

MEMS/Nano-Tech/Compound Semiconductor Terminology

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

A

<i>Abrasive</i>	A hard and wear-resistant material (such as a ceramic) used to wear, grind, or cut away other material.
<i>Accuracy</i>	The degree of correctness with which the measuring system yields the “true value” of a measured quantity, where the “true value” refers to an accepted standard, such as a standard meter or volt. Typically described in terms of a maximum percentage of deviation expected based on a full-scale reading.
<i>Ampere (amp) [A]</i>	Measure of electric current: 1A = 1 coulomb/second.
<i>Analyte</i>	A chemical species targeted for quantitative analysis.
<i>Angstrom [Å]</i>	Measure of length: 1 Å= 1x10 ⁻¹⁰ m.
<i>Anisotropic</i>	Exhibiting different values of a property in different crystallographic directions.
<i>Anneal</i>	Heat process used to remove stress, crystallize or render deposited material more uniform.
<i>Anode</i>	The electrode in an electrochemical cell or galvanic couple that experiences oxidation, or gives up electrons.
<i>Arrhenius equation</i>	The equation representing the rate constant as $k = Ae^{E_a/RT}$ where A represents the product of the collision frequency and a steric factor, and $e^{E_a/RT}$ is fraction of collisions with sufficient energy to produce a reaction.
<i>ASIC</i>	Application-specific integrated circuit; an IC designed for a custom requirement.
<i>Atomic mass unit (a.m.u.)</i>	A unit of mass used to express relative atomic masses. It is equal to 1/12 of the mass of an atom of the isotope carbon-12 and is equal to 1.66033x10 ⁻²⁷ kg.
<i>Atomic number (also proton number Z)</i>	The number of protons within the atomic nucleus of a chemical element.
<i>Atomic weight</i>	The weighted average mass of the atoms in a naturally occurring element.
<i>Austenite</i>	Face-centered cubic iron; also iron and steel alloys that have the FCC crystal structure.
<i>Avogadro's number</i>	The number of atoms in exactly 12 grams of pure ¹² C, equal to 6.022 x 10 ²³ .

B

<i>Back-grinding</i>	A process of initial thinning the back-side (non-device side) of a wafer.
<i>BAW</i>	Bulk acoustic wave.
<i>Bilayer lipid membrane (BLM)</i>	The structure found in most biological membranes, in which two layers of lipid molecules are so arranged that their hydrophobic parts interpenetrate, whereas their hydrophilic parts form the two surfaces of the bilayer.

<i>Biosensor</i>	The term “biosensor” is a general designation that denotes either a sensor to detect a biological substance or a sensor which incorporates the use of biological molecules such as antibodies or enzymes. Biosensors are a subcategory of chemical sensors.
<i>Bipolar-junction transistor</i>	Transistor with n-type and p-type semiconductors having base-emitter and collector-base junctions.
<i>Body-centered cubic (BCC)</i>	A common crystal structure found in some elemental metals. Within the cubic unit cell, atoms are located at corner and cell center positions.
<i>Bow</i>	Wafer flatness measurement.
<i>Brazing</i>	A metal joining technique that uses a molten filler metal alloy having a melting temperature greater than about 425°C (800°F).
<i>Breakdown</i>	Failure of a material resulting from an electrical overload. The resulting damage may be in the form of thermal damage (melting or burning) or electrical damage (loss of polarization in piezoelectric materials).
<i>Bulk micromachining</i>	Etching microstructures directly into a wafer.
C	
<i>Calibration</i>	A process of adapting a sensor output to a known physical quantity to improve sensor output accuracy.
<i>Capacitance (C)</i>	The charge-storing ability of a capacitor, defined as the magnitude of charge stored on either plate divided by the applied voltage. A 1-F capacitor charged to 1 V contains C of charge (see also capacitor) and 1 C is an amount of charge equal to that of about 6.24×10^{18} electrons.
<i>Capacitor</i>	Energy storage circuit element having two conductors separated by an insulator.
<i>Cathode</i>	The electrode in an electrochemical cell or galvanic couple at which a reduction reaction occurs; in other words the electrode receiving electrons from an external circuit.
<i>Ceramic</i>	A nonmetallic material made from clay and hardened by firing at high temperature; it contains minute silicate crystals suspended in a glassy cement.
<i>Cermet</i>	A composite material consisting of a combination of ceramic and metallic materials. The most common cermets are the cemented carbides, composed of an extremely hard ceramic (e.g. WC, TiC), bonded together by a ductile metal such as cobalt or nickel.
<i>Chemical vapor deposition (CVD)</i>	Growth of thin solid films on a substrate.
<i>Chemo mechanical planarization (CMP)</i>	Polishing technology which combines physical polishing with chemical etching.
<i>Chromatography</i>	The general name for a series of methods for separating mixtures by employing a system with a mobile phase and a stationary phase.
<i>CMOS</i>	Complementary metal oxide semiconductor – integrated circuit containing n-channel and p-channel MOSFETs.
<i>Codons</i>	Organic bases in sets of three that form the genetic code.

<i>Colloidal silica</i>	An aqueous dispersion of Nano-Sized Silicon Dioxide particles.
<i>Conductor</i>	Material such as the metals copper or aluminum that conducts electricity via the motion of electrons.
<i>Copolymer</i>	A polymer that consists of two or more dissimilar monomer units in combination in its molecular chains. Also a polymer formed from the polymerization of more than one type of monomer.
<i>Corrosion</i>	Deteriorative loss of a metal as a result of dissolution environmental reactions.
<i>Coulomb [C]</i>	Measure of electrical charge: 1 C is an amount of charge equal to that of about 6.24×10^{18} electrons.
<i>Covalent bond</i>	A primary interatomic bond that is formed by the sharing of electrons between neighboring atoms.
<i>Creep</i>	The time-dependent permanent deformation that occurs under stress; for most materials it is important only at elevated temperatures.
<i>Crystal structure</i>	For crystalline materials, the manner in which atoms or ions are arrayed in space. It is defined in terms of the unit cell geometry and the atom positions within the unit cell.
<i>Curie temperature (also Curie point) (T_c)</i>	The temperature above which a ferromagnetic or ferromagnetic material becomes paramagnetic. For iron the Curie point is 760°C and for nickel 356°C .
<i>Current [A]</i>	Measure of rate of flow of electric charge: a one-ampere current is a flow of 1 C of charge per second.
<i>Cutoff</i>	Condition in a diode or bipolar junction transistor in which the potential across a p-n junction prevents current flow.
D	
<i>Degradation</i>	A term used to describe the deteriorative processes that occur with polymeric materials, including swelling, dissolution, and chain scission.
<i>Denaturation</i>	The breaking down of the three-dimensional structure of a protein resulting in the loss of its function.
<i>Devitrification</i>	The process in which a glass (noncrystalline or vitreous solid) transforms to a crystalline solid.
<i>Dialysis</i>	A phenomenon in which a semipermeable membrane allows transfer of both solvent molecules and small solute molecules and ions.
<i>Diamagnetism</i>	A weak form of induced or nonpermanent magnetism for which the magnetic susceptibility is negative. A type of magnetism associated with paired electrons, that causes a substance to be repelled from the inducing magnetic field.
<i>Dielectric</i>	Any material that is electrically insulating.
<i>Dielectric (breakdown) strength</i>	The magnitude of an electric field necessary to cause significant current passage through a dielectric material.
<i>Dielectric constant (ϵ)</i>	The ratio of the permittivity of a medium to that of a vacuum. Also called the relative dielectric constant or relative permittivity.

<i>Dielectric displacement</i>	The magnitude of charge per unit area of capacitor plate.
<i>Diffusion</i>	A thermochemical process whereby controlled dopants are introduced into a substrate.
<i>Diffusion coefficient</i>	The constant of proportionality between the diffusion flux and the concentration gradient in Fick's first law. Its magnitude is indicative of the rate of atomic diffusion.
<i>Dimer</i>	A molecule formed by the joining of two identical monomers.
<i>Diode</i>	Two-terminal device that conducts current well in one direction and poorly in the other.
<i>Dip</i>	Dual In-line Package – common ceramic or plastic enclosure for an integrated circuit.
<i>Dipole (electric)</i>	A pair of equal yet opposite electrical charges that are separated by a small distance.
<i>Dislocation</i>	A linear crystalline defect around which there is atomic misalignment. Plastic deformation corresponds to the motion of dislocations in response to an applied shear stress. Edge, screw, and mixed dislocations are possible.
<i>Domain</i>	A region of a ferromagnetic or ferrimagnetic material in which all atomic or ionic magnetic moments are aligned in the same direction.
<i>Doping</i>	Process of introducing impurity atoms into a semiconductor to affect its conductivity.
<i>DRAM</i>	Dynamic Random Access Memory – memory in which each stored bit must be refreshed periodically.
<i>Ductility</i>	A measure of a material's ability to undergo plastic deformation before fracture; expressed as a percent elongation (%EL) or percent area reduction (%AR) from a tensile test.
E	
<i>EDP</i>	Ethylene diamine pyrocatechol.
<i>Elastic deformation</i>	A nonpermanent deformation that totally recovers upon release of an applied stress.
<i>Elastomer</i>	A polymeric material that may experience large and reversible elastic deformations.
<i>Electric field [V/m]</i>	In simplest form, the potential difference between two points divided by the distance between the two.
<i>Electrical breakdown</i>	Condition in which, particularly with high electric field, a nominal insulator becomes electrically conducting.
<i>Electroluminescence</i>	In electrical engineering: the emission of visible light by a p-n junction across which a forward-biased voltage is applied. In electrochemistry: emission of light by a molecule which is being reduced or oxidized on a biased electrode. If the exciting cause a photon, rather than an electron, the process is called photoluminescence.

<i>Electrolyte</i>	A solution through which an electric current may be carried by the motion of ions.
<i>Electromotive force (emf) series</i>	A series of chemical elements arranged in order of their electromotive force. The electromotive force is the greatest potential difference that can be generated by a particular source of electric current. In practice this potential may be observable only when the source is not supplying current, because of its internal resistance.
<i>Electron</i>	Elementary negative particle whose charge is 1.602×10^{-19} coulombs.
<i>Electron state (level)</i>	One set of discrete, quantized energies that are allowed for electrons. In the atomic case each state is specified by 4 quantum numbers.
<i>Electronegative</i>	Describing elements that tend to gain electrons and form negative ions. The halogens are typical electronegative elements.
<i>EMI</i>	Electromagnetic interference.
<i>Energy [J]</i>	Capacity for performing work or to cause heat flow. Like work itself, it is measured in Joules.
<i>Enthalpy (H)</i>	A property of a system equal to $E + PV$ where E is the internal energy of the system, P is the pressure of the system, and V is the volume of the system. At constant pressure the change in enthalpy equals the energy flow as heat.
<i>Enzyme</i>	A large molecule, usually a protein, that catalyzes biological reactions.
<i>Epitaxial or epi</i>	A single-crystal semiconductor layer grown upon a single-crystal substrate having the same crystallographic characteristics as the substrate material.
<i>EPROM</i>	Electrically Programmable Read-Only Memory --- nonvolatile memory device.
<i>Etching</i>	Removal of unwanted material from the wafer surface. Wet etching employs liquid chemicals and dry etching, gaseous plasma.
<i>Extrinsic</i>	Characterizes doped, rather than pure, semiconductor.
F	
<i>Fab</i>	For “fabrication”, a term referring to the making of semiconductor devices such as microprocessors.
<i>Face-centered cubic</i>	A crystal structure found in common elemental metals also FCC. Within the cubic unit cell, atoms are located at all corner and face-centered positions.
<i>Farad</i>	The unit of capacitance (see “capacitance”).
<i>Faraday</i>	A constant representing the charge on one mole of electrons; 96, 485 coulombs.
<i>FEA</i>	Finite element analysis.

<i>Fermi energy</i>	The energy level in a solid at which the probability of finding an electron is $\frac{1}{2}$. For a metal, the energy corresponding to the highest filled electron state in the valence band at 0 K,
<i>Ferroelectric material</i>	A dielectric material such as Rochelle salt and barium titanate with a domain structure containing dipoles (asymmetric distributions of electrical charge), which spontaneously align. Their domain structure makes them analogous to ferromagnetic materials. They exhibit hysteresis and usually the piezoelectric effect.
<i>Ferromagnetism</i>	Permanent and large magnetizations found in some metals (e.g. Fe, Ni and Co), resulting from the parallel alignment of neighboring magnetic moments.
<i>FET</i>	Field-Effect Transistor – semiconductor device whose insulated gate electrode controls current flow.
<i>Fick's first law</i>	The diffusion flux is proportional to the concentration gradient. This relationship is employed for steady-state diffusion situations.
<i>Ficks's second law</i>	The time rate of change of concentration is proportional to the second derivative of concentration. This relationship is employed in non-steady-state diffusion situations.
<i>Filler</i>	An inert foreign substance added to a polymer to improve or modify its properties.
<i>Firing</i>	A high temperature heat treatment that increases the density and strength of a ceramic piece.
<i>Fluorescence</i>	Luminescence (see also under “luminescence”), which persists less than a second after the exciting cause has been removed. If the luminescence persists significantly longer, it is called phosphorescence.
<i>Forward bias</i>	The conducting bias for a p-n junction rectifier that assures electron flow to the n side of the junction.
<i>Free energy (G)</i>	A thermodynamic quantity that is a function of the enthalpy (H), the Kelvin temperature (T) and the entropy (S) of a system; $G=H-TS$. At equilibrium, the free energy is at a minimum. Under certain conditions the change in free energy for a process is equal to the maximum useful work.
<i>Frequency</i>	Number of times per second that a quantity representing a signal, such as a voltage, changes state. Also, the number of waves (cycles) per second that pass a given point in space
G	
<i>Gain</i>	The ratio of the amplitude of an output to input signal.
<i>Galvanic corrosion</i>	The preferential corrosion of the more chemically active of two metals electrically coupled and exposed to an electrolyte.
<i>Gate</i>	Circuit whose logical output variables are determined by its inputs.
<i>Gauss</i>	The cgs unit used in measuring magnetic induction.
<i>Gene</i>	A given segment of the DNA molecule that contains the code for a specific protein.
<i>Glass</i>	An amorphous solid obtained when silica is mixed with other compounds, heated above its melting point, and then cooled rapidly.

<i>Glass transition temperature (T_g)</i>	The temperature at which, upon cooling, a noncrystalline ceramic or polymer transforms from a supercooled liquid to a rigid glass.
<i>Grain boundary</i>	The interface separating two adjoining grains having different crystallographic orientations.
<i>Grain growth</i>	The increase in average grain size of a polycrystalline material: for most materials, an elevated temperature heat treatment is necessary.
<i>Grain Size</i>	The average grain diameter as determined from a random cross section.
<i>Green ceramic body</i>	A ceramic piece, formed as a particulate aggregate, that has been dried but not fired.
<i>Grinding</i>	Aggressive material removal process, using fixed abrasives.
<i>Ground</i>	To make electrical connection to the earth or to the chassis of a device (verb); the connection point so used (noun).
H	
<i>Hall effect</i>	The phenomenon whereby a force is applied to a moving electron or hole by a magnetic field that is applied perpendicular to the direction of motion. The force direction is perpendicular to both the magnetic field and the particle motion directions.
<i>Hardness</i>	The measure of a material's resistance to deformation by surface indentation or by abrasion. There are various scales in use to express hardness. The Mohs scale is qualitative and somewhat arbitrary and ranges from 1 on the soft end for talc to 10 for diamond. Quantitative scales are the Rockwell (HR), Brinell (indicated by HB), Knoop (HK) and Vickers (HV). Knoop and Vickers are referred to as microhardness testing methods on the basis of load and indenter size.
<i>Heat capacity (C_v at constant volume and C_p at constant pressure)</i>	The quantity of heat required to produce a unit temperature rise per mole of material.
<i>HEMT</i>	High electron mobility transistor.
<i>Henry (H)</i>	Unit of inductance (see "inductance"). One henry (H) is the inductance of a closed circuit in which an electromotive force of 1 volt is produced when the electric current in the circuit varies uniformly at the rate of 1 ampere per second.
<i>Henry's law</i>	The amount of gas dissolved in a solution is directly proportional to the pressure of the gas above the solution.
I	
<i>Impedance</i>	The complex ratio of a force-like quantity (force, pressure, voltage, temperature, or electric field) to a corresponding related velocity-like quantity (velocity, volume velocity, current, heat flow, or magnetic field strength).
<i>Index of refraction (n)</i>	The ratio of the velocity of light in a vacuum to the velocity in some medium.
<i>Inductance [in Henry, H]</i>	That property of an electric circuit which tends to oppose change in current in the circuit. One henry (H) is the inductance of a closed circuit in which an electromotive force of 1 volt is produced when the electric current in the circuit varies uniformly at the rate of 1 ampere per second.

<i>Inductor</i>	Energy storage circuit component consisting of a coil of wire and possibly a magnetic material.
<i>Inhibitor</i>	A chemical substance that, when added in relatively low concentrations, slows down a chemical reaction.
<i>Insertion point (in lithography context)</i>	Adaptation of a new lithography technique is referred to as the insertion point of that technique.
<i>Insulator</i>	Material that conducts electricity very poorly.
<i>Integrated circuit (IC)</i>	Semiconductor circuit, typically on a very small silicon chip, containing microfabricated transistors, diodes, resistors, capacitors, etc.
<i>Interstitial diffusion</i>	A diffusion mechanism that causes atomic motion from interstitial site to interstitial site.
<i>Intrinsic</i>	Characterizes pure undoped semiconductor; electrical conductivity depends only on temperature and the band gap energy.
<i>Ionic bond</i>	A coulombic interatomic bond existing between two adjacent and oppositely charged ions.
<i>Ionophore</i>	A macro-organic molecule capable of specifically solubilizing an inorganic ion of suitable size in organic mediums.
<i>Isomorphous</i>	Having the same structure. In the phase diagram sense, isomorphism means having the same crystal structure or complete solid solubility for all compositions
<i>Isothermal</i>	At a constant temperature. In an isothermal process heat is, if necessary, supplied or removed from the system at just the right rate to maintain constant temperature.
<i>Isotropic</i>	Having identical values of a property in all crystallographic directions.
K	
<i>Kilobyte (kB)</i>	2^{10} (=1024, or about one thousand) bytes of information.
<i>Kilohertz (kHz)</i>	One thousand cycles per second (see also “frequency”).
<i>Kinetic molecular theory</i>	A model that assumes that an ideal gas is composed of tiny particles (molecules) in constant motion.
L	
<i>Lapping</i>	A thinning process using silicon carbide or aluminum oxide slurries to remove grinding damage prior to polishing.
<i>Laser</i>	Light Amplification by the Stimulated Emission of Radiation – quantum device that produces coherent light.
<i>Laser trimming</i>	A method for adjusting the value of thin- or thick-film resistors by using a computer-controlled laser system.

LCD	Liquid Crystal Display – display device employing light source and electrically alterable optically active thin film.
LED	Light-emitting diode – semiconducting diode that produces visible or infrared radiation.
Lewis acid	An electron-pair acceptor.
Lewis base	An electron-pair donor.
Life (lifetime)	The length of time the sensor can be used before its performance changes.
LIGA	An acronym from the German words for lithography, electro-plating and molding. This micro-machining process produces tall, straight-walled structures with very small features.
Limit of detection	The smallest measurable input. This differs from resolution, which defines the smallest measurable change in input. For a temperature measurement, this would provide an indication of the lowest temperature a sensor could generate an output in response to.
Linear coefficient of thermal expansion	See thermal expansion coefficient, linear.
Lipids	Water-insoluble substances than can be extracted from cells by nonpolar organic solvents.
Luminescence	Defined as the emission of light from a substance in an electronically excited state.
M	
Magnetization (M)	The total magnetic moment per unit volume of material. Also, a measure of the contribution to the magnetic flux by some material within an H field. The magnitude of M is proportional to the applied field as: $M = X_m \times H$, with X_m the magnetic susceptibility
Magnetostrictive material	A material that changes dimension in the presence of a magnetic field or generates a magnetic field when mechanically deformed.
Martensite	A metastable iron phase supersaturated in carbon that is the product of a diffusionless (athermal) transformation from austenite.
Mask	Pattern on glass, like a photographic negative, for producing integrated-circuit elements on semiconductor wafer.
MCM	MultiChip Module; the interconnection of two or more semiconductor chips in a semiconductor-type package.
Measurand	A physical quantity, condition, or property that is to be measured.
Mechatronics	The synergistic combination of precision mechanical engineering with electronic control.
Megabyte (MB)	2^{20} (= 1,048,576, or about one million) bytes of information.

<i>Megahertz (Mhz)</i>	One million cycles per second (see also “frequency”).
<i>MEMS</i>	Stood originally for Micro-ElectroMechanical System –microscopic mechanical elements, fabricated on silicon chips by techniques similar to those used in integrated circuit manufacture, for use as sensors, actuators, and other devices. Today almost any miniaturized device (based on Si technology or traditional precision engineering, chemical or mechanical) is referred to as a MEMS device.
<i>Microfabrication</i>	Manufacturing technology for making microscopic devices, such as Integrated Circuits or MEMS.
<i>Micromachining</i>	See “Surface micromachining”
<i>Micron</i>	Unit of thickness/length: 1/1,000,000 of a meter or 0.00003937.
<i>Microprocessor</i>	Chip containing the logical elements for performing calculations and carrying out stored instructions.
<i>Microstructure</i>	In material engineering, the structural features of a material such as grain boundaries, grain size and structure, subject to observation under a microscope, selective etching etc. In MEMS microstructure unfortunately is also used to designate a micromachined feature.
<i>Miller indices</i>	A set of 3 integers (4 for hexagonal) that designate crystallographic planes, as determined from reciprocals of fractional axial intercepts.
<i>Mobility (electron, and hole)</i>	The proportionality constant between the carrier drift velocity and applied electric field.
<i>Modulus of elasticity (E)</i>	The ratio of stress to strain when deformation is totally elastic. Also the Young’s modulus.
<i>MOEMS</i>	Micro-Optical Electro-Mechanical Systems
<i>Molality</i>	The molality or molal concentration (symbol m) is the amount of substance per unit mass of solvent or mol kg ⁻¹ .
<i>Molarity</i>	Concentration in a liquid solution (symbol c), in terms of the number of moles of a solute dissolved in 10 ⁶ mm ³ (10 ³ cm ³) of solution in mol l ⁻¹ .
<i>Molding (plastics)</i>	Shaping a plastic material by forcing it, under pressure at a high temperature, into a mold cavity.
<i>Moore’s law</i>	After Gordon Moore: “The number of transistors per computer chip will double roughly every two years.”
<i>MOSFET</i>	Metal-Oxide-Semiconductor Field-Effect Transistor – device where gate electrode potential controls current flow.
<i>MRAMS</i>	Magnetoresistive random-access memories.
<i>MUX</i>	Device for combining several signals or data streams into a single flow.

N	
<i>n-type</i>	Characterizes a semiconductor containing predominantly mobile electrons (also see “p-type”).
<i>Nanometer</i>	Unit of thickness/length: 1/1,000,000,000 of a meter or 0.00000003937.
<i>Nanotechnology</i>	Devices ranging in size from sub-nanometer to a 1/10 μm .
<i>Nernst equation</i>	An equation relating the potential of an electrochemical cell to the concentrations of the cell components: $E = E_0 + \frac{RT}{zF} \ln \frac{C_1}{C_2}$ with z the charge exchanged at the electrode and C_1 and C_2 concentrations of two electro-active compounds.
<i>Nucleation</i>	The initial stage in a phase transformation, evidenced by the formation of small particles (nuclei) of the new phase, which are capable of growing.
<i>Nucleotide</i>	A monomer of the nucleic acids composed of a five-carbon sugar, a nitrogen-containing base, and phosphoric acid.
O	
<i>Ohm (Ω)</i>	Unit of resistance. One ohm is the electrical resistance between two points of a conductor when a constant potential difference of 1 volt, applied to these points, produces a current of 1 ampere in the conductor.
<i>Ohmmeter</i>	Tool for measuring electrical resistance.
<i>Oscillator</i>	Circuit that produces an alternating voltage (current) when supplied by a steady (DC) energy source.
<i>Osmosis</i>	The flow of solvent into a solution through a semi-permeable membrane.
<i>Osmotic pressure (π)</i>	The pressure that must be applied to a solution to stop osmosis: $\pi = MRT$.
<i>Oxidation</i>	The removal of one or more electrons from an atom, ion or molecule.
P	
<i>p-type semiconductor</i>	A semiconductor for which the predominant charge carriers responsible for electrical conduction are holes.
<i>Package</i>	Protective enclosure for a chip or a sensor, typically made of plastic or ceramic.
<i>Paramagnetism</i>	A relatively weak form of magnetism resulting from the independent alignment of atomic dipoles (magnetic) with an applied magnetic field. Also a type of induced magnetism, associated with unpaired electrons, that causes a substance to be zapped into the inducing magnetic field.
<i>Phase shift</i>	A time difference between the input and output signals.
<i>Phase transformation</i>	A change in the number and/or character of the phases that make up the microstructure of an alloy.

<i>Phonon</i>	A single quantum of vibrational or elastic energy.
<i>Phosphorescence</i>	Luminescence that occurs at times greater than on the order of a second after an electron excitation event (see also “luminescence”).
<i>Photodiode</i>	Semiconductor diode that produces voltage (current) in response to illumination (see also “phototransistor”).
<i>Photomicrograph</i>	The picture made with a microscope.
<i>Phototransistor</i>	Transistor that, when powered, produces amplified voltage (current) in response to illumination.
<i>Piezoelectric material</i>	A ferroelectric material in which an electrical potential difference is created due to mechanical deformation, or conversely, in which the application of a voltage causes dimensional changes in the material.
<i>Pinhole</i>	The term pinhole embraces a wide variety of oxide defects and is used in a broad sense today. Listed in this category are cracks caused by thermal contraction after oxidation or by handling, and regions of oxide with low dielectric strength caused by dust particles, inadequate masking, contamination, or poor resist adhesion.
<i>Pitting</i>	A form of very localized corrosion wherein small pits or holes form, usually in a vertical direction.
<i>pK value</i>	A measure of the strength of an acid on a logarithmic scale. The pK value is given by $\log_{10}(1/K_a)$, where K_a is the acid dissociation constant pK values often are used to compare the strengths of different acids.
<i>Planarity</i>	Combined uniform flatness and total thickness variation of devices contained on a wafer.
<i>Plastic deformation</i>	Permanent or nonrecoverable deformation, accompanied by permanent atomic displacement.
<i>Plasticizer</i>	A low molecular weight polymer additive that enhances flexibility and workability and reduces stiffness and brittleness.
<i>Point defect</i>	A crystalline defect associated with one or several atomic sites.
<i>Poisson’s ratio (ν)</i>	For elastic deformation, the negative ratio of lateral and axial strains that result from an applied axial stress.
<i>Polarization (P)</i>	The total electric dipole moment per unit volume of dielectric material.
<i>Polishing</i>	Generation of fine finish with low-surface and sub-surface damage.
<i>Polysilicon</i>	Polycrystalline silicon used as a conductor in integrated circuits, and especially FETs.
<i>Potentiometric device</i>	Monitors the voltage between a sensing electrode and a reference electrode. A high input impedance voltmeter is used to minimize current flow. The voltage typically is proportional to the logarithm of the analyte concentration.
<i>Power [W]</i>	Product of voltage and current in a component; also, refers to the field of electric energy supply.

<i>Precision</i>	The degree of reproducibility among several independent measurements of the same true value under specified conditions.
<i>Pyroelectricity</i>	The property of certain crystals, such as tourmaline, of acquiring opposite electrical charges on opposite faces when heated.
Q	
<i>Q factor</i>	A rating, applied to coils, capacitors, and resonant circuits, equal to the reactance divided by the resistance. The ratio of energy stored to energy dissipated per cycle in an electrical or mechanical system.
<i>Quantization</i>	The concept that energy can occur only in discrete units called quanta.
R	
<i>RAM</i>	Random Access Memory – read-write memory with elements accessible in any order.
<i>Range</i>	The difference between the minimum and maximum values of sensor output in the intended operating range. Defines the overall operating limits of a sensor.
<i>Reactance</i>	Portion of impedance that characterizes non-dissipative, energy storage effects (also see “impedance”).
<i>Reactant</i>	A starting substance in a chemical reaction. It appears to the left of the arrow in a chemical reaction.
<i>Recrystallization</i>	The formation of a new set of strain-free grains within a previously cold-worked material due to an annealing heat treatment.
<i>Rectifier</i>	Device that converts bi-directional to one-way current flow.
<i>Reduction</i>	The addition of one or more electrons to an atom, ion or molecule.
<i>Reflection</i>	Deflection of a light beam at the interface between 2 media.
<i>Refraction</i>	Bending of a light beam when passing from one medium to another, at different velocities of light.
<i>Refractory</i>	A metal or ceramic that does not deteriorate rapidly or does not melt when exposed to extremely high temperatures.
<i>Reliability (life, multi-use vs. single, calibration vs. accuracy drift)</i>	How well a sensor maintains both precision and accuracy over its expected lifetime. Also includes the robustness of the sensor.
<i>Repeatability</i>	The exactness with which a measuring instrument repeats indications when it measures the same property under the same conditions.
<i>Residual stress</i>	A persisting stress in a material free of external forces or temperature gradients.

<i>Resistance [Ω-ohm]</i>	Characteristic of a resistor: in a 1-ohm resistance a current of 1 A produces a voltage drop of 1 V.
<i>Resistivity (ρ)</i>	The reciprocal of electrical conductivity, and a measure of a material's resistance to passing electric current.
<i>Resistor</i>	Energy dissipative element consisting of a poor conductor in series with connecting wires.
<i>Resolution</i>	The smallest measurable change in input that will produce a small but noticeable change in the output. In the context of chemical separations, defines the completeness of separation.
<i>Reverse bias</i>	The insulating bias for a p-n junction rectifier; electrons flow into the p side of the junction.
<i>RF</i>	Radio Frequency – refers to alternating voltages and currents having frequencies between 9 kHz and 3 MHz.
<i>rms</i>	Root mean square.
<i>ROM</i>	Read only memory; memory used for permanent, storage of unalterable data; nonvolatile memory.
S	
<i>Sacrificial anode</i>	An active metal or alloy that corrodes and protects another metal or alloy to which it is electrically coupled.
<i>Sacrificial layer</i>	A thin film that is later removed to release a microstructure from its substrate.
<i>Selectivity</i>	The ability of a sensor to measure only one metric or, in the case of a chemical sensor, to measure only a single chemical species.
<i>Semiconductor</i>	Nonmetallic material, such as silicon, whose electrical conductivity is moderate and alterable by doping.
<i>Sensitivity</i>	The amount of change in a sensor's output in response to a change at a sensor's input over the sensor's entire range. Provides an indication of a sensor's ability to detect changes. For some sensors, the sensitivity is defined as the input parameter change required to produce a standardized output change.
<i>SI units</i>	International System of units based on the metric system and units derived from the metric system.
<i>Silicon</i>	The most common semiconductor wafer.
<i>Single crystal</i>	A crystalline solid for which the periodic and repeated atomic pattern extends throughout its entirety without interruption.
<i>Sintering</i>	Particle coalescence of a powdered aggregate by diffusion that is accomplished by firing at an elevated temperature.
<i>Slip</i>	Plastic deformation resulting from dislocation motion; also, the shear displacement of 2 adjacent planes of atoms.

<i>Slip casting</i>	A forming technique used to shape ceramic materials. A slip or suspension of solid particles in water is poured into a porous mold. A solid layer forms on the inside wall as water is absorbed by the mold, leaving a shell (or a solid piece) in the shape of the mold.
<i>Smart sensor</i>	A sensor in which the electronics that process the output from the sensor, and forms the modifier, are partially or fully integrated on a single chip.
<i>Solvent</i>	The component of a solution that dissolves a solute.
<i>Specific heat</i>	The heat capacity per unit mass of material.
<i>Specific modulus (specific stiffness)</i>	The ratio of elastic modulus to specific gravity for a material.
<i>Specific strength</i>	The ration of tensile strength to specific gravity for a material.
<i>Spinning</i>	Fiber forming process: a multitude of fibers are spun as molten material is forced through many small orifices.
<i>Squeeze-film damping</i>	Effect of ambient fluid and spacing on the vertical movement of a structural member with respect to a substrate.
<i>Stability</i>	The ability of a sensor to retain specified characteristics after being subjected to designated environmental or electrical test conditions.
<i>Stabilizer</i>	A polymer additive that counteracts deteriorative processes.
<i>Standard atmosphere</i>	A unit of pressure equal to 760mm Hg.
<i>Steady-state diffusion</i>	The diffusion condition for which there is no net accumulation or depletion of diffusing species. The diffusion flux is independent of time.
<i>Stiction</i>	Static friction; adhering of thin micromachined layers to a substrate.
<i>Stoichiometry</i>	For ionic compounds, the state of having exactly the ratio of cations to anions specified by the chemical formula. Stoichiometric quantities refers to quantities of reactants mixed in exactly the correct amounts so that all are used up at the same time.
<i>Strain (symbol ϵ)</i>	The change in gauge length of a specimen, in the direction of an applied stress, divided by its original gauge length.
<i>Strain gauge</i>	An element (wire or foil) that measures a strain based on electrical resistance changes of the gauge that result from a change in length or dimension strain of the wire or foil.
<i>Stress concentration</i>	The concentration or amplification of an applied stress at the tip of a notch or small crack.
<i>Stress corrosion (cracking)</i>	A form of failure resulting from the combined action of a tensile stress and a corrosion environment, occurring at lower stress levels than required when the corrosion environment is absent.
<i>Substrate</i>	Another term for wafer.

<i>Superconductivity</i>	A phenomenon characterized by the disappearance of the electrical resistivity at temperatures approaching 0 K.
<i>Surface micromachining</i>	The assembly of micro-mechanical devices by deposition and removal processes.
<i>Surface plasmon</i>	A collective motion of electrons in the surface of a metal conductor, excited by the impact of light of appropriate wavelength at a particular angle.
<i>Systematic error</i>	An error that always occurs in the same direction.
T	
<i>TAB bonding</i>	Tape automated bonding; semiconductor packaging technique that uses a tiny lead-frame to connect circuitry on the surface of the chip to a substrate instead of wire bonds.
<i>Taper</i>	Parallelism within a substrate, normally specified with Bow.
<i>Tensile strength (TS)</i>	The maximum engineering stress, in tension, sustainable without fracture; also called “ultimate (tensile) strength”.
<i>Tesla [T]</i>	Unit of magnetic induction $1T = 1 \text{ weber/m}^2$ (also, $1T = 10^4 \text{ gauss}$).
<i>TFT</i>	Thin film transistor.
<i>Thermal conductivity (κ)</i>	For steady-state heat flow, the proportionally constant between the heat flux and the temperature gradient. Also, a parameter characterizing the ability of a material to conducting heat.
<i>Thermal expansion coefficient, linear (α)</i>	The fractional change in length divided by the change in temperature.
<i>Thermal fatigue</i>	A type of fatigue failure that introduces the cyclic stresses by fluctuating thermal stresses.
<i>Thermal shock</i>	The fracture of a brittle material resulting from stresses introduced by a rapid temperature change.
<i>Thermal stress</i>	A residual stress introduced within a body resulting from a change in temperature.
<i>Thermistor</i>	A temperature-measuring device, that contains a resistor or semiconductor whose resistance varies with temperature.
<i>Thermocouple</i>	A temperature-measuring device, which contains a pair of end-joined dissimilar conductors in which an electromotive force is developed by thermoelectric effects when the joined ends and the free ends of the conductors are a different temperature.
<i>Thermoplastic polymer</i>	A substance that, when molded to a certain shape under appropriate conditions, can later be remelted.
<i>Thermoset polymer</i>	when molded to a certain shape under pressure and high temperatures cannot be dissolved.

Thinning	Material removal process (grinding, lapping, polishing, etching) to a TTV and Taper.
Toughness	A measure of the amount of energy absorbed by a material as it fractures, indicated by the total area under the material's tensile stress-strain curve.
Transformer	Device using magnetically linked inductors to change AC voltage level.
Transistor	Semiconductor device used for amplification and switching.
Tribology	The science and technology of two interacting surfaces in relative motion and of related subjects and practices. The popular equivalent is friction, wear, and lubrication in surfaces sliding against each other, as in bearing and gears.
TTV	Total Thickness Variation
U	
ULSI	Ultra large-scale integration; a chip with over 1,000,000 components.
Unit cell	The basic structural unit of a crystal structure, defined in terms of atom (or ion) positions within a parallelepiped volume.
V	
Valence band	The electron energy band that contains the valence electrons in solid materials.
Valence electrons	The electrons in the outermost occupied electron shell, that participate in interatomic bonding.
van der Waals bond	A secondary, permanent or induced, interatomic bond between adjacent molecular dipoles.
Viscoelasticity	A type of deformation exhibiting the mechanical characteristics of viscous flow and elastic deformation.
Viscosity (symbol is η)	The ratio of the magnitude of an applied shear stress to the velocity gradient that it produces; in other words: a measure of a noncrystalline material's resistance to permanent deformation.
Vitrification	During firing of a ceramic body, the formation of a liquid phase that becomes a glass-bonding matrix upon cooling.
VLSI	Very large scale integration; a chip with 100,000 to 1,000,000 components.
Volt	Unit of electrical potential difference (see voltage”).
Voltage [V]	Potential difference between two points: energy to move a 1-C charge through a 1-V potential difference is 1-J.

W	
Wafer	Semiconductor disk out of which integrated circuits are made (also see “chip”, “mask”).
Watt (W)	Unit of power. One watt is the power that, in 1 second, gives rise to an energy of 1 joule.
Weber	Unit of magnetic flux. One weber is a magnetic flux that, linking a circuit of 1 turn, would produce in it an electromotive force of 1 volt if it were reduced to zero at a uniform rate in 1 second.
Weight percent (wt%)	Concentration specification on the basis of weight (or mass) of a particular element relative to the total alloy weight (or mass).
Whisker	A very thin, single crystal of high perfection which has an extremely large length-to-diameter ratio. Whiskers are used as the reinforcing phase in some composites.
X	
X-ray lithography	A photolithographic process using short wave X-rays, photo masks, and photoresists.
Y	
Yield strength	The stress required to produce a very slight yet specified amount of plastic strain; a strain offset of 0.002 is commonly used.
Yielding	The onset of plastic deformation.
Z	
Zener diode	Semiconductor diode that has a well-defined turn-on voltage for conduction in the reverse direction.
Zone refining	A metallurgical process for obtaining a highly pure metal that depends on continuously melting the impure material and recrystallizing the pure metal.