

Abbreviations in crystals name and crystal growth technique

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Given below are transcription of the most commonly used abbreviations related to the crystals, method of growing crystals and films.

Keywords: abbreviation, crystal name, growth method, film deposition.

Скорочення в назві кристалів і техніка вирощування кристалів. Л.Литвинов.

Нижче наведено транскрипцію найпоширеніших скорочень, що стосуються кристалів, способу вирощування кристалів і плівок.

1. Introduction.

Recently in the talks and scientific papers the authors widely use abbreviated names of crystals, films and methods of their growth frequently not explaining these abbreviations. Abbreviations are a tool for reducing the length of articles and improving readability. However, there are many specialized terms that can be difficult for some readers without a significant background in the subject. While, for instance, the majority of specialists in crystals growth understand that the expression Cz-Si is Silicon grown by the Czochralski method. Many of them will guess that GaP(LECz) is a GaP crystal grown by Liquid encapsulated Czochralski method but no means everybody of the specialists in the field of crystal growth will associate SEG with Si Epitaxial Growth or Bi:RIG with Bi-substituted rare-earth Iron garnet. “V” can be abbreviation of Vacuum or Vertical etc.

In the abbreviated names of crystals by one and the same letters can denote not only different elements or radicals (T - Tl or Tb; A-As or Al, or Ammonium; L - La or Li; I - In or Iron) but also different conceptions (G - Gd, Ga or garnet; P - Pb or perovskite).

The given transcripts of the most commonly used abbreviations will help in reading scientific literature concerning crystals, films and growth methods.

2. Abbreviation in methods of crystals growth and films deposition

CGT – Crystal Growth Technology

Bridgmen Method

DRSSVBT – Double Run Selective Self-seeding Vertical Bridgman Technique
HB – Horizontal Bridgman
HGF – Horizontal Gradient Freezing Method
HPB – High Pressure Bridgman
GFB – Gradient Freeze Bridgman
VB – Vertical Bridgman
LEVB, (LE)VB – Liquid Encapsulated Bridgman
VGF – Vertical Gradient Freeze Method
LEVGM – Liquid Encapsulated Gradient Freeze Method
SSVBT – Self-seeding Vertical Bridgman technique

Czochralski Method, CZ, Cz

ECz – Encapsulated Czochralski
EMCz – Electro Magnetic Cz
HWC, HWCz – Hot-wall Cz
LEC, LECz – Liquid Encapsulated Cz
LTGCz – Low-thermal-gradient Version of the Cz
MCz – Cz-growth Technique with Magnetic Fields

TMCz – Cz-growth Technique with Transverse Magnetic Field
 MLEC – Magnetic Liquid Encapsulated Cz
 VCz, VCCz – Vapor Pressure Controlled Cz
 ZLCz – Zone-leveling Cz

Kyropoulos Method, Ky, Ks

SAPMAC – sapphire growth technique with micro-pulling and shoulder-expanding at control centre

Stepanov Method

CS – Classic Stepanov
 CAST - Capillary Action Shaping Technique
 CST – Capillary Shaping Technique
 DCST – Double Crucible Stepanov Technique
 EFG – Edge-defined Film-fed Growth
 GES – Growth from Element of Shape
 ICM – Internal crystallisation Method
 IS – Inverted Stepanov
 NCS – Noncapillary Stepanov
 TPS – Technique of Pulling from Shaper
 μ-PD – Micro-pulling Down Method

Floating zone, float zone, floating zone technique, FZ, FZT

I-TSFZ – Improved Traveling Solvent Floating Zone
 LHFZG, LHFZ – Laser Heated Float Zone Growth
 TSFZ – Traveling Solvent Floating Zone
 TLZ – Traveling Liquidus Zone Method

Horizontal Direct Solidification Method, Bagdasarov Method, HDSM, HDS

HDCM – Horizontal Direct Crystallization Method
 LANCE – Large-Area Net-shape Crystal Extraction
 ACRT – Accelerated Crucible Rotation Technique
 AHP – Axial Heating Process
 AVC – Axial Vibration Control Method
 CHES – Controlled Head Extraction System
 CTHM – Cold Traveling Heater Method
 DS – Directional Solidification
 FCVA – Filtered Cathodic Vacuum Arc Technique
 FFM – Flame Fusion Method
 GF-TSSG – Gas-fed Top-seeding Solution Method
 GPM – Gradient Projection Method
 GSM – Gradient Solidification Method
 HEM – Heat Exchanger Method
 HFRM – Head Field Rotation Method
 HP-HT, HPHT – High Pressure High Temperature Process
 HP-EDGF – High Pressure Electro-Dynamic Gradient Freeze Method
 IFUM – Introduction Field Up-shift Method
 LHPG – Laser-heated Pedestal Growth Method
 LPSG – Low Pressure Solution Growth Process
 MSC – Modified Slow Cooling Method
 RSSG – Repeated Solid Solvent Growth Method

SAG – Selected Area Growth
 SHS – Self-propagating High-temperature Synthesis
 SLS – Sequential Lateral Solidification Process
 SSR – Solid State Recrystallization
 THM – Traveling Heated Method
 TGT – Temperature Gradient Zone Technique
 TGZM – Temperature Gradient Method
 TSSG – Top-seeding Solution-growth
 VHGF – Vertical-horizontal Gradient Freezing Method
 VLS – Vapor-liquid-solid Growth
 UDS – Unidirectional Solidification

Methods of films growth (deposition)

ABLEG – air-bridged lateral epitaxial growth
 ALD – atomic layer deposition
 CBE – chemical beam epitaxy
 CFV – Crystallization from Finite Volume
 CSD – chemical solution deposition
 CSVT – close-spaced vapor transport technique
 CVT – chemical vapor transport Method

CVD – Chemical Vapor Deposition

EBI-CVD – Electron Beam induced CVD
 Cat-CVD – catalytic CVD
 ECR-CVD – electron cyclotron resonance CVD
 HW CVD – hot wire CVD
 PEPECVD – low energy plasma-enhanced CVD
 MOCVD – metal-organic chemical vapor deposition
 CCS MOCVD – Close Coupled Showerhead MOCVD
 NV-CVD – nearby vaporizing CVD
 PECVD – plasma-enhanced CVD
 RIPACVD - reactive impulse plasma assisted CVD
 UHV CVD – ultra high vacuum CVD
 EFC – Eutectic Freeze Crystallization
 ESSR – epitaxy by solid state recrystallization
 ELO (E-LOG, ELOG, LEO) – epitaxy lateral overgrowth
 FAC ELO – facet-controlled ELO
 FME – Flax Mediated Epitaxy
 HiPCO – high-pressure CO Conversion
 HVTE – Halide Vapor Transport Epitaxy
 HWE – hot wall epitaxy
 IAD – ion-assisted deposition
 IBAD – ion beam assisted deposition
 ISD – inclined-substrate deposition
 LAWD – laser absorption wave deposition
 LCoS – liquid-crystal-on-silicon
 LIRE – laser-induced reactive epitaxy
 LPE – liquid phase epitaxy
 LPEE – liquid phase electroepitaxy

MBE – Molecular Beam Epitaxy

MOMBE – metal organic MBE
 L-MBE – laser molecular beam epitaxy

POMBE – pulsed organometallic beam epitaxy
 SSMBE – solid state MBE
 MTPVT – Multi Tube Physical Vapor Transport
 MLE – molecular-layer epitaxy
 PIAD – plasma ion-assisted deposition
 PIII – plasma immersion ion implantation
 PLD – pulsed laser deposition
 PLV – pulsed-laser vaporization
 PVD – physical-vapor-deposition, pressure vapor deposition
 RBQE – Radical Beam Quasi Epitaxy
 R-CVT – Rotational Chemical Vapor Transport
 SEG – selective epitaxial growth
 SILAR – successive ionic layer adsorption and reaction Method
 TVE – thermal vacuum evaporation

VPE – Vapor Phase Epitaxy

Cl-VPE – Chloride VPE
 HVPE – hydride vapor-phase epitaxy
 TGVE – temperature gradient VPE
 LP-MOVPE – low-pressure MOVPE
 LP-HVPE – low-pressure hydride vapor-phase epitaxy
 MOVPE – metal-organic vapor-phase epitaxy
 VTE – Vapor Transport Equilibration Method, Vapor Transport Epitaxy
 UVPLD – ultraviolet-pulsed laser deposition

3. Abbreviation in crystal names

ADP – $\text{NH}_4\text{H}_2\text{PO}_4$
 BBO – BaB_2O_6
 BGO – $\text{Bi}_4\text{Ge}_3\text{O}_{12}$, $\text{Bi}_{12}\text{GeO}_{20}$
 BiBO – BiB_3O_6
 Bi:RIG – Bi-substituted rare-earth Iron garnet
 BLF – BaLiF_3
 BMF – BaMgF_4
 BNN – $\text{Ba}_2\text{NaNb}_5\text{O}_{15}$
 BSC – Benzaldehyde Semicarbazone
 BSCCO – $\text{Bi}_k\text{Sr}_1\text{Ca}_m\text{Cu}_n\text{O}_b$
 BSNO – $\text{Ba}_k\text{Sr}_x\text{Nb}_2\text{O}_6$
 BSO – $\text{Bi}_4\text{Si}_3\text{O}_{12}$, $\text{Bi}_{12}\text{SiO}_{20}$
 BST – $\text{Ba}_x\text{Sr}_{1-x}\text{TiO}_3$
 BTO – $\text{Bi}_{12}\text{TiO}_{20}$ or BaTiO_3
 Bi-2201 – $\text{Bi}_2\text{Sr}_2\text{CuO}_9$
 BZT – $\text{Ba}(\text{Zr}_x\text{Ti}_{1-x})\text{O}_3$

Diamonds, carbon

a-D – amorphous Diamond
 ta-D – tetrahedral a-D
 DLC – diamond-like Carbon
 UNCD – ultra-nanocrystalline Diamond
 CA – Carbon arc synthesis
 CBO – $\text{Cs}_2\text{O} \cdot 3\text{B}_2\text{O}_3$, CsB_3O_5
 CBBO – $\text{Sr}_2\text{Be}_2\text{B}_2\text{O}_7$
 cBN – cubic Boron Nitride
 CGC – CsGeCl_3
 CGG – $\text{Ca}_3\text{Ga}_2\text{Ge}_4\text{O}_{14}$
 CGS – CuGaSe_2

CIGS – $\text{Cu}(\text{I,Ga})\text{Se}_2$
 CIS – CuInS_2
 CISE – CuInSe_2
 CLBO – $\text{Cs}_2\text{O} \cdot \text{Li}_2\text{O} \cdot 6\text{B}_2\text{O}_6$
 CLSA – $\text{Ca}_2\text{La}_8(\text{SiO}_4)_6\text{O}_2$
 CLPA – $\text{Ca}_8\text{La}_2(\text{PO}_4)_6\text{O}_2$
 CLYPA – $\text{Ca}_8\text{La}_{1,98}\text{Yb}_{0,02}(\text{PO}_4)_6\text{O}_2$
 CMT – $\text{Cd}_x\text{Hg}_{1-x}\text{Te}$ - Cadmium Mercury Telluride
 CNAO – CaNdAlO_4
 CNGG – $\text{Ca}_3(\text{NbGa})_{2-x}\text{Ga}_3\text{O}_{12}$
 CNGS – $\text{Ca}_3\text{NbGa}_3\text{Si}_2\text{O}_{14}$
 CTA – CsTiOAsO_4
 CZT – CdZnTe
 CWO – CdWO_4
 DKAP – Deuterated Potassium acid Phthalate
 DKDP – Deuterated KDP, KD_2PO_4
 DTGS – Deuterated Triglycine Sulphate
 ITO – Indium Tin Oxide

Family of calcium phosphate crystals

HA, HAP – $\text{Ca}_{10}(\text{PO}_4)_6(\text{OH})_2$ Hydroxyapatite
 OCP – $\text{CaH}(\text{PO}_4)_3 \cdot 2,5\text{H}_2\text{O}$ Octacalcium Phosphate
 DCPA – CaHPO_4 Decalcium Phosphate Anhydrate
 DCPD – $\text{Ca}_2\text{HPO}_4 \cdot \text{H}_2\text{O}$ Decalcium Phosphate Dihydrate
 TCP – $\text{Ca}_3(\text{PO}_4)_2$ Tricalcium Phosphate
 TTCP – $\text{Ca}_4(\text{PO}_4)_2\text{O}$ Tetracalcium Phosphate
 C-FAP – $\text{Ca}_5(\text{PO}_4)_3\text{F}$ Calcium Fluorapatite
 S-FAP – $\text{Ca}_{5-x}\text{S}_x(\text{PO}_4)_3\text{F}$ Calcium Sulphate Fluorapatite
 Gd-2122 – $(\text{Gd,Ce})_2\text{NbSr}_2\text{Cu}_2\text{O}_{10}$
 GdCOB – $\text{GdCa}_4\text{O}(\text{BO}_3)_3$
 GGG – garnet of Gd-Ga, $\text{Gd}_3\text{Ga}_5\text{O}_{12}$
 GPI – $[\text{NH}_3\text{CH}_2\text{COOH}_3\text{PO}_3]$
 GPS – $\text{Gd}_2\text{Si}_2\text{O}_7$ - Pyrosilicate of Gadolinium
 GSGG – garnet of Gd-Sc-Ga
 GSO – Gd_2SiO_5
 QWMF – quarter-wave Magnesium Fluorid
 KAB, KABO – $\text{K}_2\text{Al}_2\text{B}_2\text{O}_7$
 KBBF – $\text{KBe}_3(\text{BO}_3)_2\text{F}_2$
 KDP – KH_2PO_4
 KLN – $\text{K}_3\text{Li}_2\text{Nb}_5\text{O}_{15}$
 KMF – KMgF_3
 KNB – $\text{K}_3\text{Nb}_3\text{B}_2\text{O}_{12}$
 KNP – $\text{KNd}(\text{PO}_3)_4$
 KSZ – kubisch stabilisiert Zirkonium-oxide
 KTA – KTiAsO_4
 KTN – $\text{K}_2(\text{Nb,Ta})\text{O}_6$
 KTP – KTiOPO_4
 KYW – $\text{KYb}(\text{WO}_4)_2$
 L-AlFB – L-Alanine Tetrafluoroborate
 LAO – LaAlO_3
 LaBO – LaB_3O_6
 LBO, 3LBO – LiB_3O_5 - Lithium Triborate
 LCMO – $\text{La}_{0,66}\text{Ca}_{0,33}\text{MnO}_3$
 LiBO – $\text{Li}_2\text{B}_4\text{O}_7$
 LiCAF – LiCaAlF_6

LiGBO – $\text{Li}_6\text{GdB}_3\text{O}_9$	PZN – $\text{Pb}(\text{Zn}_{1/3}\text{Nb}_{2/3})\text{O}_3$
LIS – LiInS_2	PZNT – $\text{Pb}(\text{Zn}_{1/3}\text{Nb}_{2/3})\text{O}_3\text{-PbTiO}_3$
LISAF, LiSAF – LiSrAlF_6	PZT – $\text{Pb}(\text{ZrTi})\text{O}_3$
LiSCAF – $\text{LiSr}_{0.8}\text{Ca}_{0.2}\text{AlF}_6$	PWO – PbWO_4
LGG – $\text{La}_3\text{Ga}_5\text{GeO}_{14}$	RAB – $\text{RAl}_3(\text{BO}_3)_4$, R - rare-earth metal
LGS – $\text{LaGa}_5\text{SiO}_4$, $\text{La}_3\text{Ga}_5\text{SiO}_{14}$ - Langasit or Lithium Gallium spinel LiGa_5O_8	RCTA – RbCsTiOAsO_4
LGSA, LGAS – $\text{La}_3\text{Ga}_{4.5}\text{Al}_{0.2}\text{SiO}_{14}$	RE123 – (rare earth element) $\text{Ba}_2\text{Cu}_3\text{O}_7$
LGSO – $\text{La}_3\text{Ga}_5\text{SiO}_{14}$ - Langasit	RIG – Rare-earth Iron garnet
LGT – $\text{La}_3\text{Ta}_{0.5}\text{Ga}_{5.5}\text{O}_{14}$	RLHS, RLHSe – $\text{Rb}_4\text{LiH}_3(\text{SeO}_4)_4$
LGN – $\text{La}_3\text{Nb}_{0.5}\text{Ga}_{5.5}\text{O}_{14}$	RTA – RbTiOAsO_4
LLF, LLuF – LiLuF_4	RTP – RbTiOPO_4
LLGG – $\text{La}_3\text{Lu}_2\text{Ga}_3\text{O}_{12}$	SBN – $\text{SrBaNb}_2\text{O}_6$
LMBO – $\text{LaMgB}_5\text{O}_{10}$	SBT – $\text{SrBi}_2\text{Ta}_2\text{O}_9$
LMG – LiGaO_2 - Lithium Metagallate	SGG(r) – $\text{Sr}_3\text{Ga}_2\text{Ge}_4\text{O}_{14}$ (red)
LN, LNB – LiNbO_3	SGGG – Substituted Gadolinium Gallium garnet
CLN – congruent LiNbO_3	SLA, SLAO – SrLaAlO_4
SLN – stoichiometric LiNbO_3	SLG, SLGO – SrLaGaO_4
PPLN – periodically poled Lithium Niobate	SLT – stoichiometric Lithium Tantalate
LNCA – $\text{La}_3\text{Nb}_{0.5}\text{Ga}_{5.3}\text{Al}_{0.2}\text{O}_{14}$	SMALO – $\text{Sr:MgAl}_2\text{O}_4$
LNG – $\text{La}_3\text{Nb}_{0.5}\text{Ga}_{5.5}\text{O}_{14}$	SMO – SrMoO_3
LNO – LiNbO_3	SNGS – $\text{Sr}_3\text{Nb}_{1-x}\text{Ga}_{3+(5/3)x}\text{Si}_2\text{O}_{14}$
LNSAT – $\text{La}_{0.15}\text{Nd}_{0.21}\text{Sr}_{0.64}\text{Al}_{0.68}\text{Ta}_{0.32}\text{O}_3$	SRO – SrRuO_3
LSAT – $(\text{La,Sr})(\text{Al,Ta})\text{O}_3$	STO – SrTiO_3
LSCO – $\text{La}_{0.5}\text{Sr}_{0.5}\text{CoO}_3$	TAG – $\text{Tb}_3\text{Al}_5\text{O}_{12}$ (G-garnet)
LSO – Lu_2SiO_5	TAP – TbAlO_3 (P-perovskite)
LSTG – $\text{La}_{3-x}\text{Sr}_x\text{Ta}_{0.5+x/2}\text{Ga}_{5.5-x/2}\text{O}_{14}$	TAS – Tl_3AsSe_3
LTB – $\text{Li}_2\text{B}_4\text{O}_7$, Tetraborate of Lithium	TGG – Terbium Gallium garnet
LTCA – $\text{La}_3\text{Ta}_{0.5}\text{Ga}_{5.3}\text{Al}_{0.2}\text{O}_{14}$	TGS – $(\text{NH}_2\text{CH}_2\text{COOH})_3\text{H}_2\text{SO}_4$ - Triglycine Sulfate
LTG – $\text{La}_3\text{Ta}_{0.5}\text{Ga}_{5.5}\text{O}_{14}$	Ti:S, Ti:Sa, ticor – Ti:sapphire
LT-GaN – low temperature GaN	TMGa, TMG – Trimetilgallium
LTO – LiTaO_3	TMAl – Trimetilaluminum
LYF – LiYF_4	TSAG – $\{\text{Tb}_3\}\{\text{Sc}_2\}(\text{Al}_3)\text{O}_{12}$
LuAG – $\text{Lu}_3\text{Al}_5\text{O}_{12}$	Y123 – $\text{YBa}_2\text{Cu}_3\text{O}_x$
LuLF, LLuF – LuLiF_4	Y211 – Y_2BaCuO_5
MALO – MgAl_2O_4	YAG – $\text{Y}_3\text{Al}_5\text{O}_{12}$
MCT – HgCdTe - Mercury Cadmium Telluride	YAP – YAlO_3
MBTC – $\text{MnHg}(\text{SCN})_4$	diYAG – $\text{Y}_3\text{Al}_5\text{O}_{12}$ for jewelry
MMTD – $\text{MnHg}(\text{SCN})_4(\text{C}_2\text{H}_6\text{OS})_2$	Yb:S-FAP – $\text{Yb:Sr}(\text{PO}_4)_3\text{F}$
MC-Si – multicrystalline Silicon	YbYAB – $\text{Yb}_x\text{Y}_{1-x}\text{Al}_3(\text{BO}_3)_4$
Nd123 – $\text{NdBa}_2\text{Cu}_3\text{O}_x$	YBCO, YBCO-123 – $\text{YBa}_2\text{Cu}_3\text{O}_7$
NBCO – $\text{NdBa}_2\text{Cu}_3\text{O}_7$	YCOB – $\text{YCa}_4\text{O}(\text{BO}_3)_3$ - Yttrium Calcium Oxyborate
NEW – $\text{NaEr}(\text{WO}_4)_2$	YIG – $\text{Y}_3\text{Fe}_5\text{O}_{12}$
NGG – $\text{Nd}_3\text{Ga}_5\text{O}_{12}$	YLF – LiYF_4
NGS – $\text{Nd}_3\text{Ga}_5\text{SiO}_{14}$	YLuF – YLuF_4
NHT – $\text{NdTa}_7\text{O}_{19}$	YSO – Y_2SiO_5
NSAT – $\text{Nd}_{0.4}\text{Sr}_{0.6}\text{Al}_{0.7}\text{Ta}_{0.3}\text{O}_3$	YSZ – ZrO_2 , Yttria-stabilized Zirconia
NYW – $\text{NaY}(\text{WO}_4)_2$	ZBP – Zn_3BPO_7
NYAB – $\text{Nd}_x\text{Y}_{1-x}\text{Al}_3(\text{BO}_3)_4$	ZCTC – $\text{ZnCd}(\text{SCN})_4$
PAB – $\text{PrAl}_3(\text{BO}_3)_4$	ZMO – ZnMoO_4
PC – photonic crystal	ZTC – Zinc Thiourea Chloride
PGS – $\text{Pr}_3\text{Ga}_5\text{SiO}_{14}$	ZWO – ZnWO_4
PLN – periodically polarized crystal LN	
PLT – $(\text{Pb}_{0.7}\text{La}_{0.28})\text{Ti}_{0.93}\text{O}_3$	
PMN – $\text{Pb}(\text{Mg}_{1/3}\text{Nb}_{2/3})\text{O}_3$	
PMNT, PMN-PT – $\text{Pb}(\text{Mg}_{1/3}\text{Nb}_{2/3})\text{O}_3\text{-PbTiO}_3$	
PSCCO – $\text{B}_2\text{Sr}_2\text{CaCu}_2\text{O}_8$	
PSNT – $\text{Pb}(\text{Sc}_{1/3}\text{Nd}_{1/3})\text{O}_3\text{-PbTiO}_3$	
PT, PTO – PbTiO_3	

