THE MORPHOLOGICAL STABILITY OF GROWING CRYSTALS

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The morphological stability of growing crystals is a very old problem preoccupying many scientists. The primary problem of the morphological stability of growing crystals is the recovery of the mathematical expression that depicts crystal growth. To solve this problem, we start in this paper from the perturbation of field concentration in the interphases border that is represented by a Laplace equation. The field concentration at the interphase border is a real physical field, upon which mathematical physics can be applied. By partial solution of the Laplace equation, and the presentation of that solution as Legendre polynomial, we can get a complex function that describes the growth of several crystal forms in the cubic system.

Growth of the {100} and {100}{111} crystal forms

Growth of the {100} crystal form can be described by the following function (perturbation of field concentration) at the interphase border: $\frac{dd_\ell}{dtd_\ell} = \left(Y^4 - \ell ai\right) = 0$; $\psi = (C_k - C_0)$, where C_k is the density of a crystal, C_0 is the density at the interphase border; $a = \frac{g_{(100)}}{RTd}$, where $\gamma_{(100)}$ is the interphase surface energy at the (100)-plane (erg/cm^2), $R = 8.314 \cdot 10^7$ erg/mol K, T is the temperature in K and d is the thickness of an interphase border; ℓ is the fundamental number of lamina growth. If we solve the above function, we get four symmetrical solutions for $\ell = 1, 2$ that are presented in Fig. 1a.

The growth of the {100}{111} combination can be described by the function $\frac{dd_\ell}{dtd_\ell} = \left(Y^4 - \ell ai\right)^2 = 0$. If we solve this function, we get eight symmetrical solutions for $\ell = 1, 2$ that are presented in Fig. 1b.

Growth of the {111} and {111}{100} crystal forms

The growth of the {111} crystal form can be described by the function $\frac{dd_\ell}{dtd_\ell} = \left(Y^3 - \ell bi\right) = 0$, $b = \frac{g_{(111)}}{RTd}$; the growth of the {111}{100} crystal form can be described by the function $\frac{dd_\ell}{dtd_\ell} = \left(Y^3 - \ell bi\right)^2 = 0$. If we solve these functions, we get adequate solutions for $\ell = 1, 2$. The solutions for the growth of the {111} and {111}{100} crystal forms are presented in Fig. 1c and Fig. 1d, respectively.

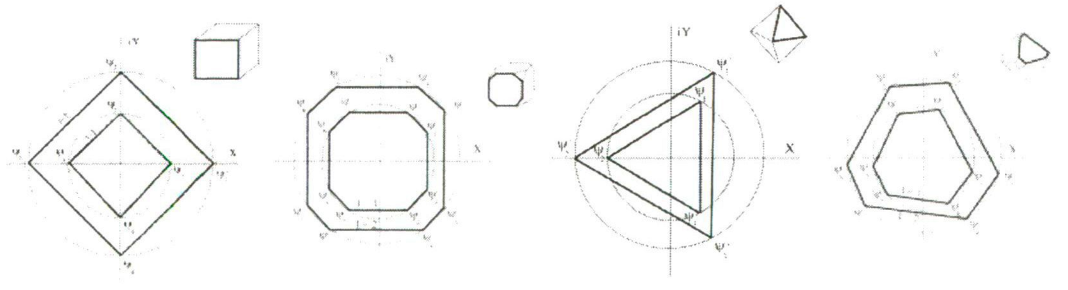

Fig. 1a **Fig. 1b** **Fig. 1c** **Fig. 1d**