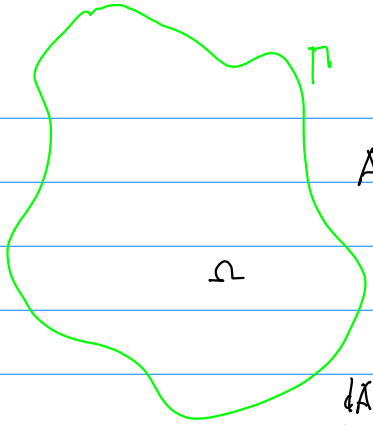


$v_n = \kappa$

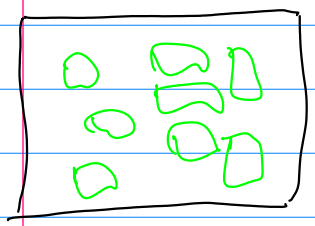
$$A = \int_\Omega dx$$

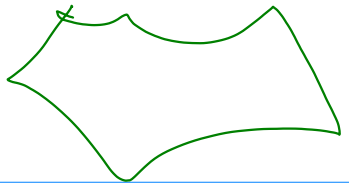
$$= \frac{1}{2} \int_\Gamma x \cdot n \, ds$$

$$\frac{dA}{dt} = -\frac{1}{2} \int_\Gamma v_n \, ds = -\frac{1}{2} \int_\Gamma \kappa \, ds$$

$$= -\frac{1}{2} \int_\Gamma \frac{d\theta}{ds} \, ds$$

$$= -\pi \quad \text{for all regions}$$





$$\frac{dA}{dt} = \frac{\pi}{6}(n-6)$$

Burke-Turnbull (C.V. Thompson, 2001)

phenomenological model

networks

everything is averaged

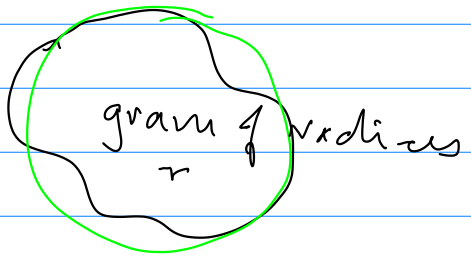
normal grain growth: average geometric properties scale with time

$\langle d \rangle$ average cell diameter

$d \propto t^\alpha$ has a distribution

$f\left(\frac{d}{\langle d \rangle}, t\right)$ $\langle d \rangle$ = average over blue

$v_n = \mu \langle \kappa \rangle$ $\mu = m \langle \gamma_{gb} \rangle$



$\langle \kappa \rangle = \frac{c}{r}$

$$\frac{dr}{dt} = \frac{m \langle \gamma_{gb} \rangle}{r}$$

$$\frac{1}{2} \frac{d}{dt} \langle r \rangle^2 = m \langle \gamma_{gb} \rangle$$

$$r^2 - r_0^2 = 2m \langle \gamma_{gb} \rangle t,$$

$$\Rightarrow \quad \alpha = \frac{1}{2}$$

$\langle r \rangle^2 = \langle r^2 \rangle$

$m \propto C e^{-\frac{}{kT}}$