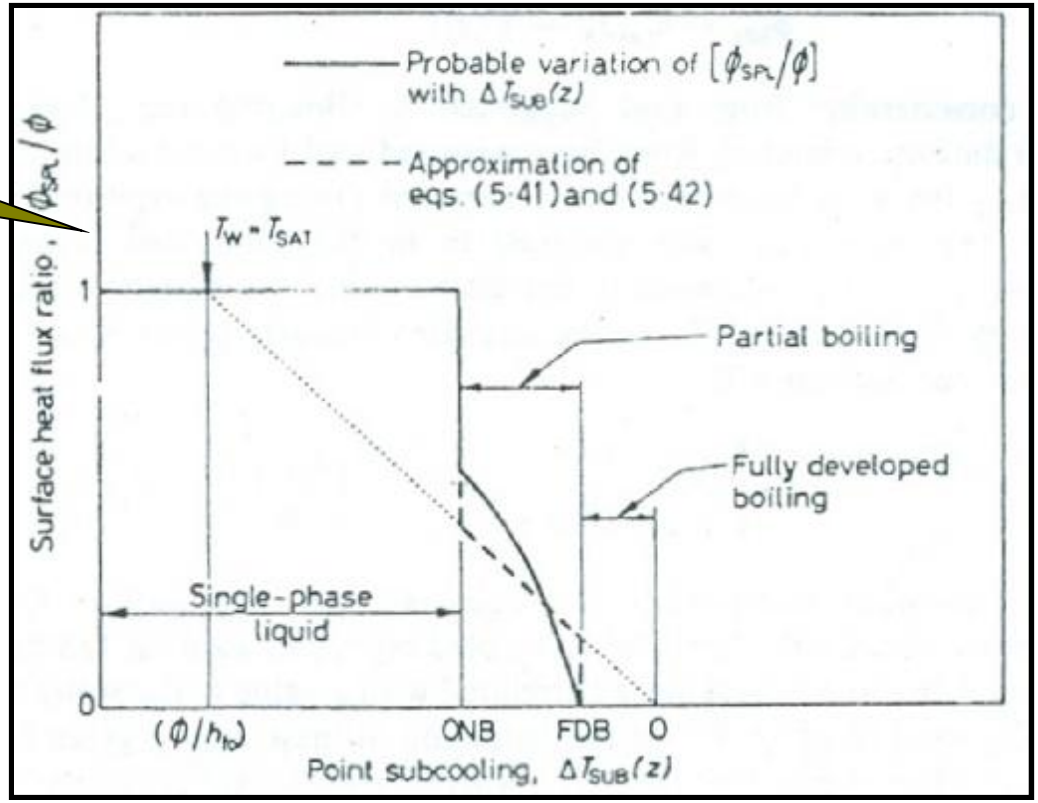
$$(T_W)_{ONB} - T_f(z) = \frac{f_E}{1.4 h_{f0}}$$

$$(T_W)_{ONB} - T_f(z) = y\left[\frac{f_E}{1.4}\right]^n$$

$$\Delta T_{SUB}(z)_{FDB} = \left[\frac{f}{1.4 h_{f0}}\right] - y\left[\frac{f}{1.4}\right]^n$$

Partial subcooled boiling

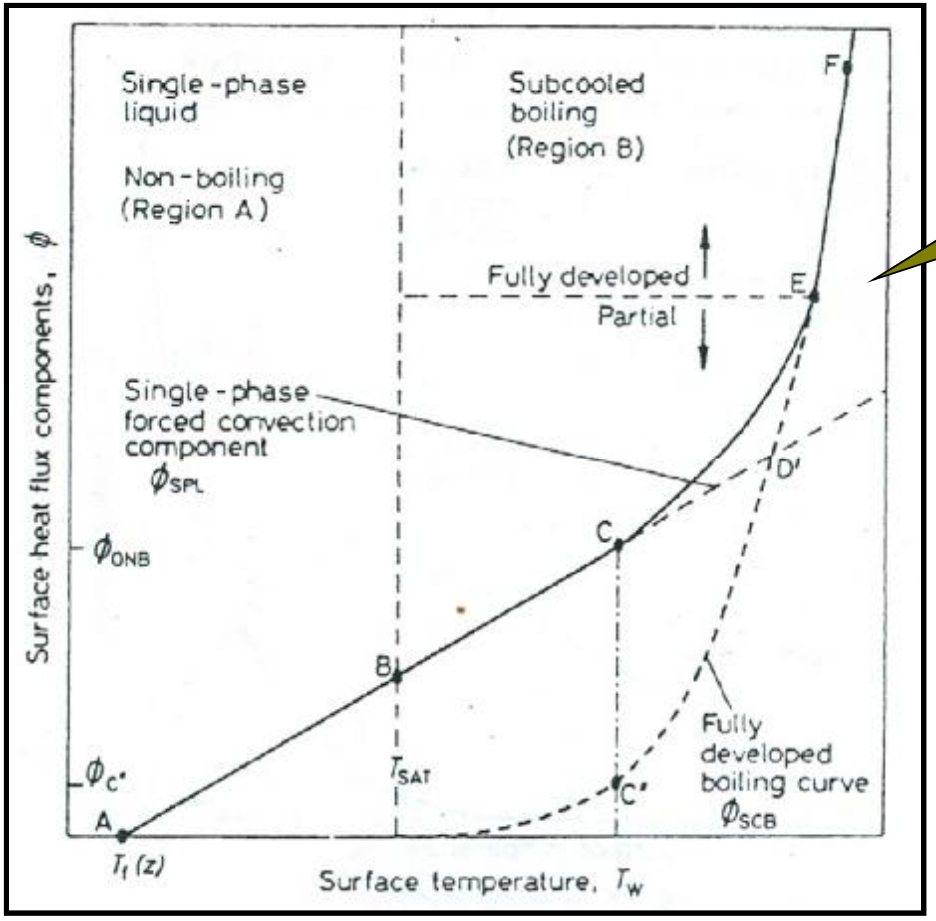
Bowring model



$$f_{SPL} = h_{fo}\left(T_W - T_f(z)\right)$$

$$\left[\frac{c_{pf}\Delta T_{SAT}}{i_{fg}}\right] = C_{sf}\left[\frac{f_{SCB}}{m_f i_{fg}}\sqrt{\frac{s}{g\left(r_f - r_g\right)}}\right]^{0.33}\left(\frac{c_{pf}m_f}{k_f}\right)^{1.7}$$

Partial subcooled boiling

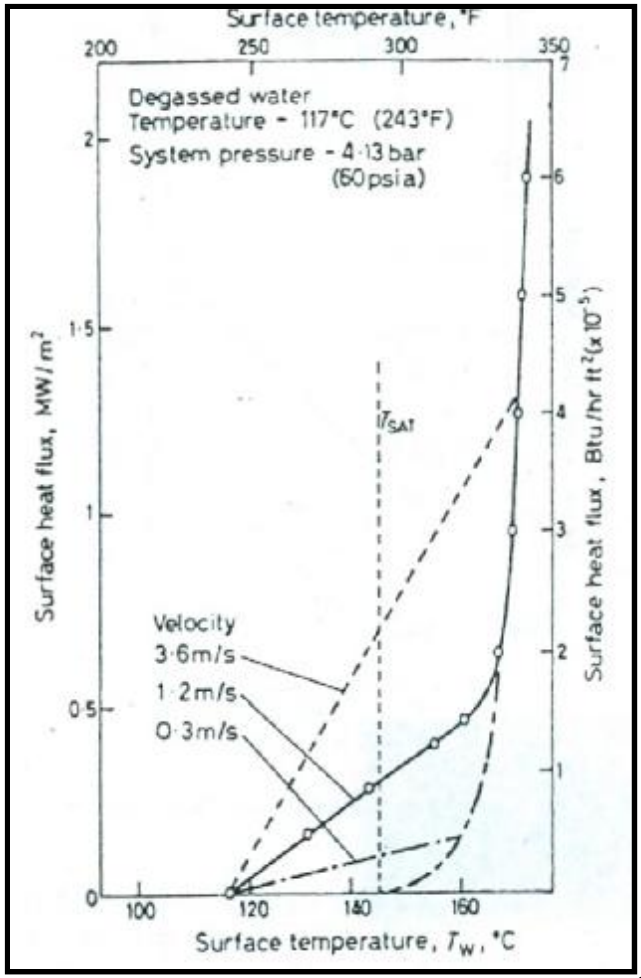


Method of Bergles and Rohsenow (1963)

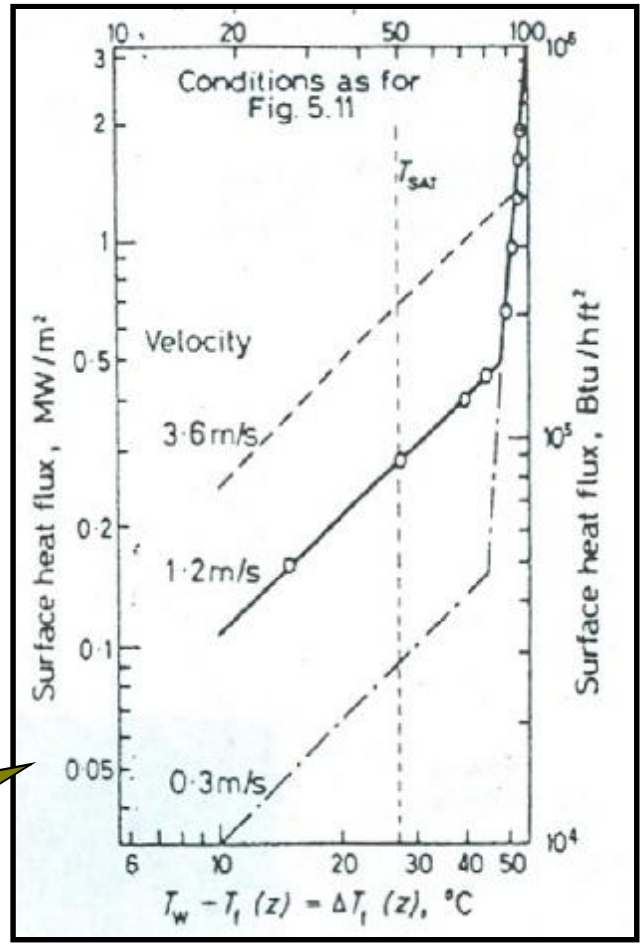
For CE line:

$$f = f_{SPL}\left[1+\left\{\frac{f_{SCB}}{f_{SPL}}\left(1-\frac{f_{c''}}{f_{SCB}}\right)\right\}^2\right]^{1/2}$$

Fully developed subcooled boiling

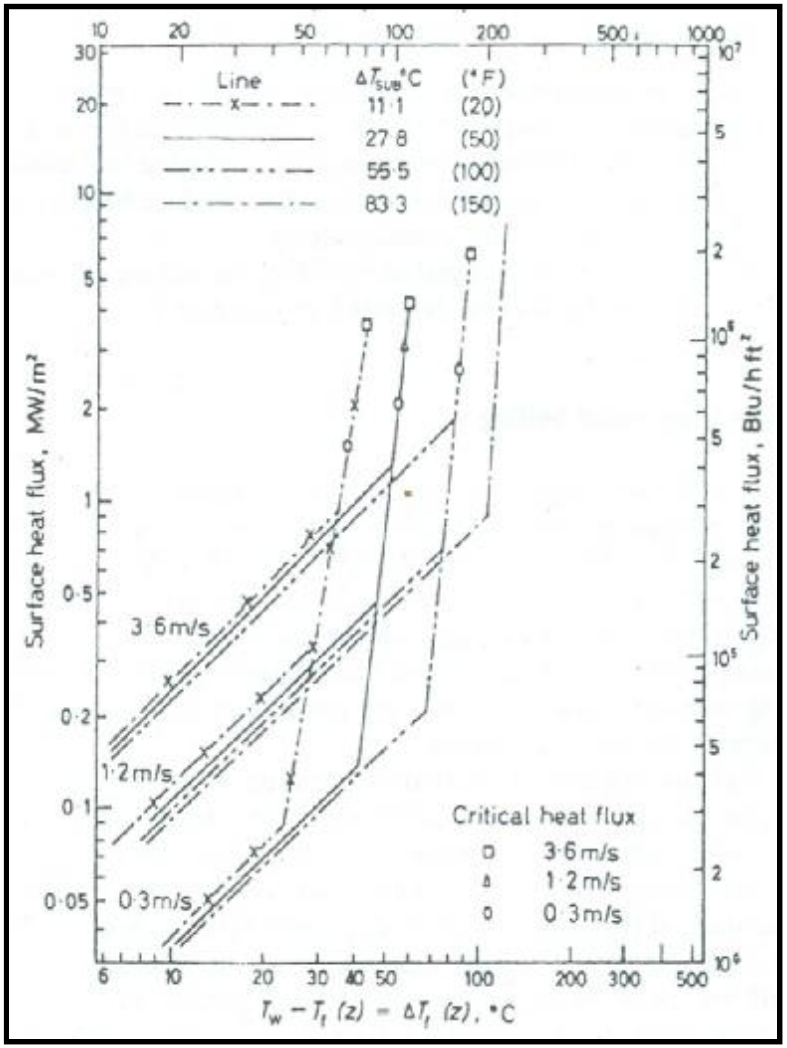


McAdams (1964)
Subcooled boiling curve



McAdams (1964)
Subcooled boiling curve

Fully developed subcooled boiling



Effect of velocity on degassed distilled water

Jens and Lottes:

$$\Delta T_{SAT} = 25 f^{0.25} e^{-p/62}$$

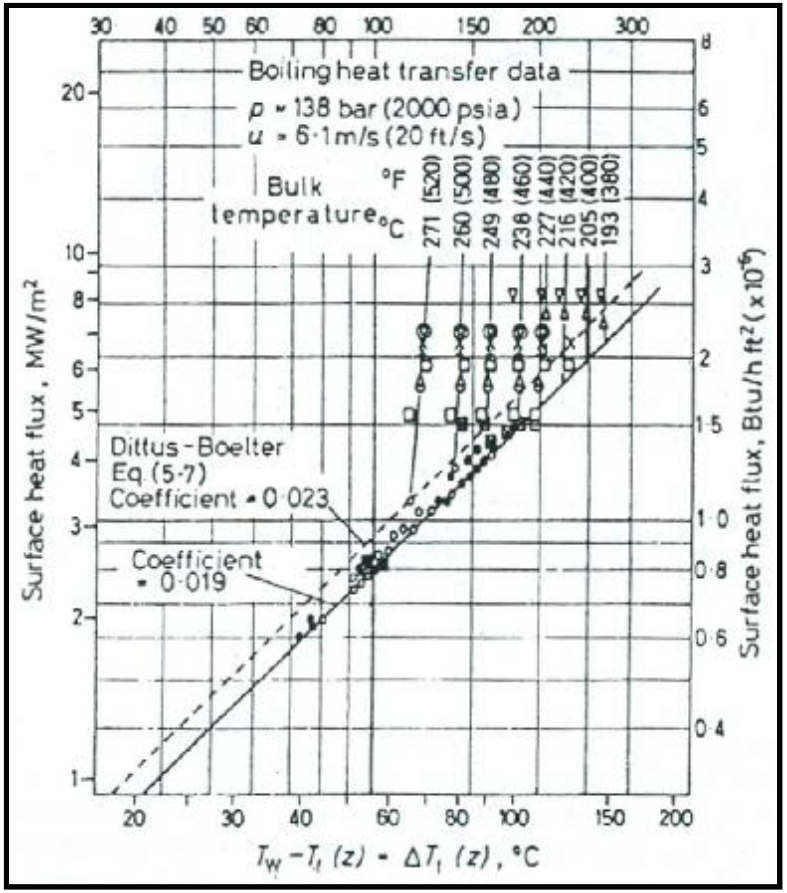
$$\Delta T_{SAT} = 1.9 f^{0.25} e^{-p/900}$$

Thome et al:

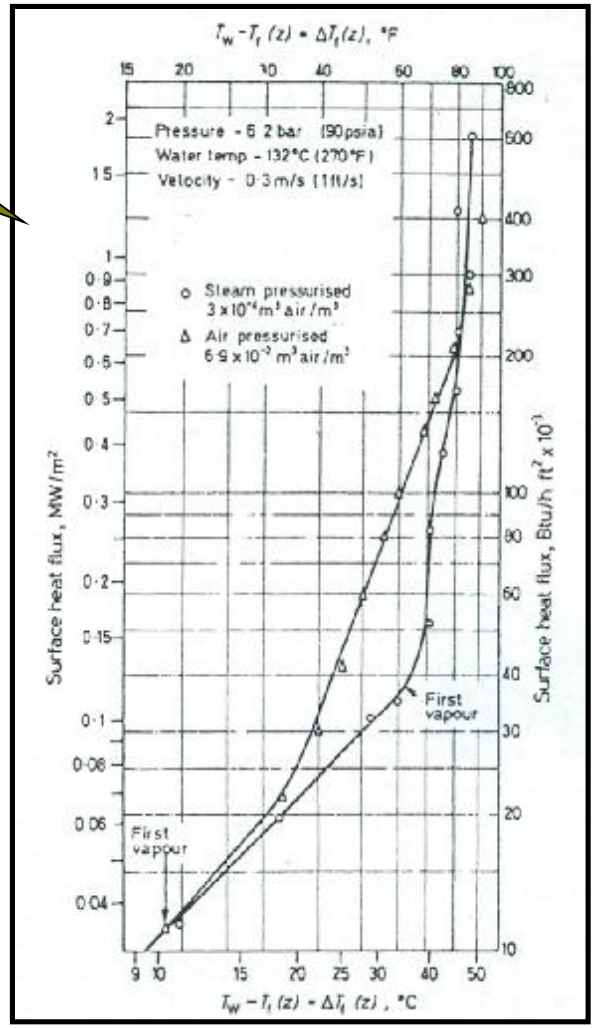
$$\Delta T_{SAT} = 22.65 f^{0.5} e^{-p/87}$$

$$\Delta T_{SAT} = 0.072 f^{0.5} e^{-p/1260}$$

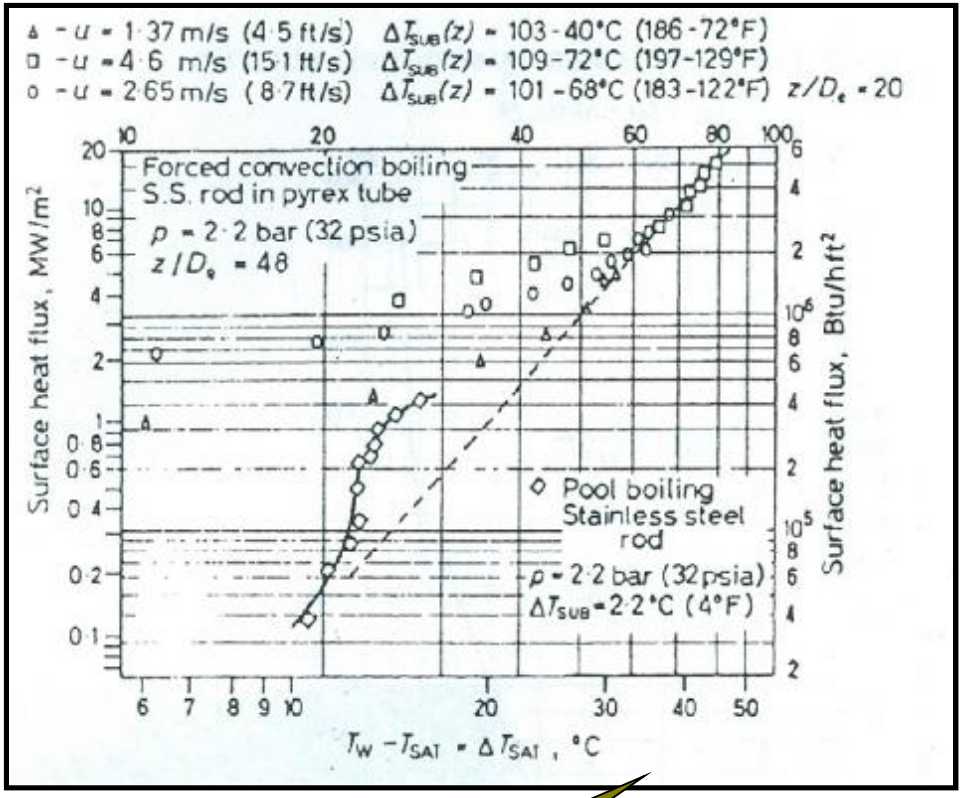
Fully developed subcooled boiling



Effect of dissolved air, McAdams (1949)

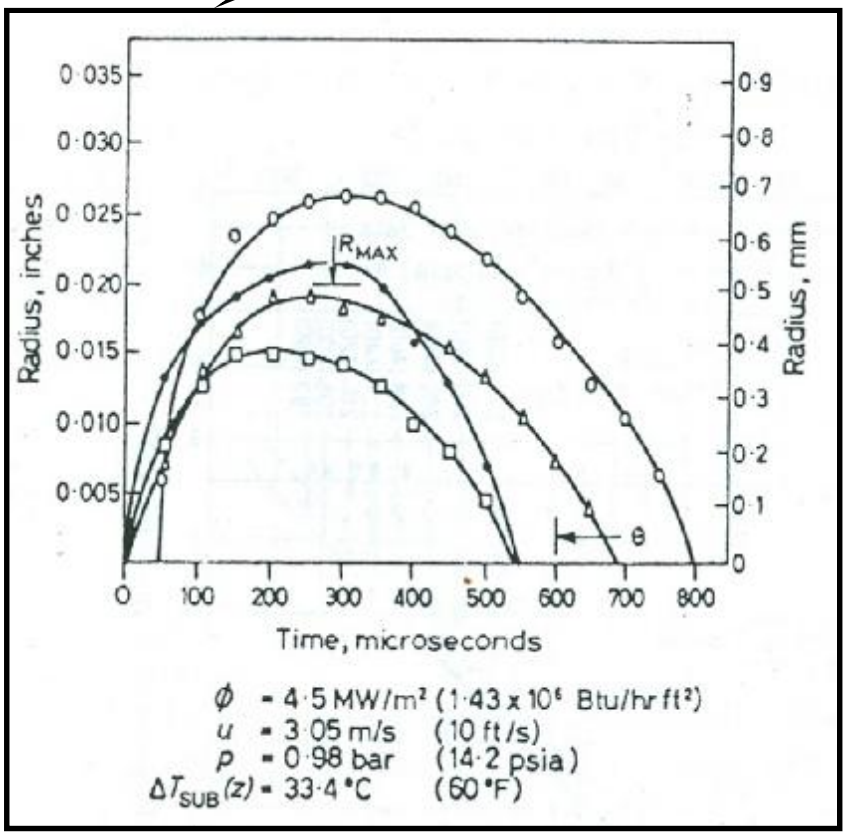


Partial subcooled boiling

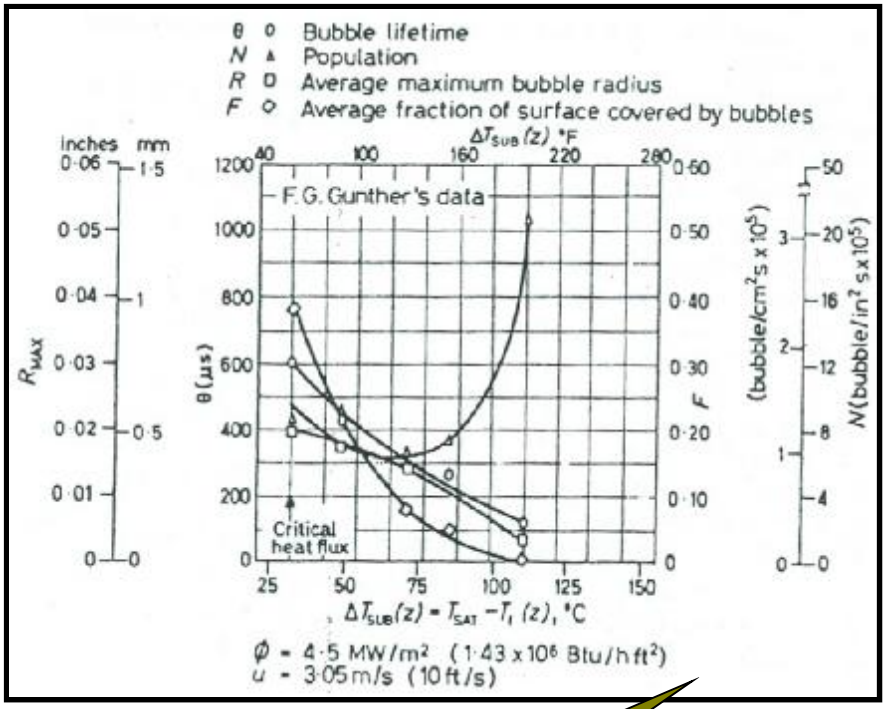


Forced convection subcooled boiling, Bergles (1963)

Bubble radius vs time Gunther (1951)



Partial subcooled boiling



Effect of subcooled on bubble population, lifetime, radius

Effect of heat transfer on bubble population, lifetime, radius