

APPENDIX H: COMMON ACRONYMS AND ABBREVIATIONS USED THROUGHOUT THE TEXT

I. Chemical

Ace	=	Acetone
AGW	=	Alcohol/Glycol/Water
BC	=	Butyl Cellusolve
BHF	=	Buffered Hydrofluoric Acid
BRM	=	Bromine:Methyl Alcohol Note: BRM is used extensively in chem/mech lapping process
CRY	=	Cryogenic (Gas) Liquid
LCl ₂	=	chlorine
LH ₂	=	hydrogen
LHe	=	helium
LN ₂	=	nitrogen
LOX	=	oxygen
LAR	=	argon
L _{air}	=	air
DCE	=	Dry Chemical Etching (ionized gas)
EA	=	Ethylene Acetate
ED	=	Ethylenediamine
EDP	=	ED:Pyrocatachol
EG	=	Ethylene Glycol
EOH	=	Ethyl Alcohol
FG	=	Forming Gas (85% N ₂ :15% H ₂)
Gly	=	Glycerin
Gly	=	Glycol
HAc	=	(Glacial) acetic acid
HOAc	=	(Glacial) acetic acid
GAA	=	(Glacial) acetic acid
IPA	=	Isopropyl Alcohol
ISO	=	Isopropyl Alcohol
KEY	=	Ketone (ref: acetone)
MEK	=	Methyl Ethyl Ketone
MeOH	=	Methyl Alcohol
PCE	=	Perchloroethylene
Perk	=	Perchloroethylene
PG	=	Propylene Glycol
P/R	=	Photo Resist (lacquer)
SH-	=	Shipley
AZ-	=	Horscht
COP-	=	Similar to AZ-types
KMER	=	KM series no longer used
PMMA	=	Designed for electron lithography
TCA	=	Trichloroethane
TCE	=	Trichloroethylene

II. Crystal, physics

G(SG)	=	Specific Gravity (geology)
g/cm ³	=	Density (SG) (chemistry)

H	=	Hardness (Mohs — geology) Brinell Hardness — (metals) Knoop Hardness (metals/materials) Rockwell Hardness (metals) Shore Hardness (rubber/plastic) Vickers Hardness (metals)
n	=	Refractive Index (Isometric System)
bcc	=	body-centered cubic
fcc	=	face-centered cubic
hcp	=	hexagonal close-packed
tcp	=	tetragonal close-packed
α, β, δ	=	tetragonal and other axes

III. Crystal, planes

(111)/(100)	=	Specific plane (Miller Indices) (xxx) parentheses
{110}	=	All planes of this type {xxx} brackets
<221>	=	Plane directions <xxx> hachures
(10 $\bar{1}$ 0)	=	Hexagonal System (4-axes). May be as: (10.0)
($\bar{1}\bar{1}\bar{1}$)	=	Negative over-script “ $\bar{1}$ ” denotes negative crystal axis.

IV. Crystal Structure

c	=	colloidal (c-Si)
a	=	amorphous (a-Ge)
c	=	crystalline (c-Si)
poly	=	polycrystalline (poly-Si) = crystalline
mc	=	microcrystalline (mc-Si)
mu	=	microcrystalline (mu-Si) (Greek letter “mu” = μ)
Mc	=	macrocrystalline (Mc-Si)
i/DLC	=	Diamond-Like Carbon (i-C/DLC)
xtl	=	single crystal
sxtl	=	single crystal
bixtl	=	bicrystal
r	=	ribbon crystal (dendritic)
GB	=	grain boundary

V. Etching

WCE	=	Wet Chemical Etching (WF = Wet Format, e.g., liquids, etc.)
EE	=	Electrolytic Etching (EF = Electrolytic Format)
DCE	=	Dry Chemical Etching (DF = Dry Format, e.g., ionized gas)

VI. Process/Equipment

A. Equipment

(1) Microscopes

AES	=	Auger Electron Microscope
FDX	=	Energy Dispersive X-ray
ESCA	=	Electron Spectroscopy for Chemical Analysis
FIM	=	Field Ion Microscope
HEED	=	High Energy Electron Diffraction
LEED	=	Low Energy Electron Diffraction
PLM	=	Polarized Infrared Microscope
SAM	=	Scanning Auger Microscope
SIMS	=	Secondary Ion-Mass Spectroscopy

SLAM	=	Scanning Laser Acoustic
UPS	=	Ultraviolet Photo-Electron Spectroscopy
XPA	=	X-ray Photo-Electron Spectroscopy
*SEM	=	Scanning Electron Microscope
*TEM	=	Transmission Electron Microscope

*Widely used in general material processing as diagnostic defect failure tool, with EDX unit.

(2) Chemical Vapor Deposition

CVD	=	Chemical Vapor Deposition
APCVD	=	Atmospheric Pressure CVD
HOMOCVD	=	Homogeneous CVD
HPCVD	=	High Pressure CVD
LPOMCVD	=	Low Pressure OMCVD
OMCVD	=	Organo-metallic CVD
PECVD	=	Plasma Enhanced CVD
VHPCVD	=	Very High Pressure CVD
HMCVD	=	Horizontal Magnetic CVD
VMCVD	=	Vertical Magnetic CVD

(3) Epitaxy Growth (Epi)

HEP	=	Horizontal Epitaxy
HPE	=	Horizontal Phase Epitaxy
HWE	=	Hot-Wall Epitaxy
LPE	=	Liquid Phase Epitaxy
CCLPE	=	Current Controlled LPE
L-SPE	=	Lateral Solid Phase Epi
VEP	=	Vertical Epitaxy
VPE	=	Vapor Phase Epitaxy
V-SPE	=	Vertical Solid Phase Epi
*MBE	=	Molecular Beam Epitaxy

*Most advanced and versatile system in present technology.

(4) Growth Systems, general

*CZ	=	Czochralski (pulled xtl)
FZ	=	Float Zone (solid xtl)
BM	=	Bridgman Method
**HB	=	Horizontal Bridgman
VB	=	Vertical Bridgman
EFG	=	Edge Defined Film Fed Growth (ribbon xtl) + other acronyms by developers
VM	=	Verneuil Method (hot droplet)
LEV CZ	=	Levitation CZ (development for space application)
LEC	=	Liquid Encapsulated CZ
MFG(FS)	=	Molten Flux Growth or Fused Salt (<i>Note</i> : xtls may be contaminated by flux)
HEM	=	Heater Enhance Method (poly CZ type)

Note: Term "ingot" = boule in sxtl growth, and more widely used.

* 2" diameter now standard; 6" available CZ/FZ/HB methods the most widely us then sliced as wafers.

** recognized by half-moon shape of cut wafers

(5) Vapor Transport Deposition

- VT = Vapor Transport
 CSVT = Close-Spaced VT

(6) Element Doping/Deposition

- ALY = Alloy into material (Al into silicon is Square Law).
 DIF = Diffuse element into material (B, Sb, As, etc., is Gaussian Diffusion Law). Called: Graded Junction
 I² = Ion Implantation (Si⁺ ionized particle at eV/MeV energy levels. Also Gaussian)
 EVAP/M = Metal evaporation + thermal
 DEC/M = drive-in (also used to metal decorate defects/decoration)
 EVAP/Ox = Oxide deposit with doping element as glass (ASG, BSG, PSG, BPSG, etc., and may be a nitride as Final coat or for thermal drive-in)
 SSDIF = Solid-Solid Diffusion (may be Solid Phase Epi, SPE)
 P-ON = Paint on compound + thermal drive-in. (Gaussian)
 CONV = Evaporate metal + thermal conversion, e.g., Silicides. (MoSi, Mo₂Si, MoSi₂, etc.)
 OX = Oxidation (Wet, Dry, Steam or SILOX System). Also electrolytic
 W/Mo = Std light filaments, white
 SILOX = Oxidation from SiH₄-O₂/N₂ 300—500°C
 RF/DC = RF/DC Plasma deposition of oxides, nitrides, metals and compounds under vacuum
 V-MET = Metal(s) evaporation under vacuum (metallization). With RF/DC Plasma as metallization or thin film compound deposition
 RF-MAG = RF magnetron deposition. Magnet enhances deposition rate/opn
 EB/E-Beam = Electron Beam metallization (260° bent beam now common)
 PD = Pyrolytic Deposition (See: CVD)

(7) Etching Systems/Methods

- IM = Ion Milling (pattern ion gas etch of thin films)
 EBL = Electron Beam Lithography (Ref: P/R with PMMA)
 MFE = Molten Flux Etching
 PE = Plasma Etching
 PL = Photolithography
 RIE = Reactive Ion Etching
 IE = Ion Etching (nonreactive)
 PR = Photo Resist

(8) Lamps/Lights

- Ar = Argon, white
 Cd = Cadmium, yellow
 Co = Cobalt, blue
 Cr = Chromium, yellow
 Fe = Iron, yellow-green
 IR = Infrared (below VL)
 K = Potassium, bright yellow
 Kr = Krypton, yellow-green
 Na = Sodium, common yellow
 Ne = Neon, orange
 Sr = Strontium, deep red

UV	=	Ultraviolet, (above VL)
VL	=	Visible light spectrum, white
W/Mo	=	Std. light filaments, white
Xe	=	Xenon, intense white

VII. Water, H₂O

Recirc	=	Recirculating water
DI	=	Distilled
dd	=	double distilled (2d) (2DI)
ddd	=	triple distilled (3d) (3DI)
Hi-Q	=	DI + ion exchange
HQ	=	High Quality
dm	=	demineralized
di	=	deionized