Anyagtudomány: az ókortól napjainkig

Groma István

ELTE, Anyagfizikai Tanszék

November 14, 2024

Ókor

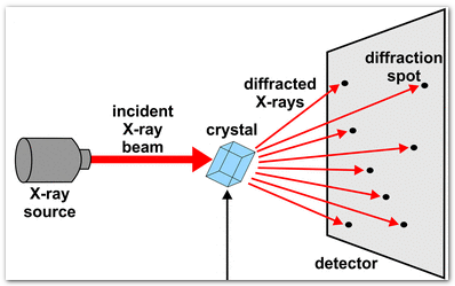
Bronz (réz ón keverék)

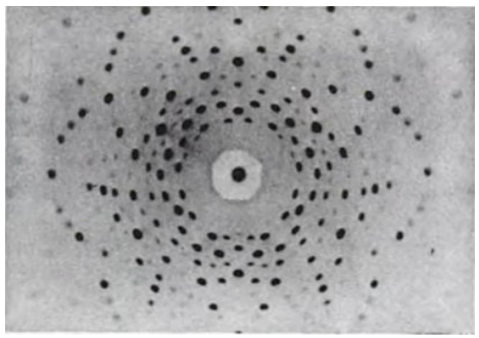
Korai bronzkor (i.e. 3500-2000)
Közép bronzkor (i.e. 2000-1600)
Késő bronzkor (i.e. 1600-1200)

Arkhimédész (i.e. 287– 212)

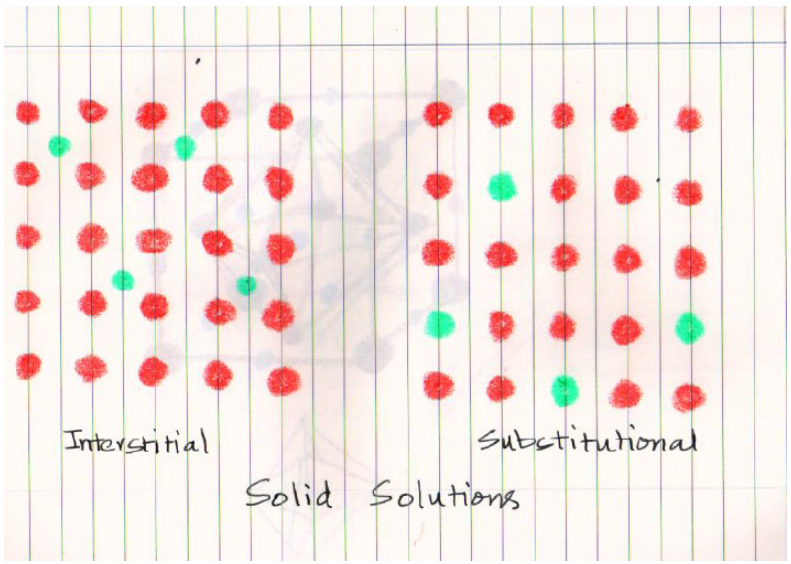
Kristály szerkezet

Röntgen sugárzás (1900)

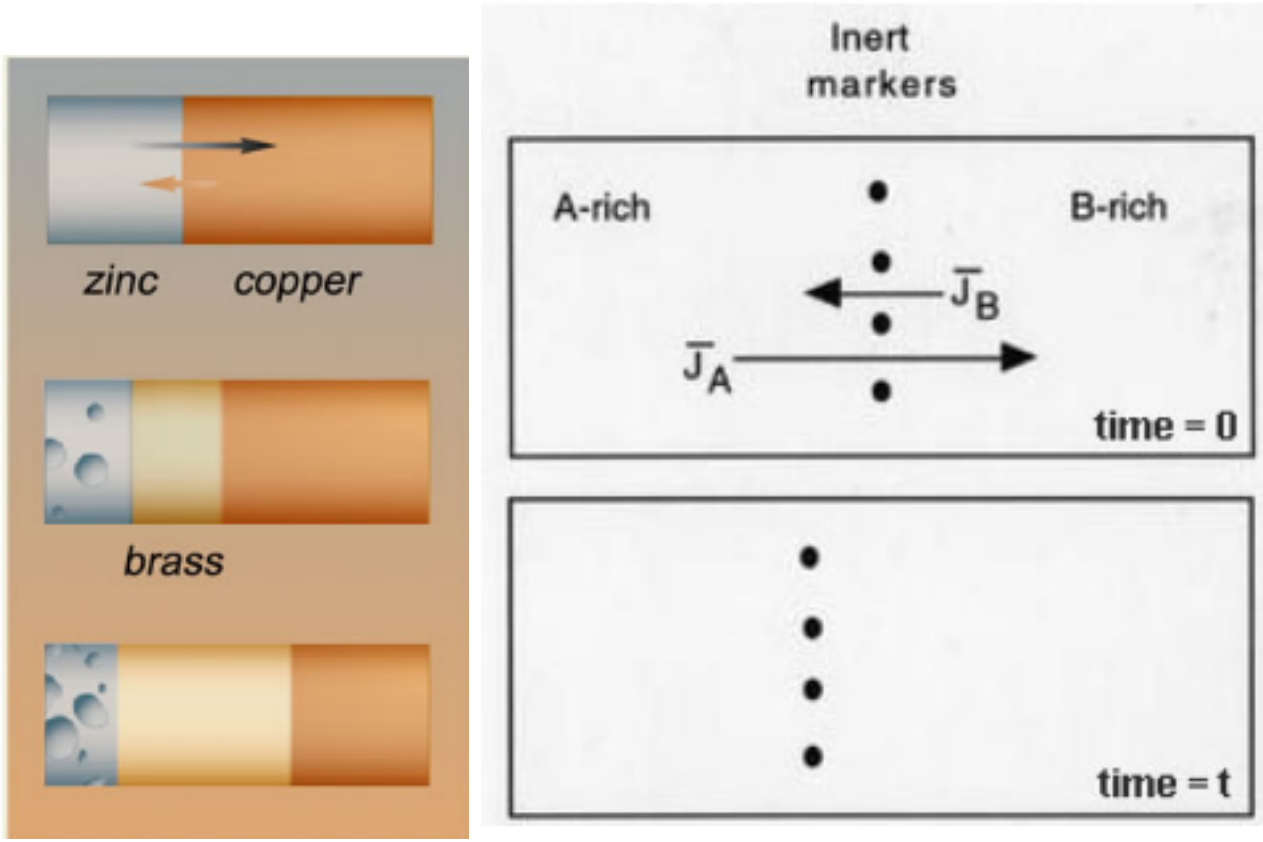




Ponthiba



Kirkendall effektus



Ernest Kirkendall (1914 -2005), 1942

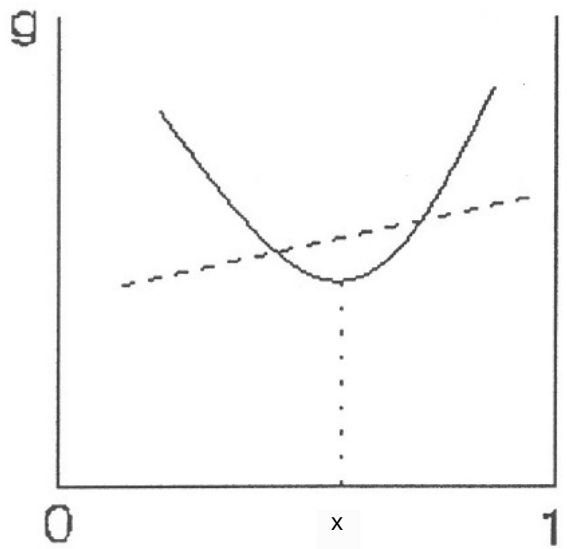
Termo“dinamika”

0+3 főtétel

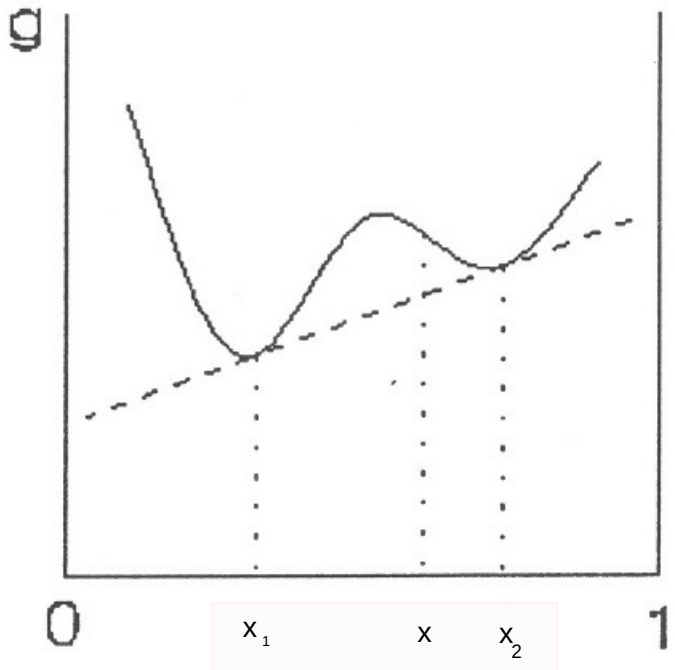
Létezik $G(T, p, N)$ függvény (szabadentalpia) ami mindent megad!

Egyensúlyban minimuma van

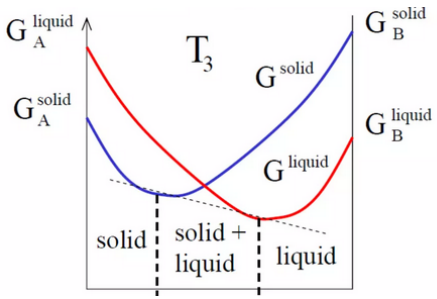
Szilárd oldat szétesése

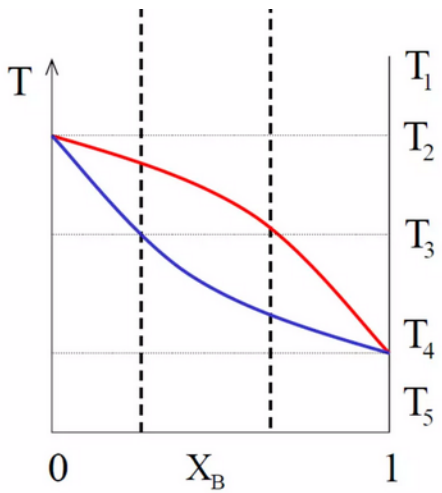


Szétesés



Szilárd-folyadék

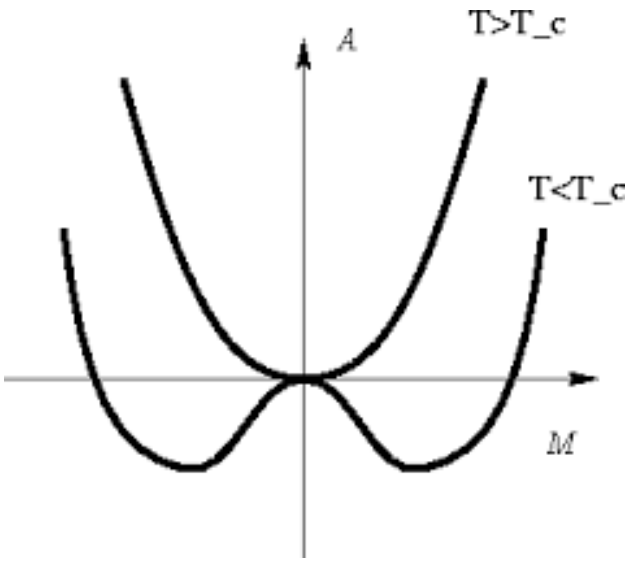




Landau elmélet

Fenomenológikus $F(M)$ reláció

$$\frac{F}{V} = f_0 + A(T)M^2 + \frac{B(T)}{2}M^4$$



$$A(T) = a(T - T_c), \qquad B = const > 0$$

Mágnesség Ginzburg-Landau elmélet

Domain fal energiája

$$F_tot = F_t(M(\vec{r}) + F_f(\triangle M(\vec{r}))$$

Egyensúlyban

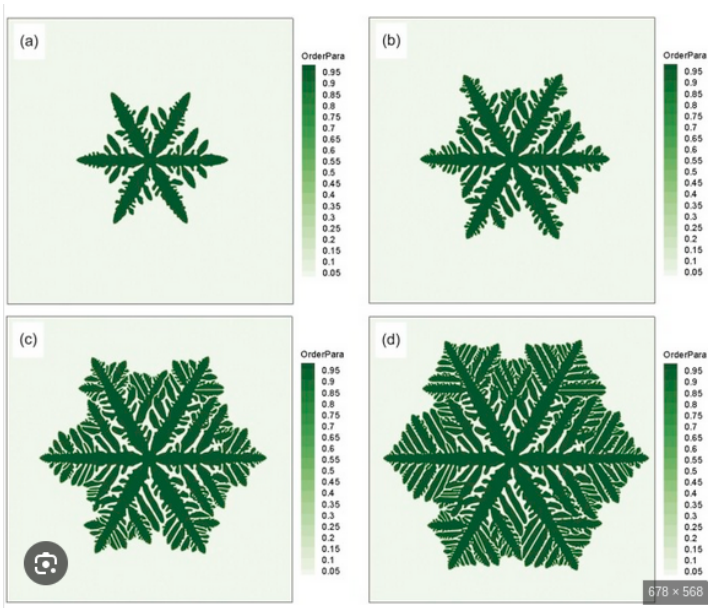
$$\frac{\triangle F}{\triangle M} = 0$$

Egyensúlyhoz közel

$$\frac{\triangle M}{\triangle t} = -D\frac{\triangle F}{\triangle M}$$

DINAMIKA!!

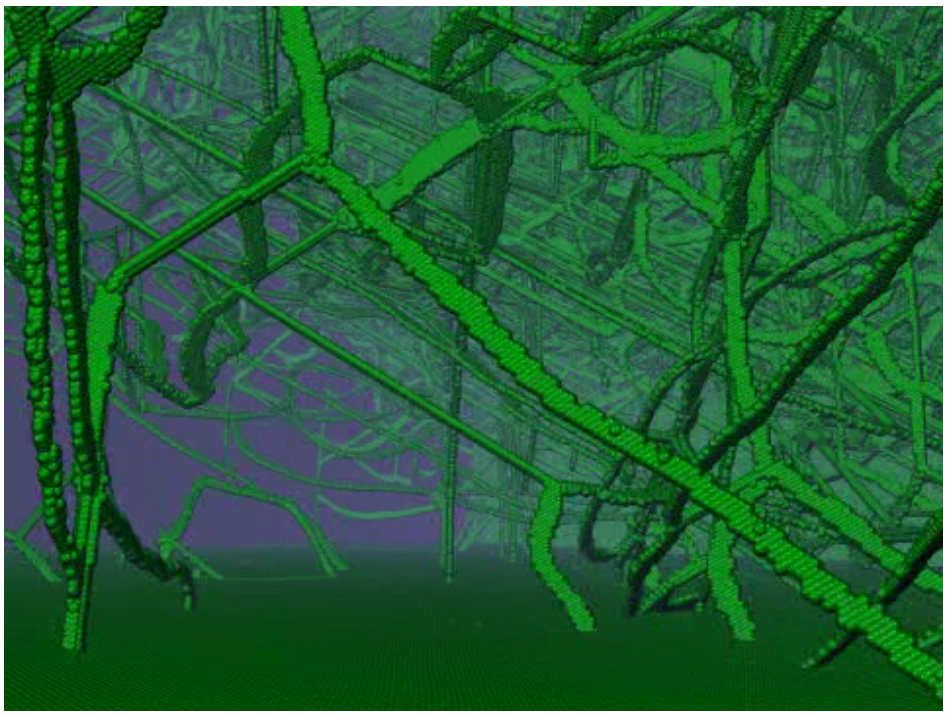
Dendrit növekedése



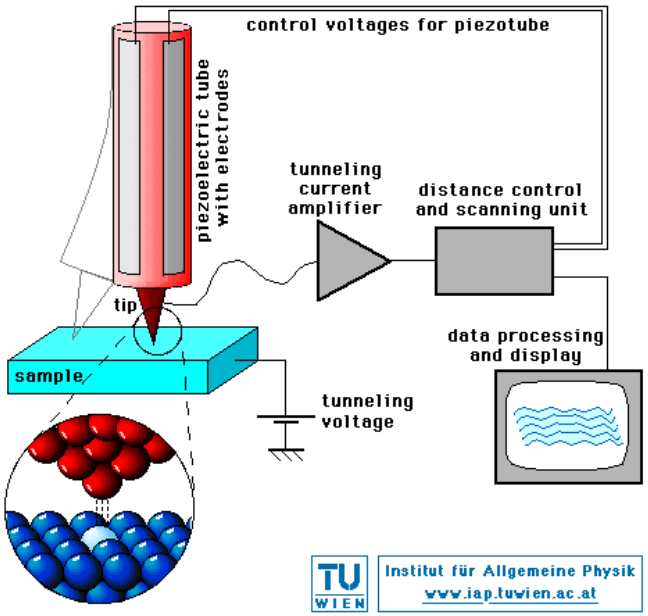
Fúziós erőmű

National Ignition Facility (D + T $\rightarrow$ 4He + n + 17.58MeV)

MD simulation with 10^9 atoms!



AFM/STM


control voltages for piezotube
piezoelectric tube with electrodes
tunneling current amplifier
distance control and scanning unit
tip
data processing and display
sample
tunneling voltage
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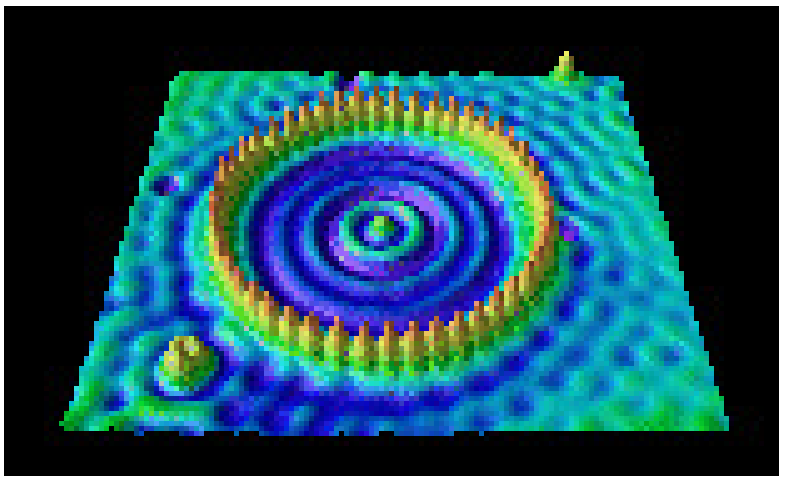
AFM



AFM képek