



ESCOLA POLITÉCNICA DA UNIVERSIDADE DE SÃO PAULO

PQI 3301 – FENÔMENOS DE TRANSPORTE II

CONVECÇÃO: MUDANÇA DE FASE - Ebulição



EBULIÇÃO

Escoamento bifásico

Mudança de Fase

Pequena diferença de temperatura

Efeito - LEIDENFROST





caldeira

queimador

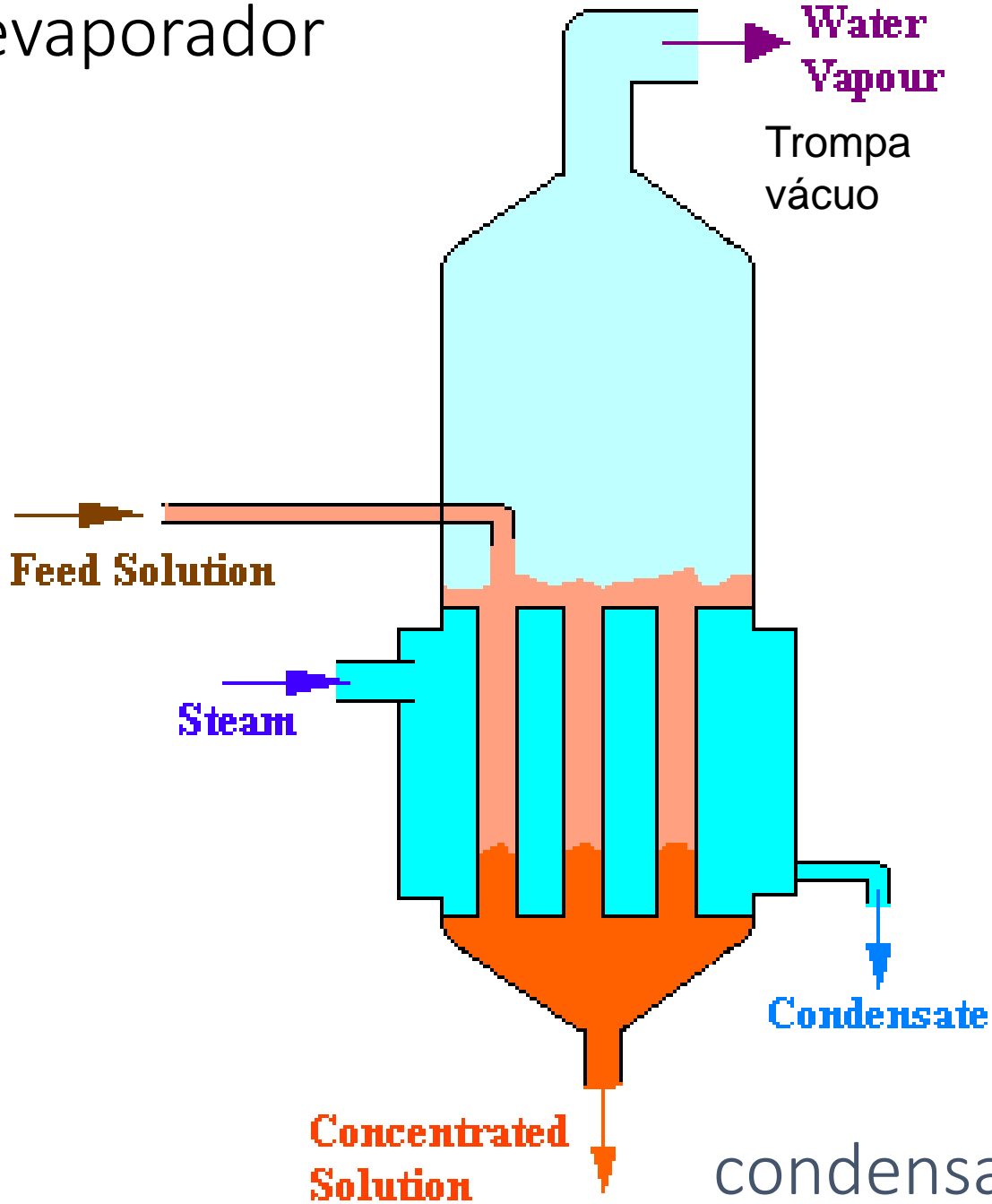


superfície

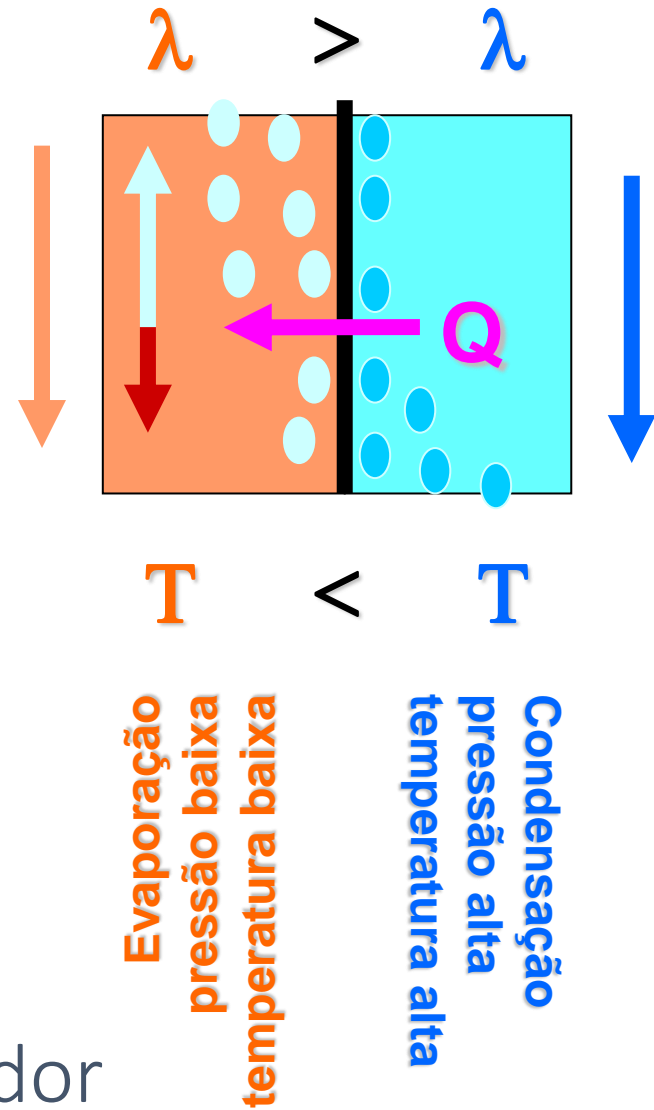
evaporador

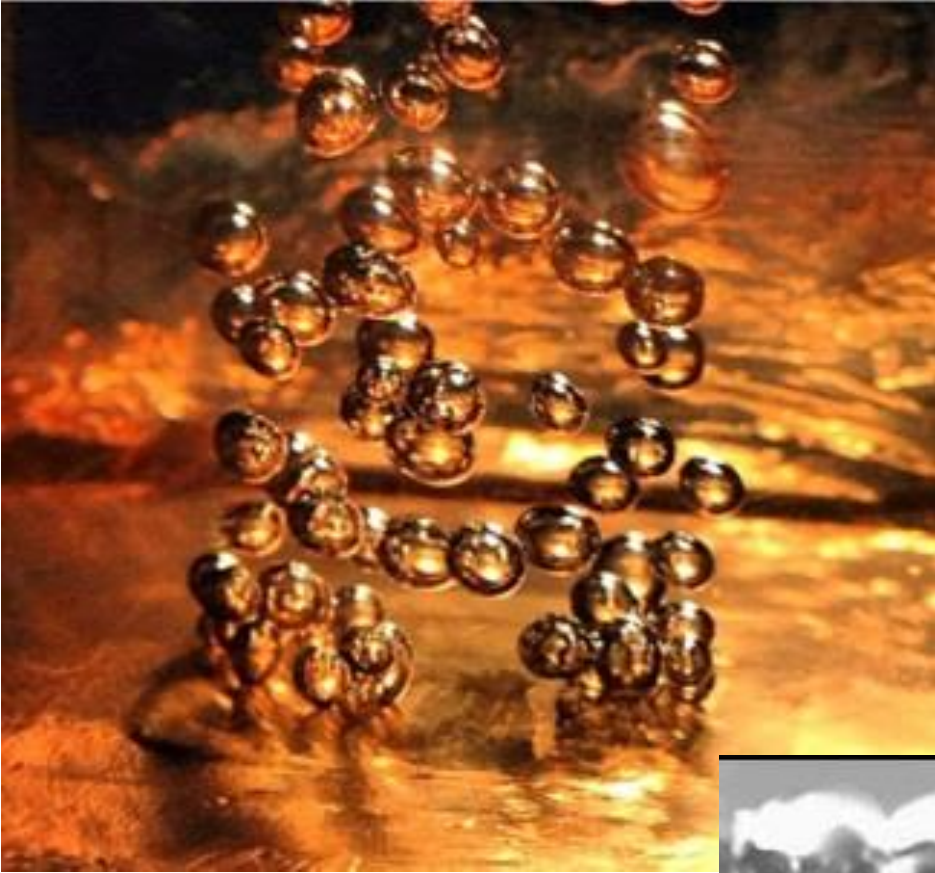


evaporador



calores latentes



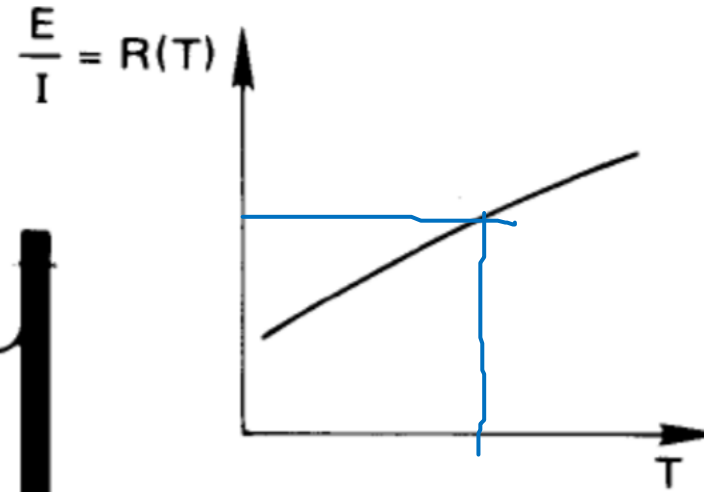
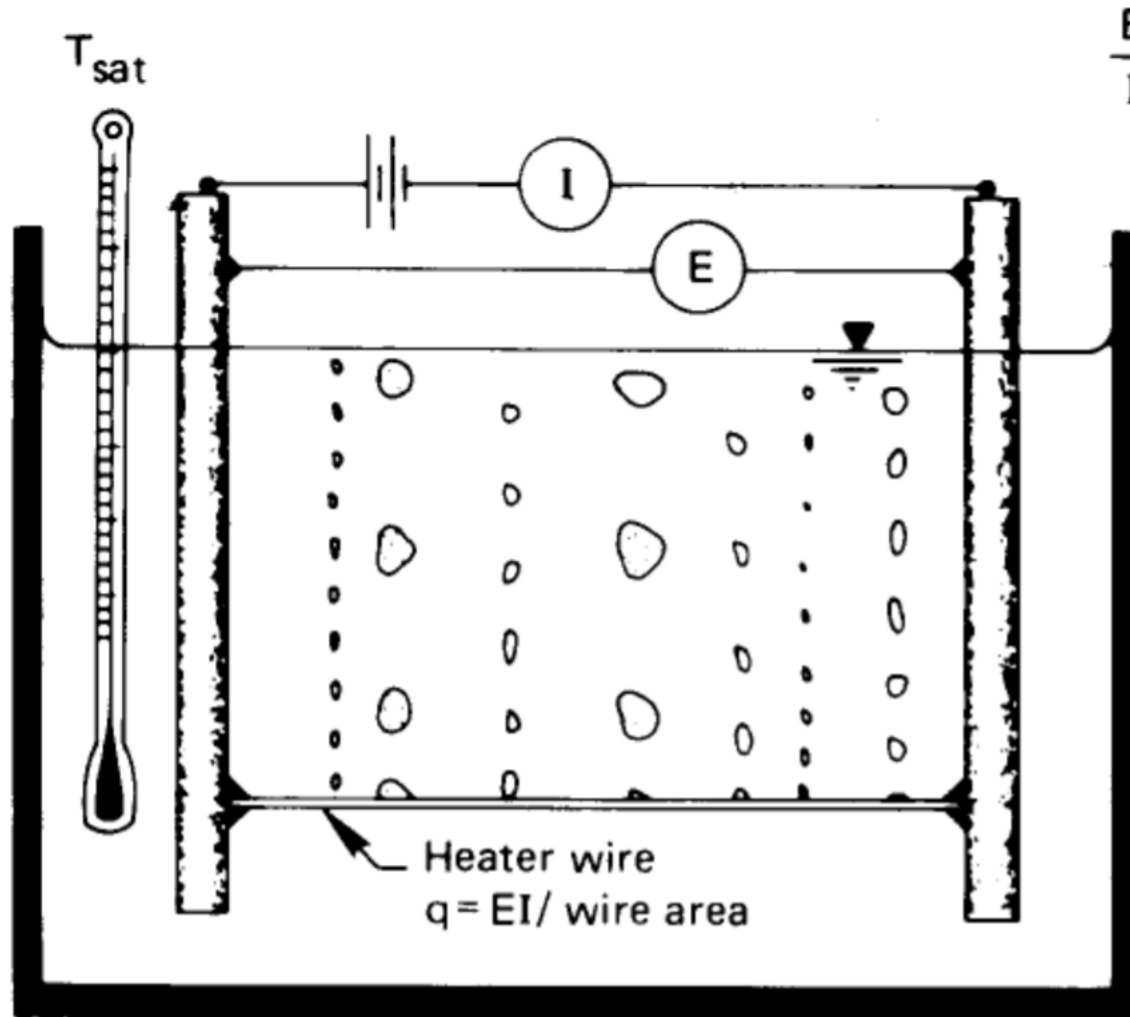


superfície

$$U = \gamma A$$



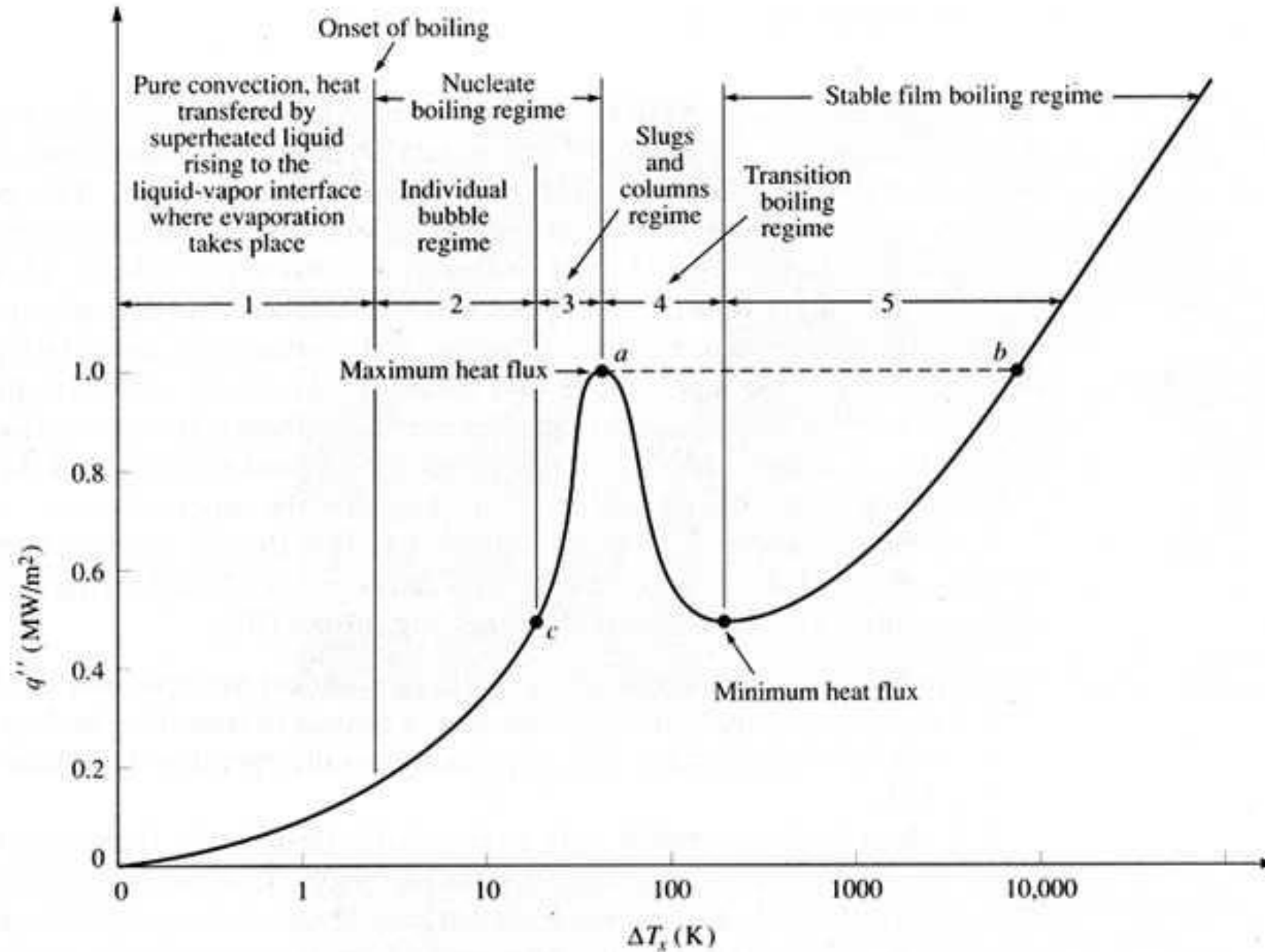
POOL BOILING – Experimento de Nukiyama - 1934



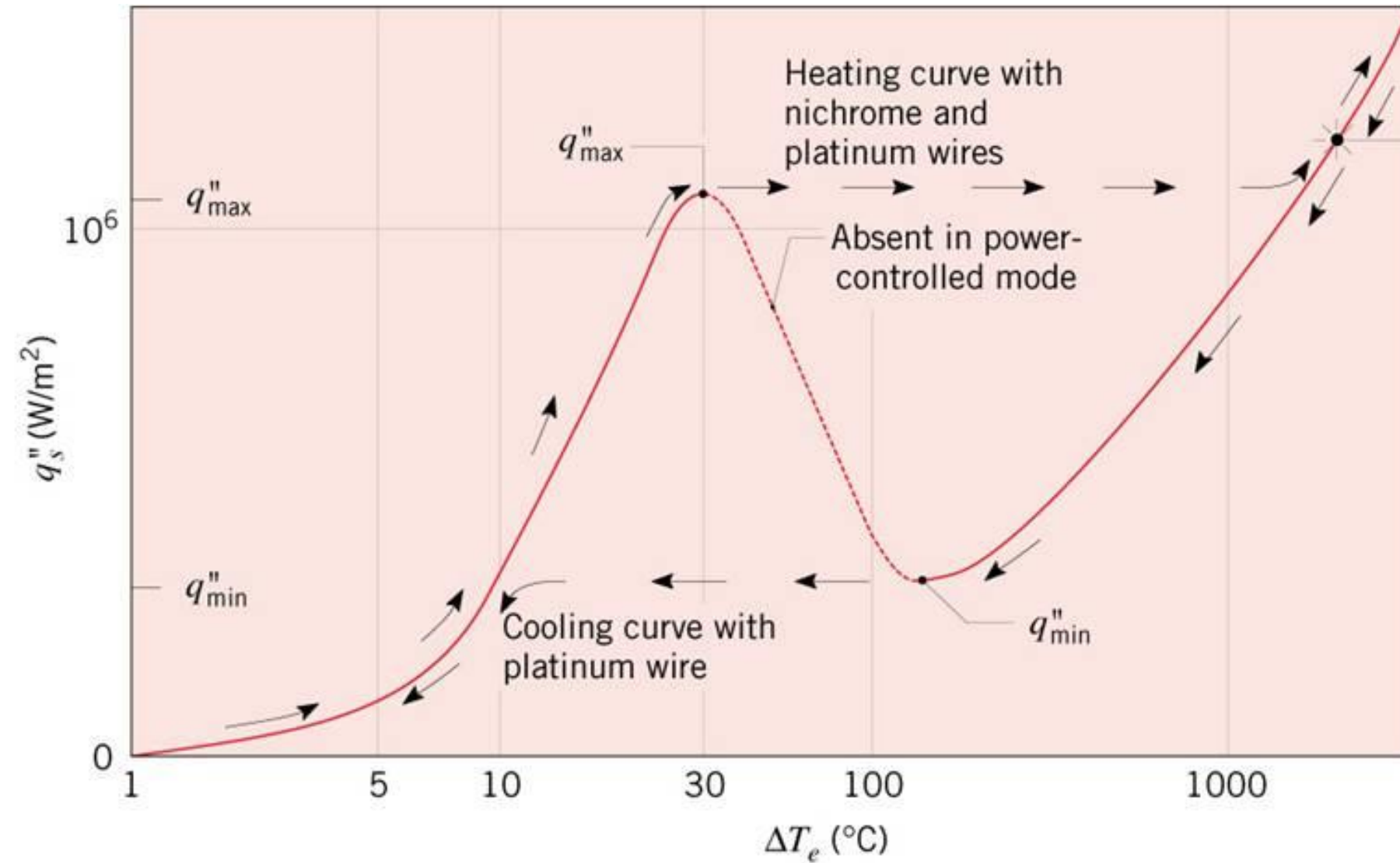
Calibration curve
to determine T_{wire}
from E and I .



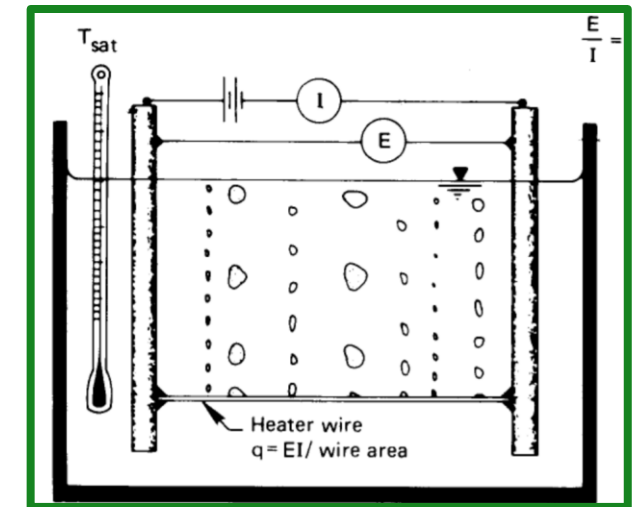
POOL BOILING - Nukiyama - 1934



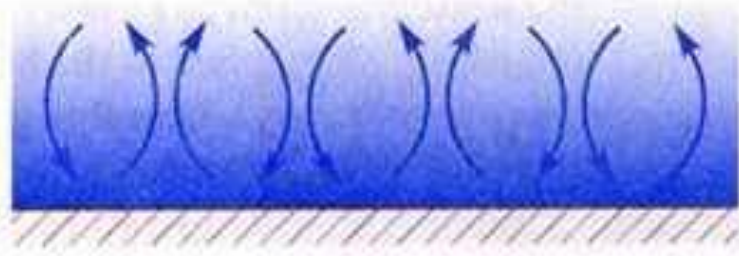
POOL BOILING - Nukiyama - 1934



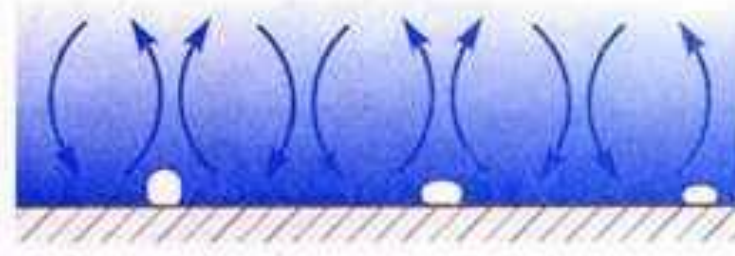
Burnout of nichrome wire



POOL BOILING



1. Natural convection



Onset of boiling



2. Individual bubble regime



3. Regime of slugs and bubbles



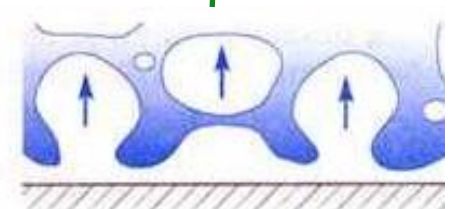
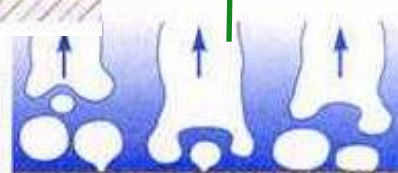
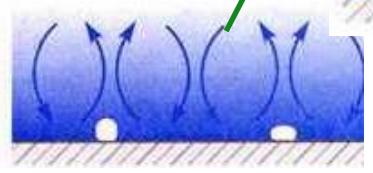
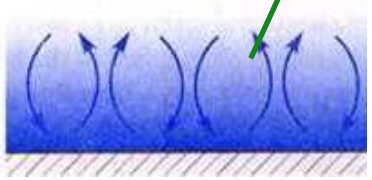
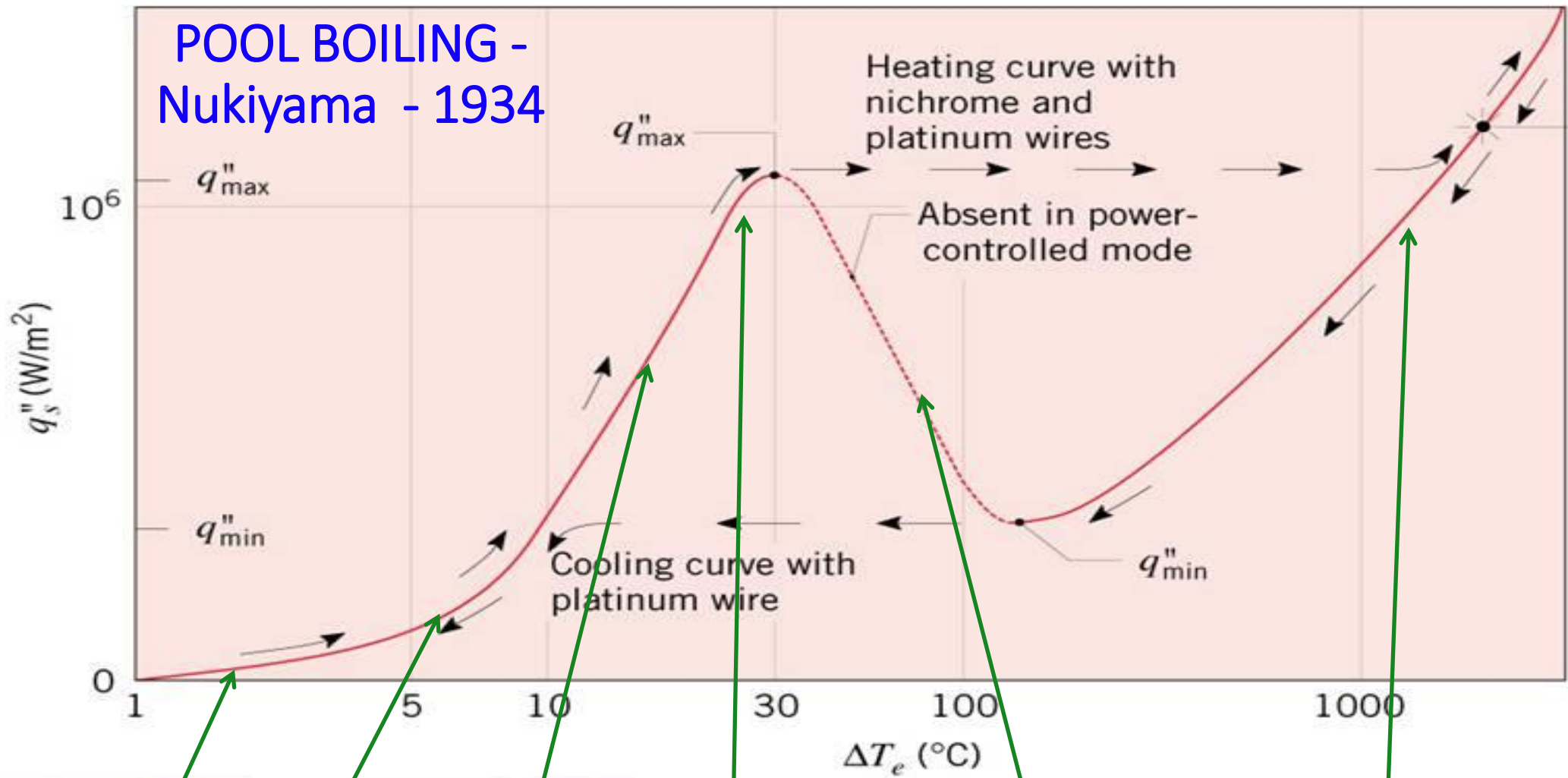
4. Transition film-boiling



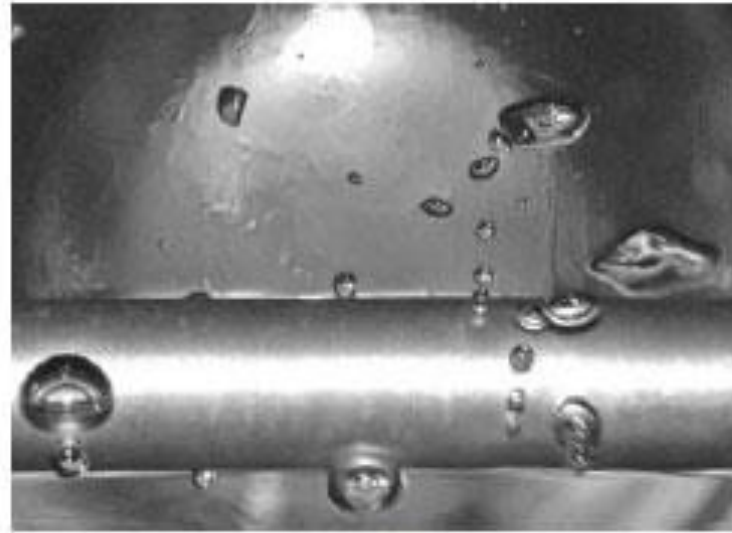
5. Stable film boiling



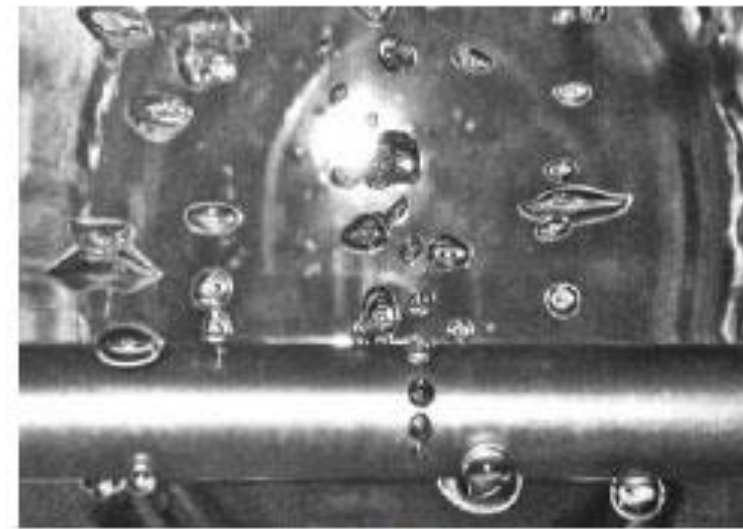
POOL BOILING - Nukiyama - 1934



POOL BOILING



(a)



(b)

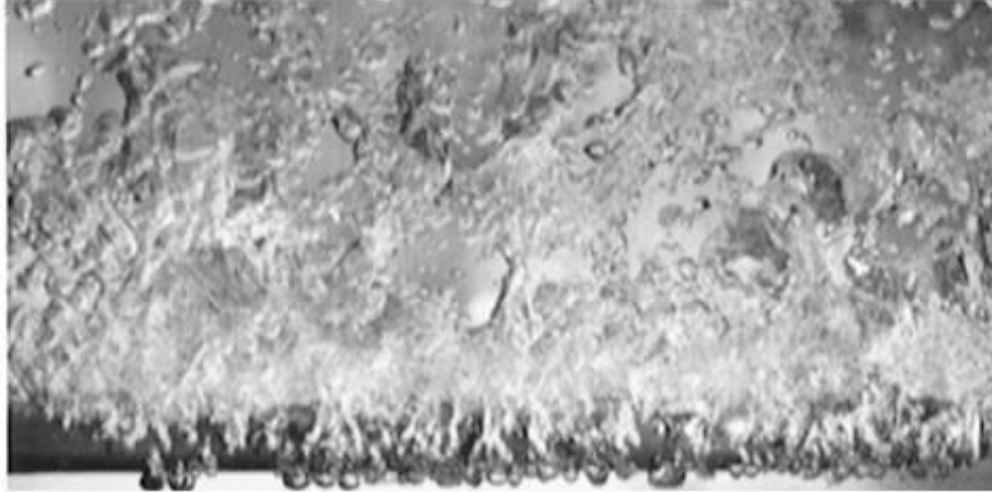


(c)

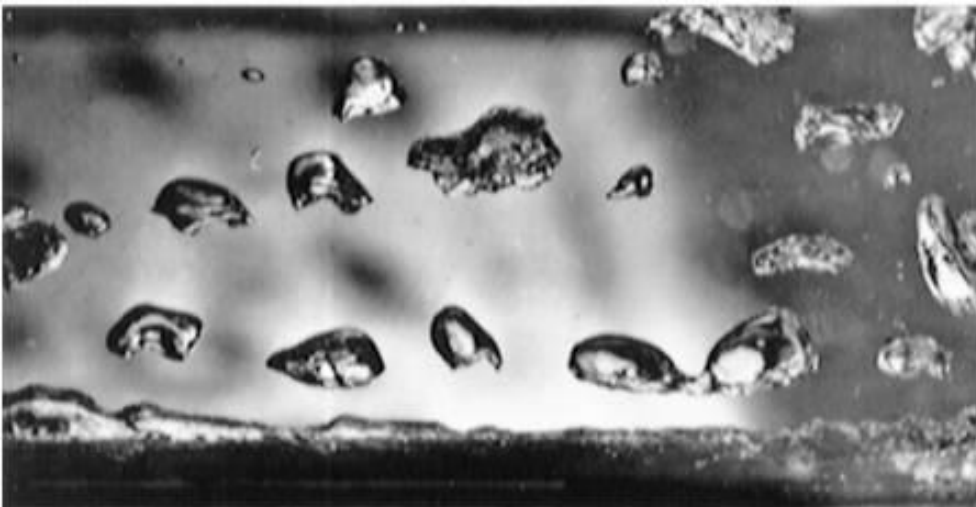
Figure 6: Comparison of bubble appearance in MEA/water solutions at different heat fluxes. (a) at 32 kW/m^2 (b) at 100 kW/m^2 (c) at 230 kW/m^2



POOL BOILING



NUCLEADA

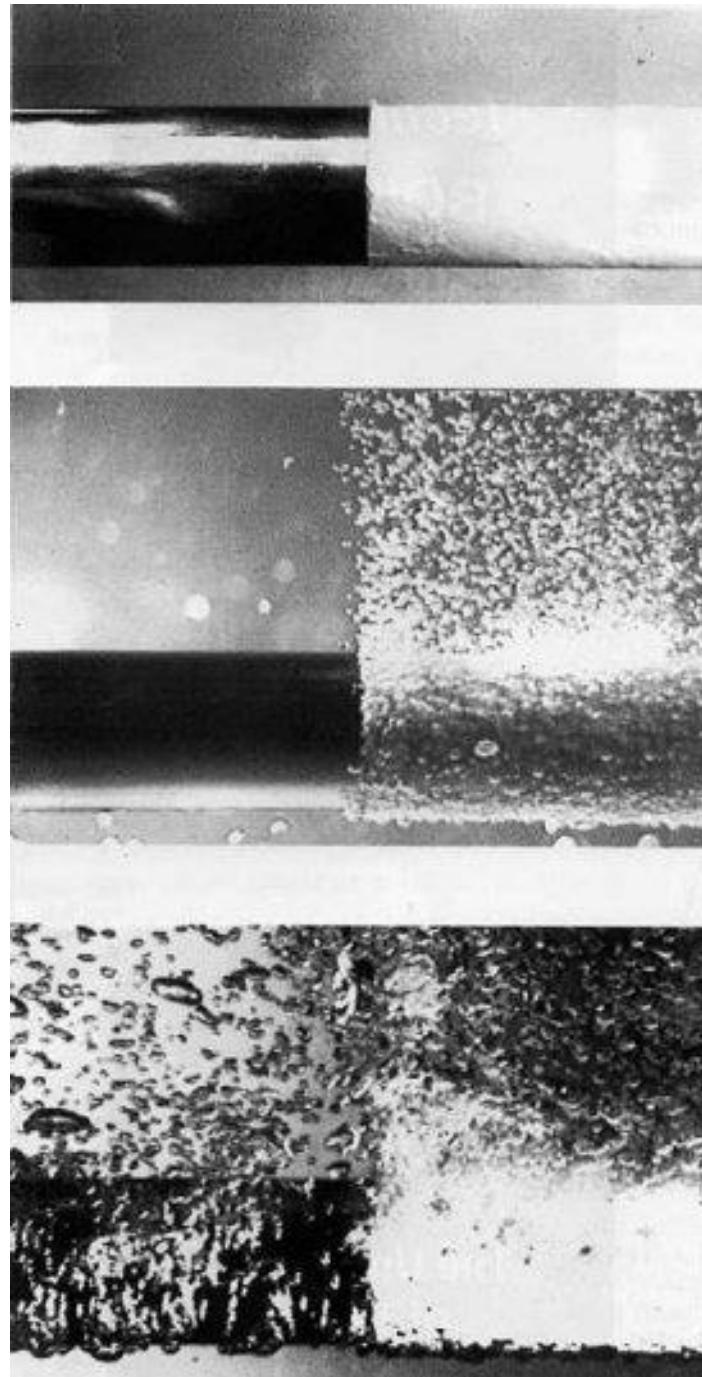


FILME

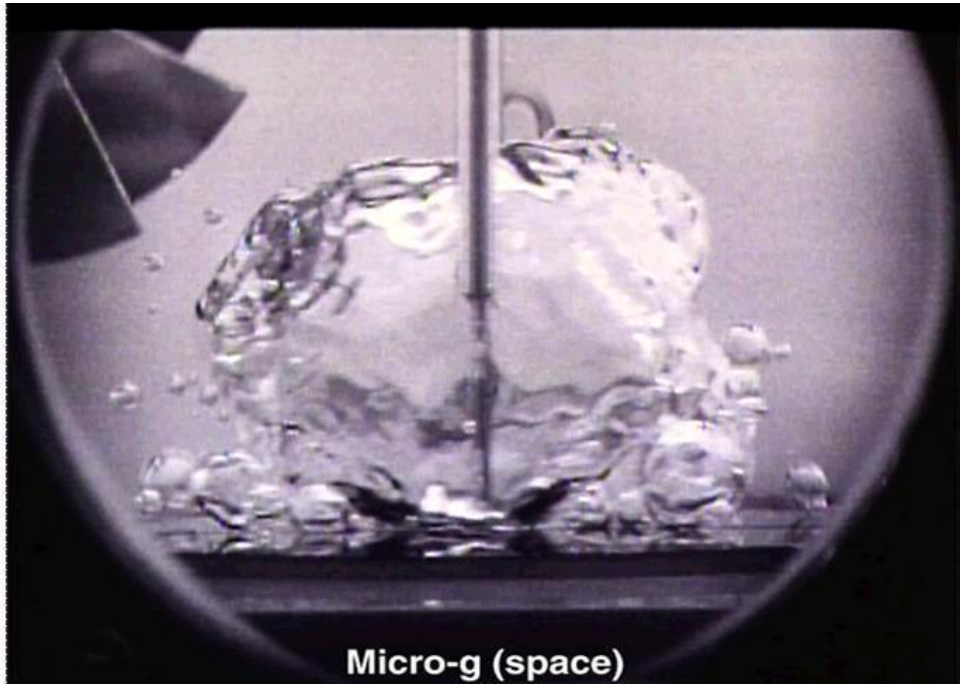
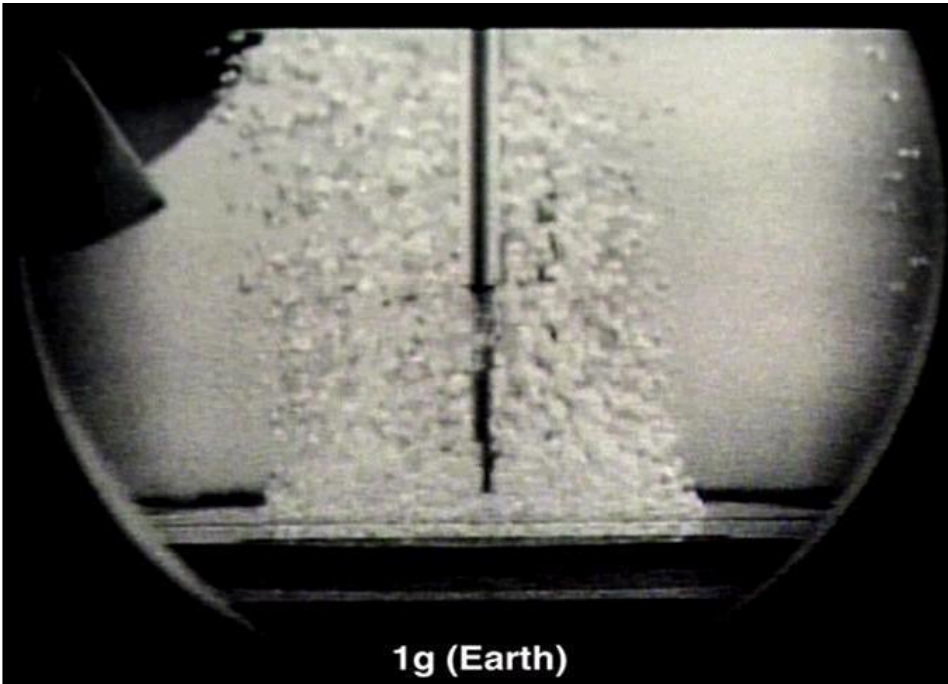


POOL BOILING

Acabamento Superficial



EBULIÇÃO - Gravidade



VAPOR – STEAM – CALDEIRAS

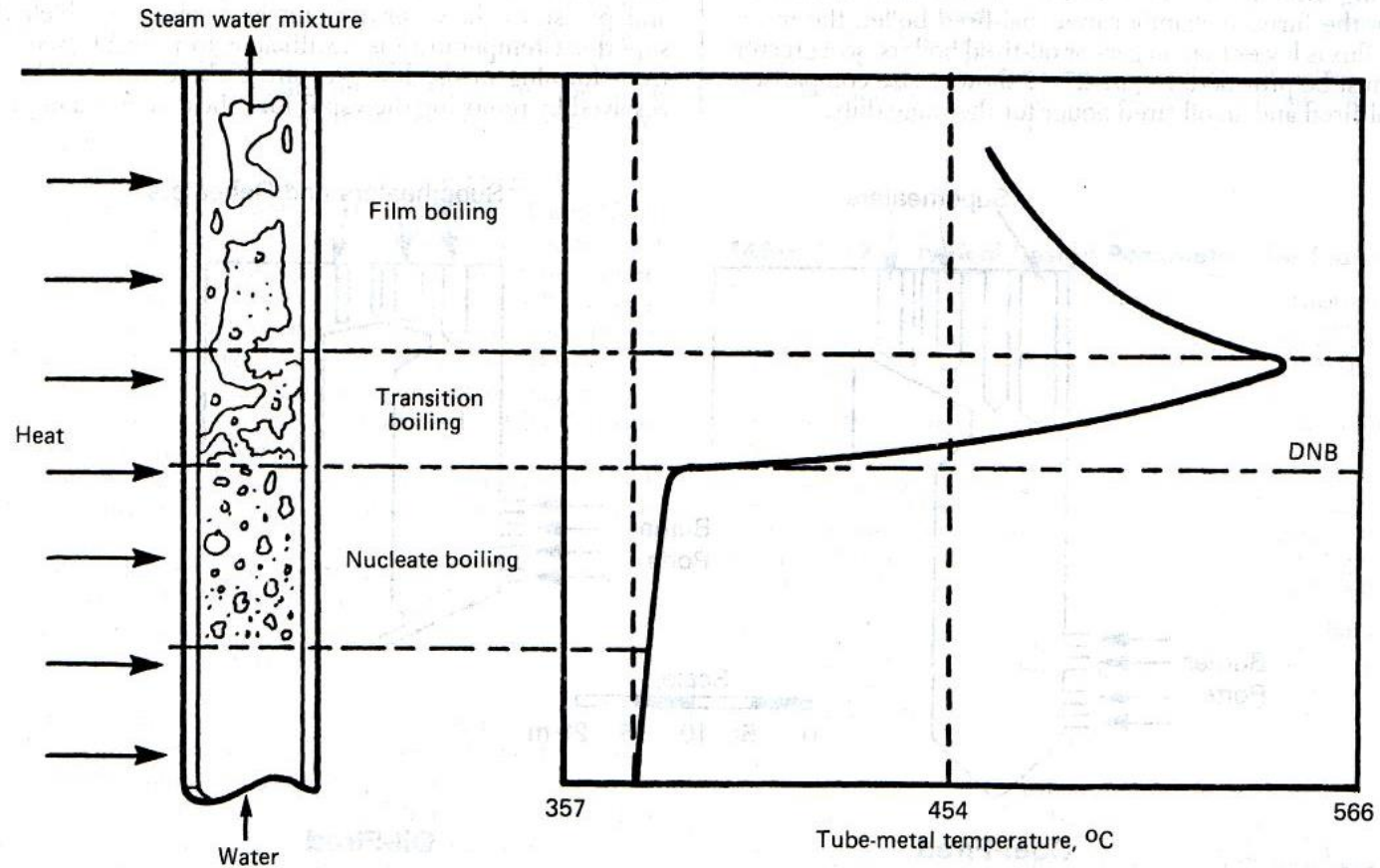
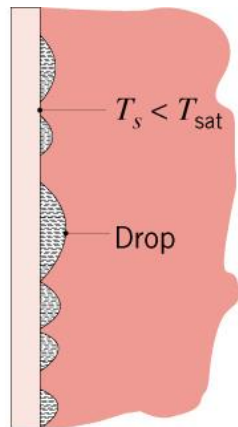
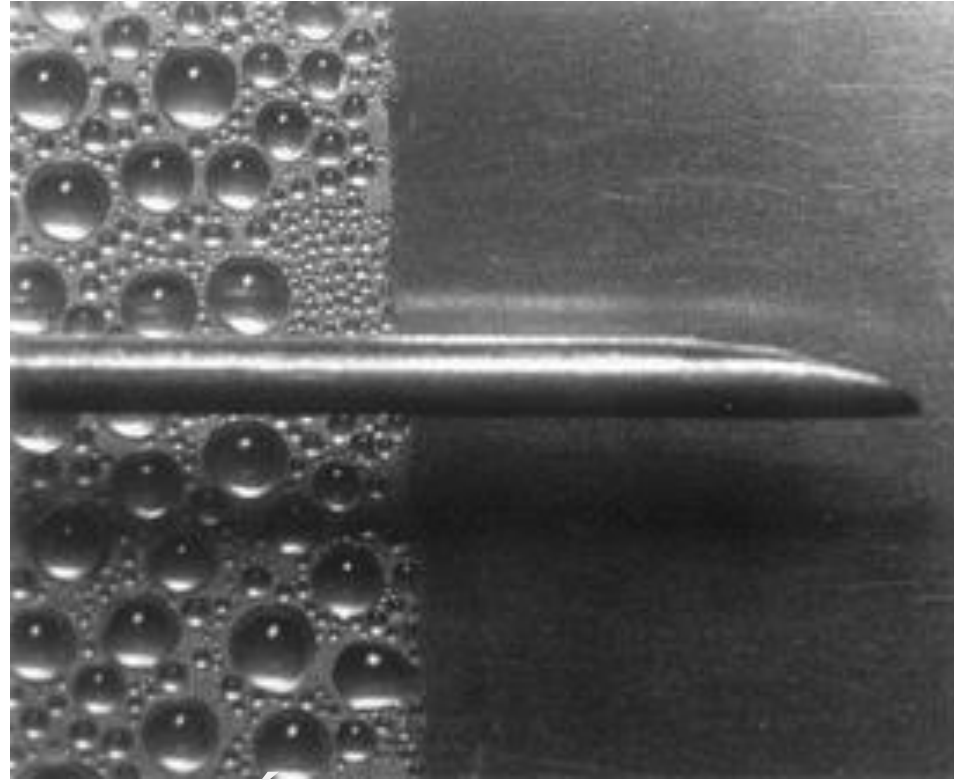


FIG. 27-40 Effect of departure from nucleate boiling (DNB) on tube-metal temperature.



Condensação



GOTÍCULA FILME

