INTERNATIONAL ATOMIC ENERGY AGENCY
UNITED NATIONS EDUCATIONAL, SCIENTIFIC AND CULTURAL ORGANIZATION

INTERNATIONAL CENTRE FOR THEORETICAL PHYSICS
34100 TRIESTE (ITALY) - P.O.B. 586 - MIRAMARE - STRADA COSTIERA 11 - TELEPHONE: 2240-1
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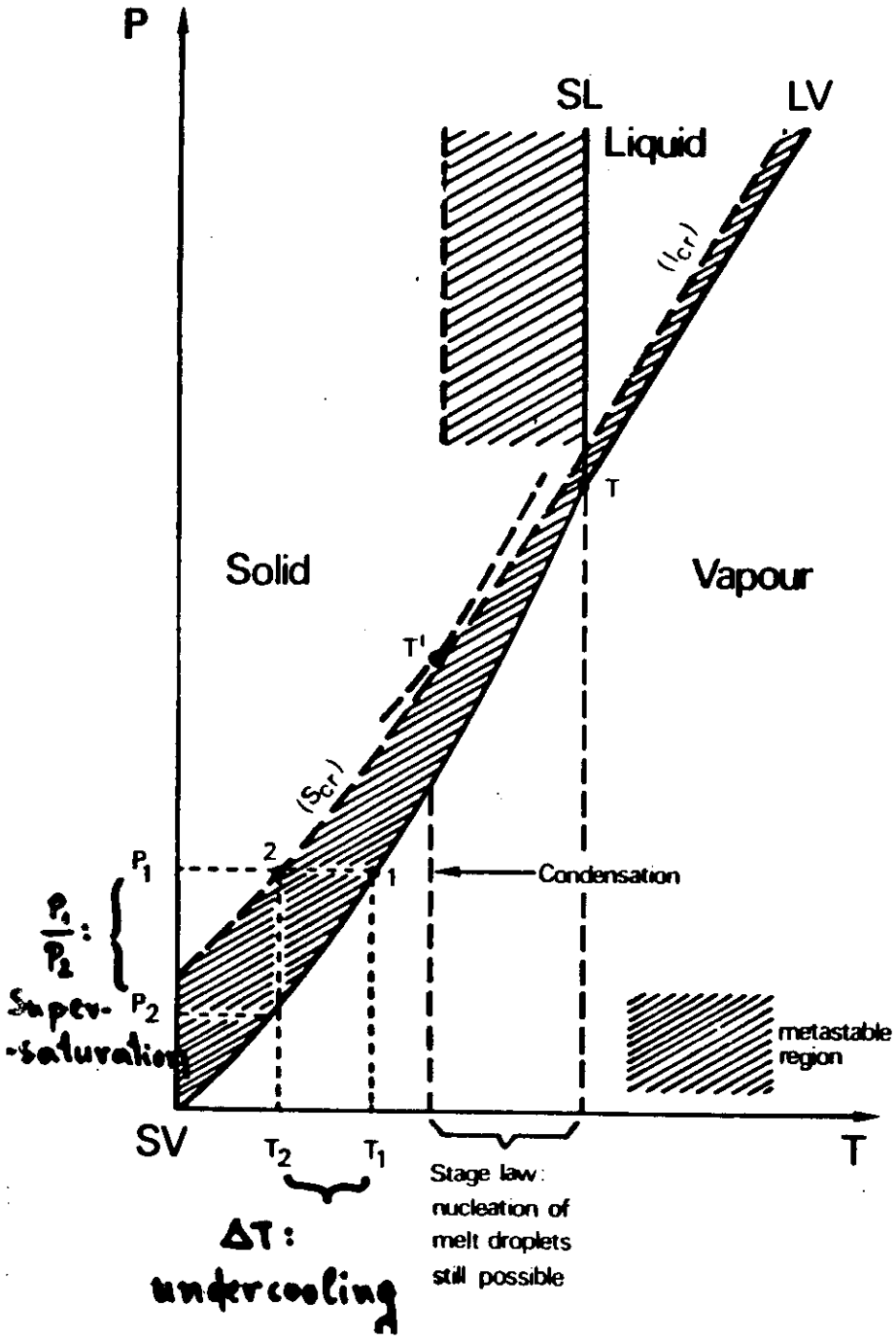
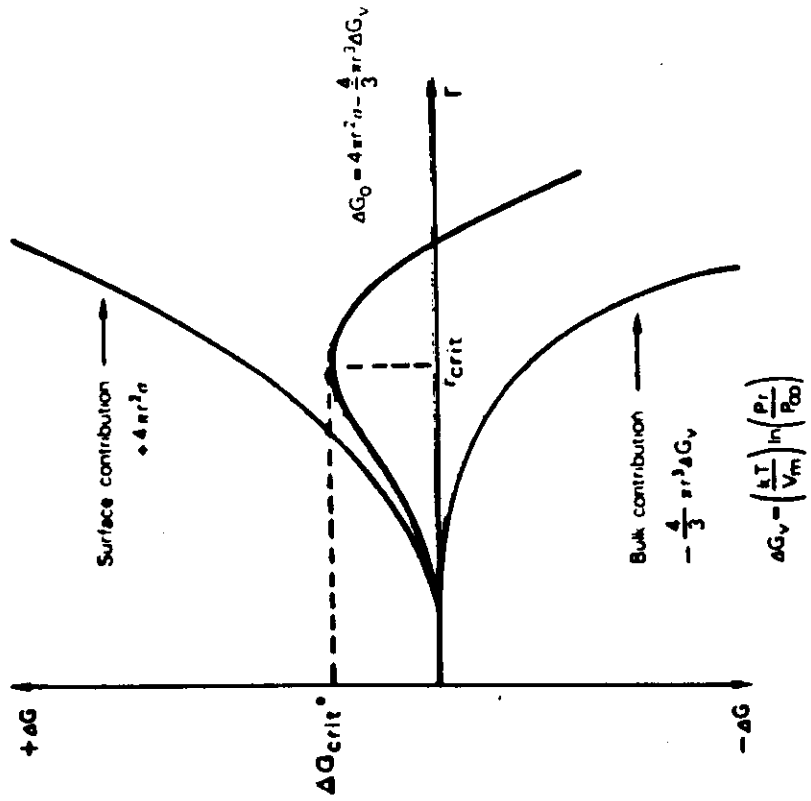
SMR/382- 14

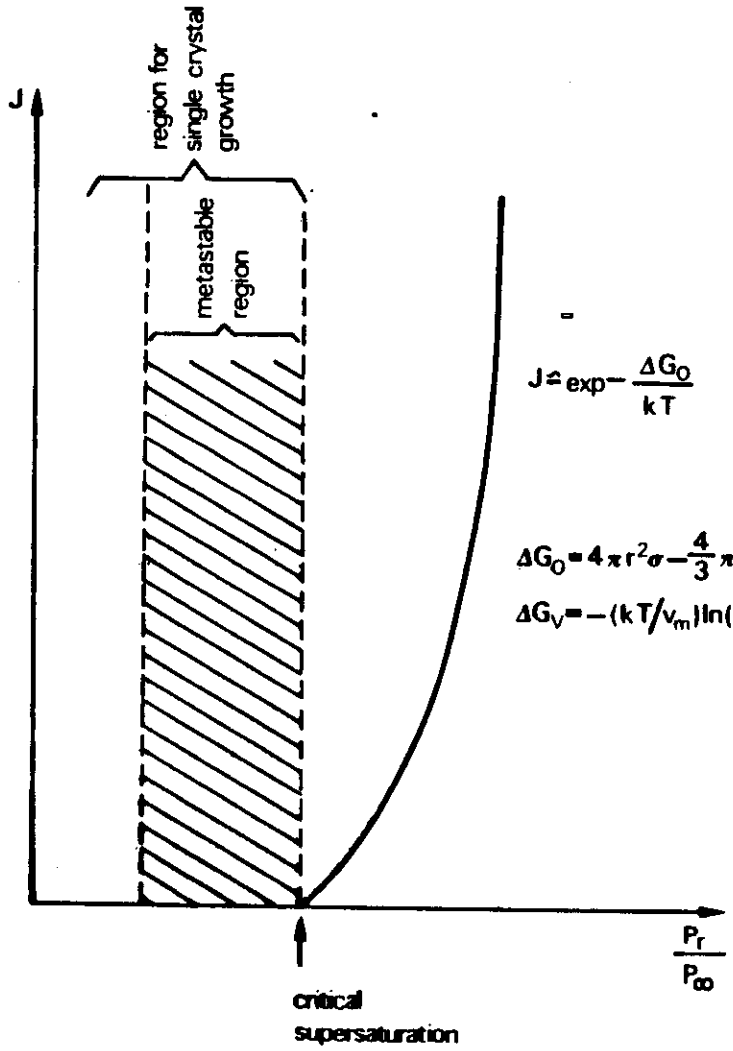
WORKSHOP ON SPACE PHYSICS:
"Materials in Micorgravity"
27 February - 17 March 1989

"Crystal Growth: Fundamental"

E. KALDIS
ETH
Zurich, Switzerland


P
SL
LV
Liquid
(l_{cr})
T
Solid
Vapour
T'
(S_{cr})
P_1
2
1
Condensation
$\frac{P_1}{P_2}$:
Super-saturation
P_2
metastable region
SV
T_2
T_1
T
ΔT:
undercooling
Stage law:
nucleation of
melt droplets
still possible

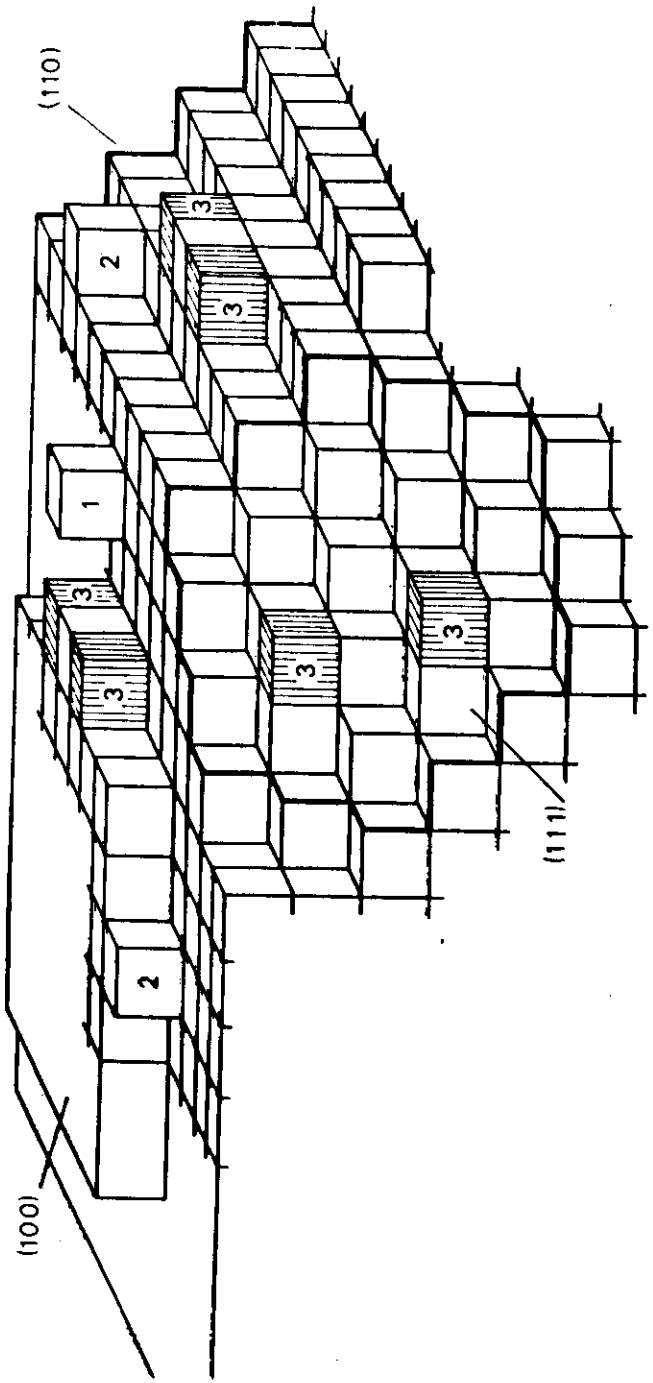

$\Delta G_0 = 4\pi r^2\sigma - \frac{4}{3}\pi r^3 \Delta G_v$
r
Surface contribution
$+4\pi r^2\sigma$
r_{crit}
Bulk contribution
$-\frac{4}{3}\pi r^3 \Delta G_v$
$\Delta G_v = \left(\frac{kT}{V_m}\right) \ln\left(\frac{P_1}{P_\infty}\right)$
+ΔG
ΔG_{crit}
−ΔG

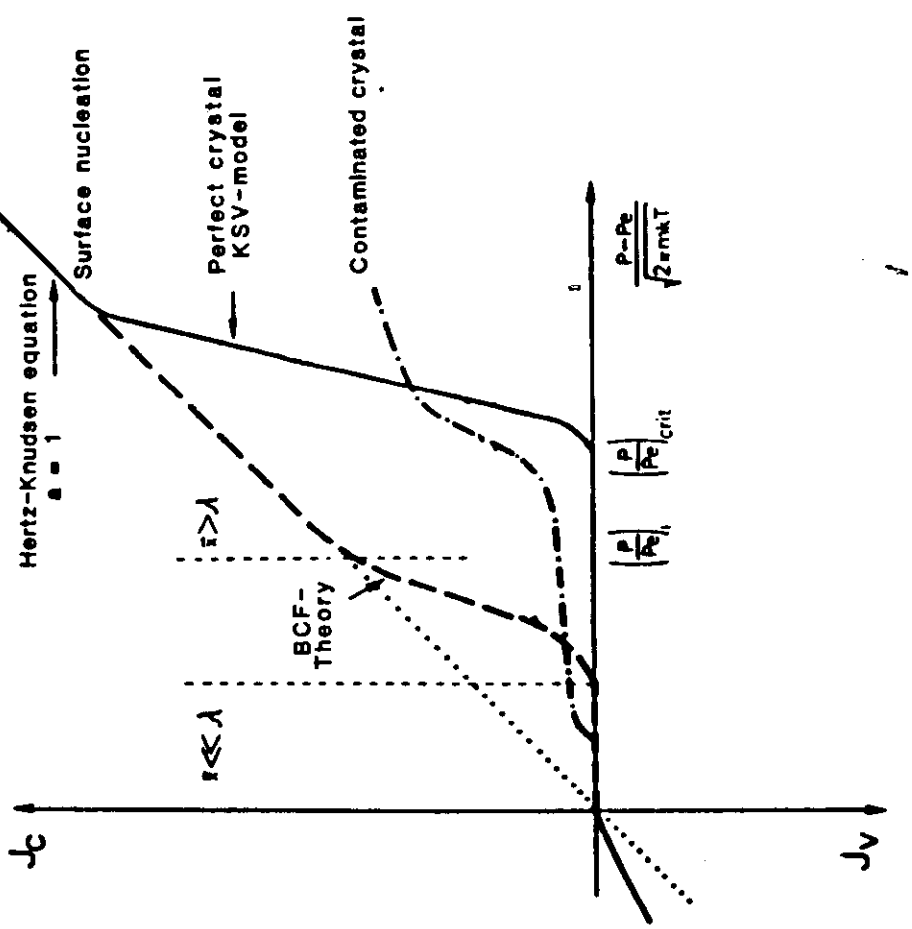


$$J \simeq \exp - \frac{\Delta G_0}{kT}$$

$$\Delta G_0 = 4\pi r^2 \sigma - \frac{4}{3}\pi r^3 \Delta G_v$$

$$\Delta G_V = -(kT/v_m)\ln(P_r/P_\infty)$$





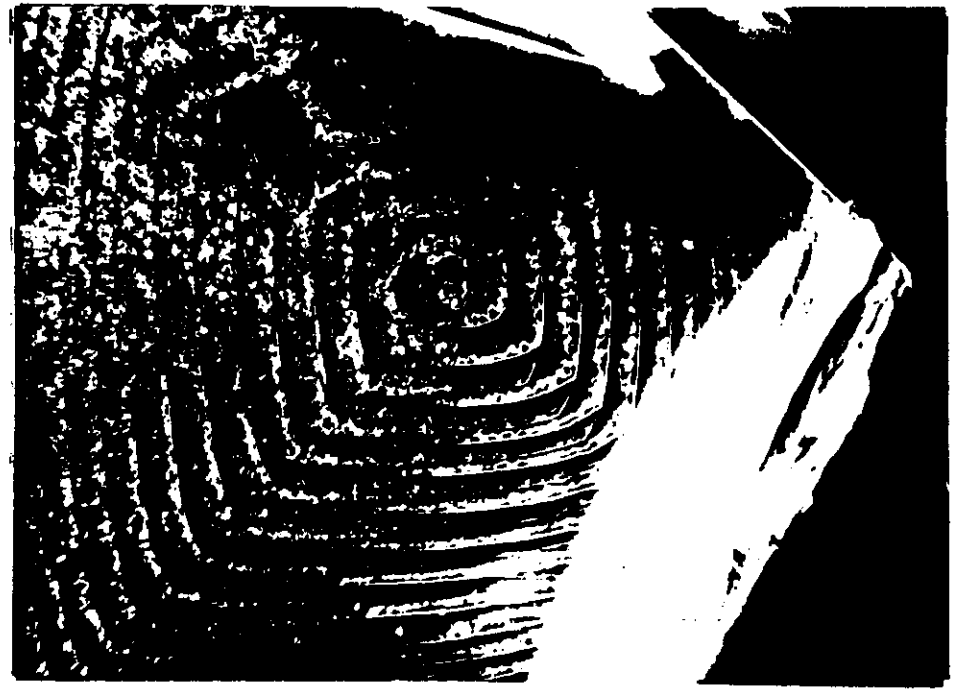


FIG. 3.9 a) An optical micrograph of an as- grown (001) facet showing the spiral pattern of an α-HgI_2 crystal in the presence of polyethylene dopant.

R. Cudoret et al

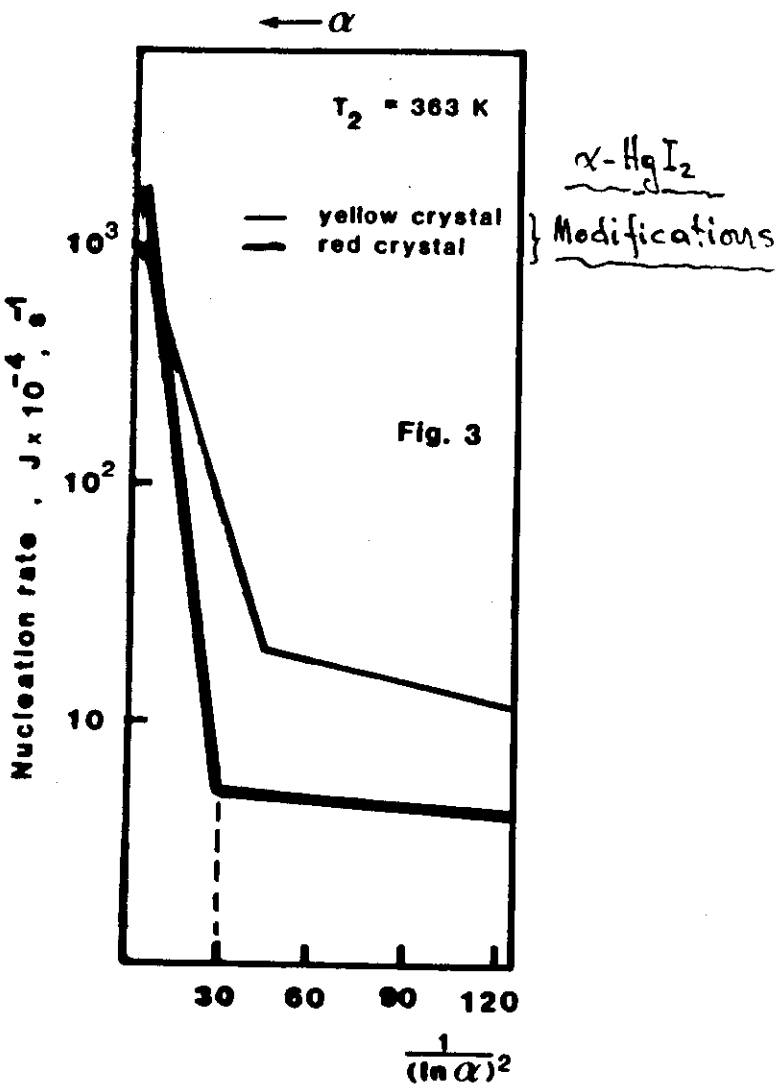


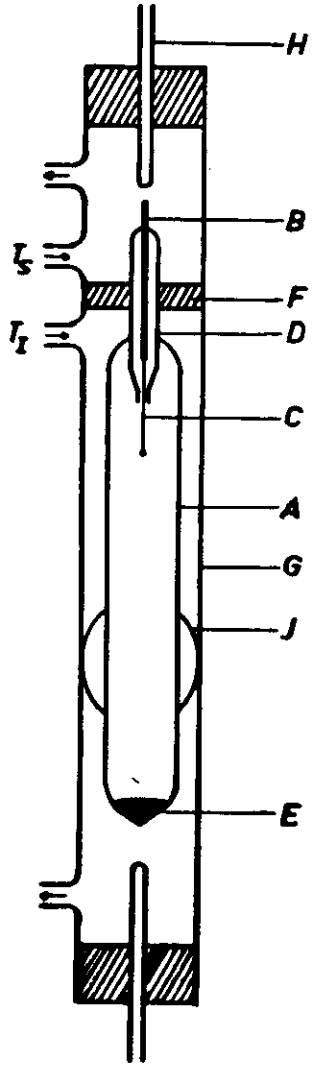
Fig. 3

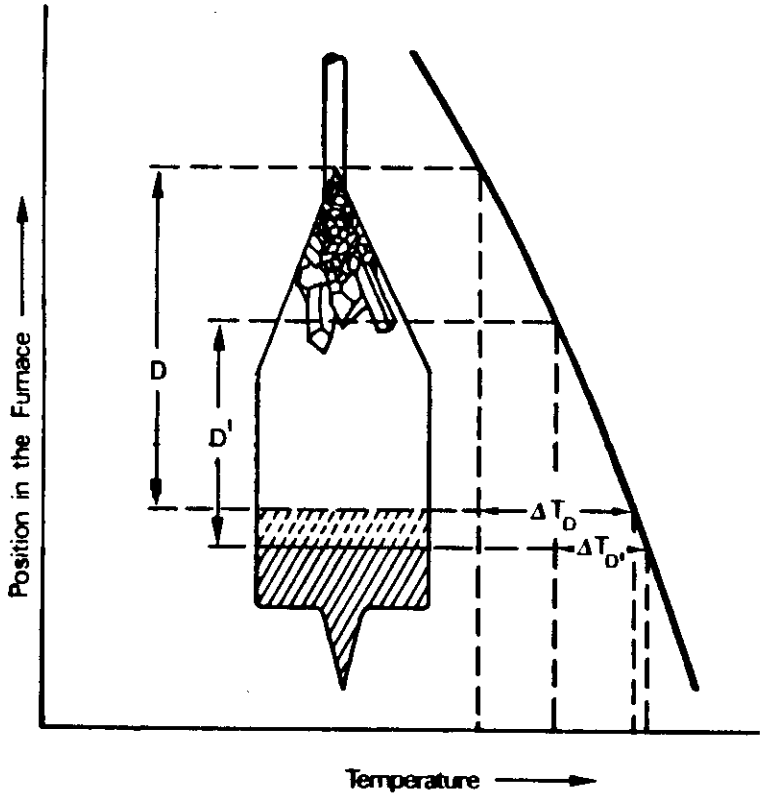
α-HgI_2

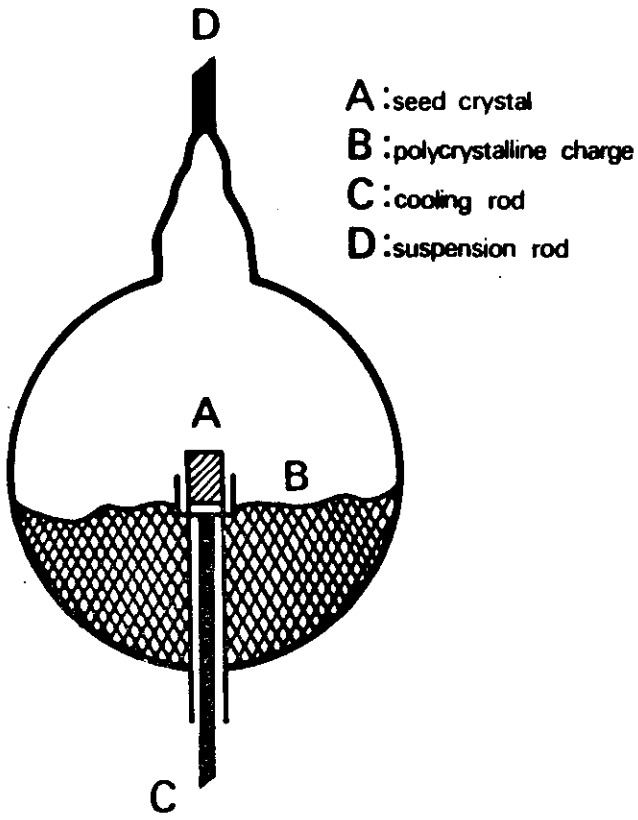
} Modifications

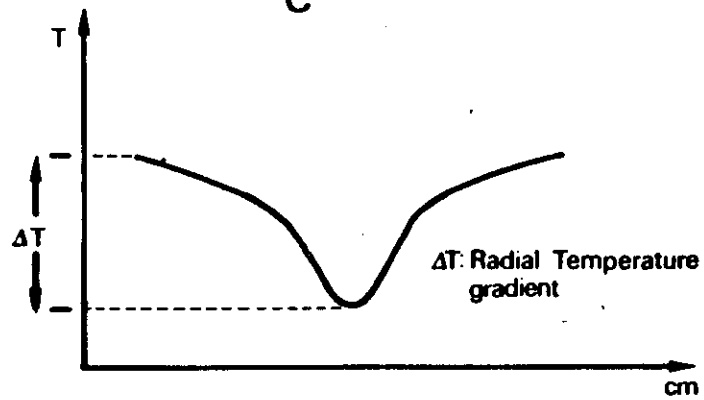
Nucleation control

- Reduction of the surface area of the substrate

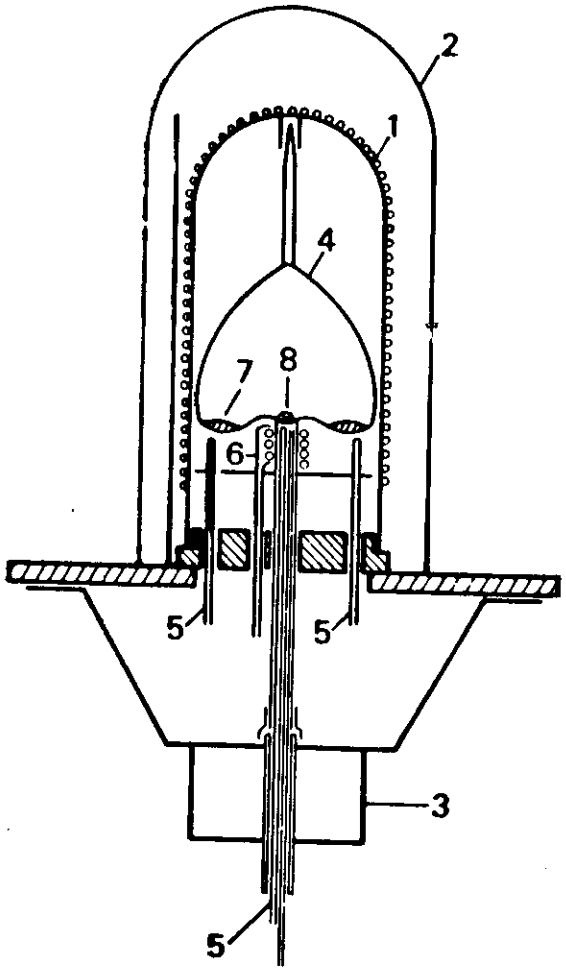








Distance along the furnace tube diameter



Furnace and ampoule design (schematic) used in the temperature gradient reversal methods. (1) silica furnace. (2) thermal shield of Duran glass. (3) rotation mechanism. (4) ampoule for crystal growth. (5) thermocouples. (6) bottom heater. (7) charge. (8) crystal.

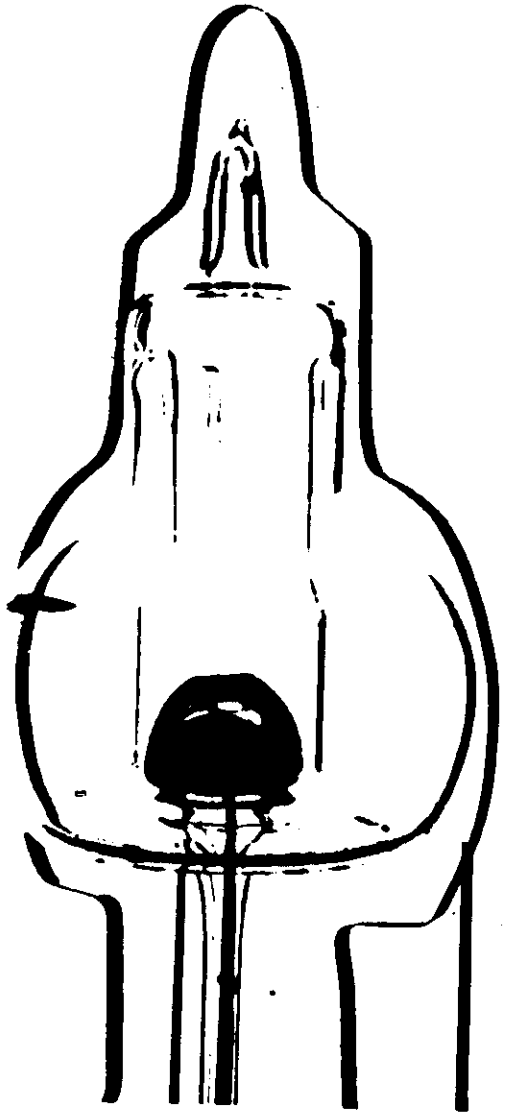


Fig.6.2 Growth striations revealed by chemical polishing with 20% solution in water. Slab was cut from a crystal grown in a vertical furnace using the TOM method. After SCHIEBER et al., 1976