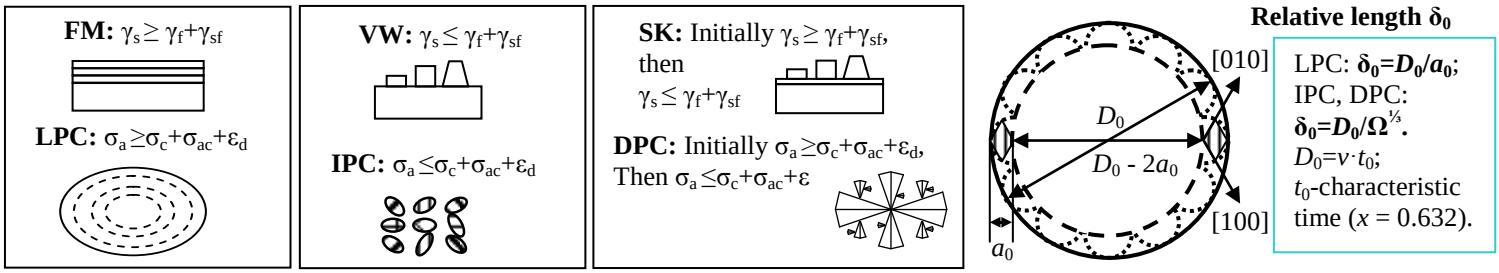
Layer polymorphous crystallizations of amorphous films: structural and kinetic aspects

A. Bagmut, I. Bagmut NTU "KhPI", Kharkiv, Ukraine)
agbagmut@gmail.com

The concepts of layer polymorphic crystallization (LPC), island polymorphic crystallization (IPC) and dendrite polymorphic crystallization (DPC) are formed [1]. LPC (Cr_2O_3, V_2O_3, Sb_2S_3, Se and others) is regarded as morphological analog of Frank–van der Merwe (FM) growth mode of a crystal from the vapor phase. IPC (Al_2O_3, ZrO_2, Ni, Re and others) is regarded as morphological analog of Volmer–Weber (VW) growth mode of a crystal from the vapor phase. DPC (HfO_2,Fe-C and others) is regarded as morphological analog of Stranski–Krastanov (SK) growth mode of a crystal from the vapor phase.

Structural analogy of crystal growth modes during condensation (FM, VW, SK) and crystallization (LPC, IPC, DPC)



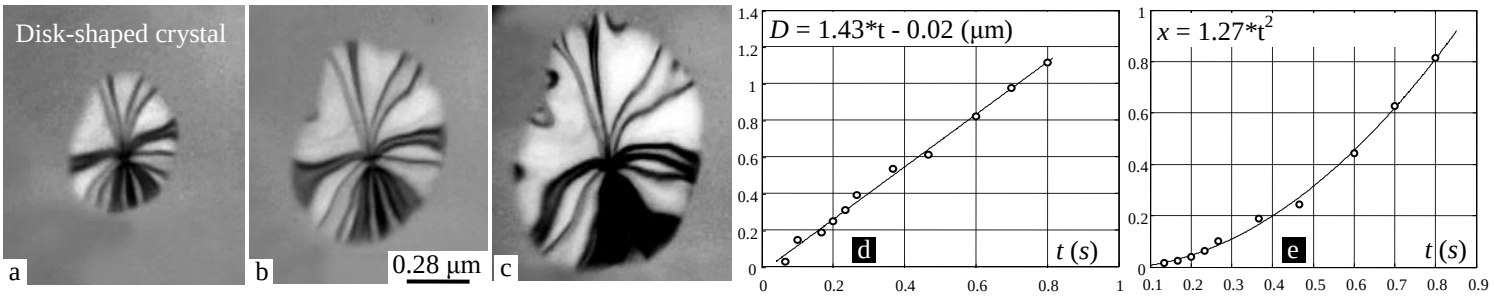


Fig. 1. Video clip frames of layer polymorphic crystallization of Cr_2O_3 (Relative length δ_0= 3100 [3]). The time moments *t*, which have passed from the beginning of the recording of the crystallization process: (a) *t* = 0.33 *s*; (b) *t* = 0.53 *s*; (c) *t* = 0.73 *s*. (d) The dependence of the diameter of the crystal *D* on time *t*. (e) The dependence of the fraction *x* of the crystalline phase on time *t*.

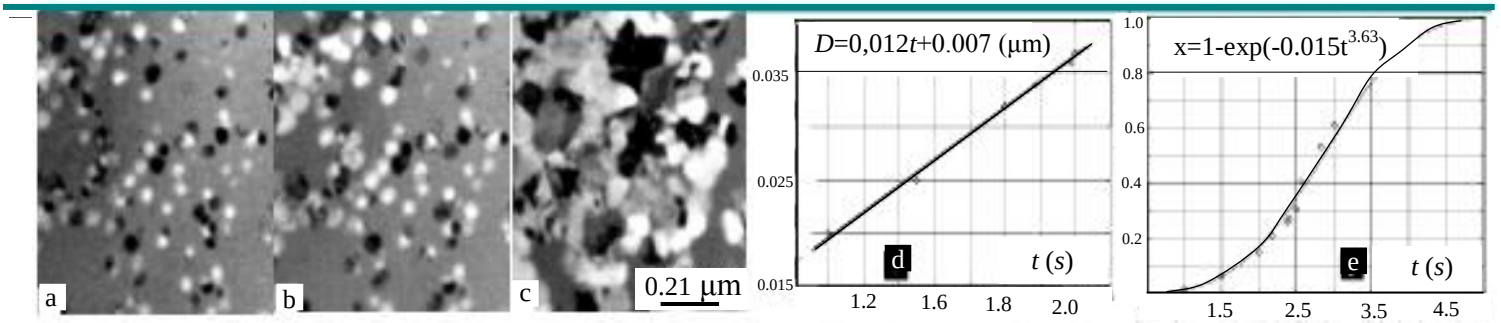


Fig. 2. Video clip frames of island polymorphic crystallization of ZrO_2 (Relative length δ_0= 120). The time moments *t*, which have passed from the beginning of the recording of the crystallization process: (a) *t* = 2.40 *s*; (b) *t* = 2.50 *s*; (c) *t* = 3.50 *s*. (d) The dependence of the average diameter of the crystal *D* on time *t*. (e) The dependence of the fraction *x* of the crystalline phase on time *t*.

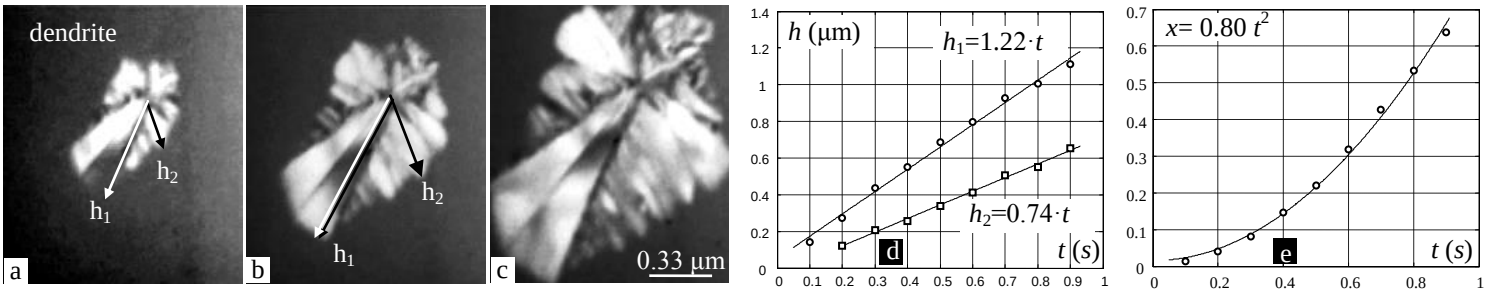


Fig. 3. Video clip frames of dendrite polymorphic crystallization of HfO_2 (Relative length δ_0= 3800). The time moments *t*, which have passed from the beginning of the recording of the crystallization process: (a) *t* = 0.40*s*; (b) *t* = 0.60 *s*; (c) *t* = 0.90 *s*. (d) The dependence of the dendrite branches length h_1, and h_2 on time *t*. (e) The dependence of the fraction *x* of the crystalline phase on time *t*.

[1]. A. Bagmut, Electron microscopy of films deposited by laser evaporation. Monograph. Kharkiv: NTU "KhPI", 2014. (in Russian).