



Electrovert®

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ACID A hydrogen-containing substance which breaks down upon solution in water to produce hydrogen ions. The strength of an acid is determined by the quantity of hydrogen ions, which are released in solution. The higher the concentration of hydrogen, the stronger the acid. See pH. The hydrogen ion carries a positive electrical charge.

ACID NUMBER Quantitative value that can be assigned to measure the degree of acidity of any acid. However, there is not necessarily a relationship between a high acid number and the corrosiveness of an acid; corrosive acid is a function of free or ionic acidity.

ACTIVATED That condition of a compound or mixture of compounds having higher chemical activity than that normally found with the compound or mixture. An example is the addition of an activator to rosin to increase its fluxing activity.

ACTIVATOR In soldering fluxes this is the additive used to increase the chemical or physical cleaning capability of a flux.

AIR LEVELING A process used to coat printed circuit boards with a thin solderable layer of molten solder. The process involves total immersion of a flux coated bare board in molten solder. Upon withdrawal, hot air knives (above the melting point of solder) are used to clear the holes, and remove excess solder from the pads and lands. Also see HOT AIR LEVELING.

ALLOY A combination of two or more metal elements. The combination may be in the form of a solid solution of one or more metals in another metal, or distinct phases, or components, of the alloy. Generally, alloys will have different properties from those exhibited by their constituent elements. An example is 63% tin plus 37% lead, a solder alloy. This alloy melts at 361°F, (183°C), whereas pure tin melts at 449°F, (231°C), and pure lead at 621°F (327°C).

ALUMINA Aluminum oxide (Al_2O_3) used as a ceramic substrate material.

AMORPHOUS A condition of a material whose atoms and molecules are not arranged in any definite pattern or form. The material is not crystalline.* A characteristic of amorphous material is lack of certain well-defined physical properties. For example, the material is

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homogeneous, but does not show a sharp melting or freezing point. Generally, amorphous materials are poor conductors of heat and electricity. Glass, carbon and rosin are examples of amorphous materials.

ANALYTICAL CHEMISTRY That branch of chemistry which deals with the detection or identification of the atoms, ions or radicals (groups of atoms which react as a unit) of which a substance is composed, the compounds which they form, and the proportions of these compounds which are present in a given substance.

ANION Negatively charged atom or radical.

ANODE The positive pole of a plating cell. It is the physical entity of the plating set-up at which negatively charged ions* leave the plating solution. The ions are converted back to the parent atom (or group of atoms) and are discharged as gas, redissolve in the solution, or precipitate as sludge in combination with other components of the solution. The electrical charge that had been carried by the ion then enters the external electrical circuit. In plating solder, as in many plating baths, the anode is consumed by giving up its metal content to the bath in the form of positive metal ions. These are then deposited on the cathode.*

ATOM The smallest particle of an element which can enter into a chemical combination. All chemical molecules are composed of atoms. The differences between molecules result from the differences in type and number of atoms involved.

AUTO-IGNITION POINT The temperature at which vapor from a material in air will spontaneously burst into flame. This is opposed to the Flash Point* where the material vapors will ignite only under the influence of an external energy source such as flame or spark.

AZEOTROPIC SYSTEM A system of two or more liquid compounds which has a constant boiling point at a particular composition.

BACKPLANES Interconnection panels used for wirewrap*, or to plug in printed circuits* and hybrids.*

BARRIER PLATING The use of a plated layer such as nickel to prevent the solution or diffusion* of one metal in another. For example, a nickel barrier is used on the termination of silver fired* chips to prevent the scavenging* of the termination.

BASE A substance, which upon solution in water produces one of more hydroxyl ions.* A hydroxyl ion is composed of one atom of oxygen and one atom of hydrogen. The hydroxyl ion carries one negative electrical charge. The strength of a base is determined by the number of hydroxyl ions that are released into solution. See pH.

BERYLLIA Beryllium oxide ceramics (BeO) significant in that they have high thermal conductivity characteristics.

BINDERS Substances added to unfired substrates and thick film compounds to hold ingredients together or fill voids.

BLOW HOLES These are defects inn platedthrough hole solder joints, where gases burst through the solidifying solder, usually at the bottom of the fillet. The cavities are often very deep and not washable, unlike pin holes.*

BOILING POINT The temperature of a liquid at which its vapor pressure* is equal to the pressure of the atmosphere surrounding the fluid. For example, at 212°F (100°C), water has a vapor pressure equal to 14.7 psi, which is the pressure of the atmosphere at sea level.

BOND STRENGTH The magnitude of the adhesion of any two materials joined together. It is also interchangeable with the Peel Strength.

BONDING PAD A metalized area at the end of a thin metallic strip or on a semiconductor to which a connection is made.

BONDING WIRE Fine gold or aluminum wire for making electrical connections in hybrid circuits between various bonding pads on the semiconductor device substrate lands.

BRAZING A metallurgical joining method using non-ferrous filler metals that melt above 800°F (427°C). Like soldering, it is based on wetting of the base metals, but usually also followed by diffusion.

BRIDGING A definition of a defect where solder bridges or shorts between two or more solder joints.

BURNOFF The removal of previously deposited electroless copper by excessive current during electroplating. Usually this occurs at the edges of plated through holes, causing barrel failures.

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CAPACITANCE The storage of an electrical charge on two metal plates separated by an insulator. The phenomena is used in making capacitors, but could be undesirable in the design of MLB* and complex circuitry.

CAPILLARY ACTION The interaction between a liquid and a small diameter channel or opening in a solid. Because of the physics involved, if the liquid wets* the sides of the solid channel, surface tension* will draw the liquid up into the capillary channel. This travel is sometimes for considerable distance. The term capillary, alone, refers to the channel itself. An example of this action in soldering is demonstrated by dipping a stranded wire into a liquid flux which wets the conductor. The small spacings between the individual strands of the wire act as capillary channels. It can be noted that the liquid flux will travel for a considerable distance up the stranded wire.

CARRIERS Holders for electronic parts and devices which facilitate handling during processing, production, imprinting or testing operations and protect such parts during transport.

CATHODE The negative pole of a plating cell. It is the physical entity of the plating set-up at which positively charged ions* leave the plating solution. The cathode is normally the object of the plating, i.e. a metal is deposited on the cathode. In solder plating, for example, metal from the anode is plated on the cathode. The anode metal enters the bath as positive ions which are attracted to the negative cathode, where they give up their electrical charge to the external circuit. The ion is then converted to an atom which then remains adhering to the cathode.

CERAMIC Non-metallic and inorganic material (e.g. alumina or beryllia) used in microelectronic substrates and component parts.

CERMET A combination of ceramic and metal powders used for thin and thick-film resistors.

CHEMICAL ANALYSIS – WET This method, quantitative or qualitative, is performed by manipulating the unknown through a series of predetermined chemical reactions. The term 'wet' arises from the fact that most of the chemical manipulations are carried out in solution.

CHEMCIAL ANALYSIS – INSTRUMENTATION This method uses a variety of instruments to identify metals and non-metallic materials. For solder analysis see SPECTROGRAPHIC ANALYSIS.

CHIP A single substrate on which all the active and passive circuit elements have been fabricated using one or all of the semiconductor techniques of diffusion, passivation, masking, photoresist and epitaxial growth. The term is also applied to discrete capacitors and resistors that are small enough to be bonded to substrates by hybrid techniques.

CHIP CAPACITORS Discrete devices which introduce capacitance into an electronic circuit, made in tiny wedge or rectangular shapes.

CHIP CARRIER Multi-leaded device with connections from all four sides. Leadless: surfaces to be soldered on carrier surfaces. Leaded: surfaces to be soldered on leads from carrier.

CHIP COMPONENT An unpackaged circuit element (active or passive) for use in electronics. Besides IC's, the term includes diodes, transistors, resistors and capacitors.

CHIP RESISTOR A discrete device in chip form, which introduces resistance into an electronic circuit. Made of a ceramic body coated with a resistive layer, having metalized terminations. Also see MELF.

CIRCUIT The interconnections of a number of devices in one or more closed paths to perform a desired electrical or electronic function.

CIRCUIT DENSITY The amount of circuitry on a given area of board usually expressed as a ratio of total surface area to circuitry and component coverage.

CLAD OR CLADDING A thin layer or sheet of metal foil which is bonded to a core or dissimilar metal.

COLD SHORT A metallurgical term to denote a brittle condition in metal at temperatures below the recrystallization temperature.

COLD SHORT JOINT This term has been erroneously used to indicate solder joints that solidified under vibrations, these are now called 'Disturbed Joints'.* It has also been used to indicate connections that did not see enough heat; these are now called 'INSUFFICIENT HEAT JOINTS'.*

COMBUSTION The rapid oxidation* of material, accompanied by the production of heat and many times also visible by radiation. The burning of fuels

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is a good example of combustion, while the slow rusting of iron (also an oxidation process) is not.

COMPONENT Any part placed on a printed circuit assembly, i.e. resistor, capacitor, diode.

COMPOUND A homogeneous, pure substance composed of two or more essentially different chemical elements*, which are present in definite proportions. Compounds usually possess properties differing from those of the constituent elements.

CONDENSATION SOLDERING See Vapor Phase Soldering.

CONDUCTIVE INK In hybrid technology, the conductive paste used on thick-film materials to form the printed conductor pattern. Usually contains metals, metal oxide, glass frit and solvent.

CONDUCTOR Any circuit element which carries current. On a printed circuit assembly, for example, all the functional copper left on a board are conductors.

CONTAMINANT An impurity or foreign substance present in a material or on a surface which affects performance of the material or circuit.

CONVECTION PREHEAT A type of preheat that uses forced hot air as the primary means to heat the circuit board. Used in both reflow and wave soldering.

COPPER MIRROR TEST A test for corrosivity of flux to a copper film 0.500 microns thick (20 microinches) vacuum-deposited on glass plate.

CORROSION The most common kind of corrosion is that of rusting. This is but a special case of a general classification known as an atmospheric corrosion, wherein the oxygen of the atmosphere reacts with the material in question. Most metals, with the exception of the noble metals such as gold, can be oxidized by atmospheric oxygen. In the usual case, however, water vapor must be present before any appreciable oxidation takes place. In a restricted sense, corrosion is considered to consist of the slow chemical and electrochemical reactions between a metal and its environment. From a broader point of view, corrosion is the slow destruction of materials by chemical agents and electrochemical reactions.

COSMETIC DEFECT A variation from the conventional appearance of a product, such as a slight change in color or surface finish; not necessarily detrimental to service performance.

CRAZING Minute cracks on the surface of materials such as ceramic and plastics.

CREEP STRENGTH That characteristic of a material which describes its strength and resistance to elongation, i.e. stretching, at low loads. This characteristic can be measured either as the load to fracture the sample at a given temperature, or the load that will produce a given percent of stretch, or elongation, at a given temperature.

CRYSTALLINE A material which has its atoms or molecules arranged in geometric repeating patterns. Salts and metals are the most common examples of crystalline materials. With a crystalline material, the dividing line between atoms and molecules is usually obliterated, since the number of repeating patterns of atoms that form the crystal are generally not fixed, but are dependent upon the conditions under which the crystal was formed. There are no definite numbers of atoms that go into an individual crystal, and since these atoms are not grouped in any way other than the regular geometry of the crystal, there is no real meaning to the subdivision of the material called a molecule. Crystalline materials have definite and sharp melting points (and in most cases of metals, are relatively good conductors of heat and electricity).

CURE To change the physical properties of a material by chemical reaction, by the action of heat and catalysts, alone or in combination, with or without pressure.

CURRENT DENSITY This is a plating term, referring to the amount of electrical current passing through an anode (or cathode) divided by the surface area of the anode. The terms are amperes per square foot.

DECOMPOSITION A process whereby a chemical compound is broken down into simpler constituents. An example of this would be the breaking down of activators in rosin fluxes when soldering temperatures are reached.

DEFINITION In electronics it refers to the accuracy of deposition. This may include solder creams*, solder mask*, circuit lines etc.

DEIONIZED AND DEMINERALIZED WATER Water that has been treated to remove the small quantity of minerals normally dissolved in hard water. In addition, any ions present are also removed in the

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process for making this grade of water. This purity water is required for certain applications in the electronic and semiconductor industries where extreme precautions must be taken to remove or reduce contamination on parts rinsed in the water.

DENSITY The ratio of the weight or mass of a substance to its volume. For example, the density of water is 62.4 lbs./cu.ft. When the units used are the gram and cubic centimeter, in place of pounds and cubic feet, density and specific gravity* are the same.

DEWETTING A condition which results when molten solder has coated a surface and then receded, leaving irregularly shaped mounds of solder separated by areas covered with a thin solder film; base metal is not exposed.

DIELECTRIC CONSTANT The resistance of a nonconductor to break down under the influence of an applied voltage. May be affected by various processing solutions and especially by failure to rinse thoroughly, thus leaving moisture-absorbing conductive salts.

DIFFUSION A physical process whereby one material passes through, i.e. diffuses, through another. Examples are the diffusion of gases through solid materials or the diffusion of one metal with another. An example in soldering is the case where the gold-plated object migrates or diffuses into solder.

DIODE A simple two-electrode semiconductor having a much greater resistance in one direction. All rectifiers are diodes (avalanche diodes) are used for voltage regulation.

DIP Dual in-line package. Carrier in which a semiconductor integrated circuit is assembled and sealed.

DIP SOLDERING The process of soldering all components on a board at one time by dipping the board in a solder pot. Board is not dipped deeply enough to immerse components.

DISCRETE COMPONENT A circuit component having an individual identity, such as a transistor, capacitor or resistor.

DISTILLATION A boiling or evaporation process generally used to separate one liquid component from a mixture of other liquids. In soldering, for example, the cleaning solution used to remove flux residues after soldering can be distilled. By maintaining the proper temperature, the basic solvent is boiled off, leaving behind a residue of soil*

that has been removed from the work. The solvent vapors are then collected and condensed back into the liquid form and reused.

DISTURBED SOLDER JOINT A solder fillet that solidified while one or both metals to be joined were vibrating. The result is a weak, non-uniform metallic structure, with many micro-cracks. This defect is also erroneously referred to as a 'Cold Joint'.*

DROSS Metal oxides and other entrapped impurities which float in or on the surface of a molten metal bath. In the case of solder, it would include the oxides of lead and tin, in addition to non-metallic impurities which as flux residues that were dragged into the solder bath and oxides of any metal impurities found in the solder.

DRAG SOLDER A mass production technique, where the fluxed printed circuit assemblies are floated on top of a solder pot.

DUAL IN-LINE PACKAGE (DIP) Carrier in which a semiconductor integrated circuit is assembled and sealed. Package consists of a plastic or ceramic body with two rows of vertical leads that are inserted into a circuit board and secured by soldering.

DUMPING PERIOD The length of time a material, such as a liquid flux or the solder in a solder pot, can be used before it is necessary to replace with new material.

ELECTRICAL INSULATION This property is the inverse of electrical conductivity and is proportional or related to electrical resistance. The insulating properties of a material describe its ability to restrict or block the flow of electricity. See Electricity Resistance.

ELECTROLYTE The property of an electrical component or assembly that describes its resistance to the flow of electricity. The unit of measurement of resistance is called an ohm. The intrinsic property of a material that describes its resistance is called resistivity. The terms resistance and resistivity should be not confused. inasmuch as an assembly containing a material with a high resistivity may, because of its size, have a lower resistance than one containing a low resistivity material. An analogy to this would be two pipes of differing size. Under a given hydraulic pressure, the larger pipe will carry more water, or conversely it has a lower resistance to fluid flow. Solders usually range from 10 to 20 times the resistivity of copper which is normally taken as the

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standard. Despite this, there is usually no problem with the resistance of a solder joint because of its large cross-section compared to the copperconducting wires.

ELECTRICAL RESISTANCE This term is commonly applied to substances which either in the molten state or in solution conduct electricity by transfer of ions. The more important electrolytes are solutions of salts, acids or bases, usually in water.

ELECTROPLATING The coating of an object with a thin layer of some metal through electrolytic deposition. The general object is to employ the article to be plated as the cathode in an electrolytic bath composed of a solution of the salt of the metal to be plated. The other terminal, the anode, may be of the same metal or it may be some chemically unaffected conductor. A low-voltage current is passed through the solution, which electrolyzes and plates the cathodic articles with the metal to the desired thickness.

ETCHANT Solution used to remove copper from noncircuit areas on printed circuit boards.

ELEMENT A substance which cannot be decomposed or otherwise modified by ordinary types of chemical processes. Neither can an element be made by chemical union.

EUTECTIC When applied to an alloy, refers to that composition of an alloy which has the lowest melting point of a series. For example, in the tin/lead system, the approximate composition of 63Sn/37Pb is the eutectic. This is the alloy composition of all those of the Sn/Pb system which has the lowest liquidus.* Another aspect of the eutectic alloy is that it is the only alloy which does not have a mushy or pasty state; that is, the solidus* and liquidus coincides. All other alloys of the Sn/Pb system, for example, will have a mushy stage, a mixture of liquid and solid metal between the liquidus and solidus temperatures.

EVAPORATION A physical process by which a liquid loses material to the atmosphere surrounding it. Evaporation is caused by the motion of the molecules of the liquid. Since these are moving randomly in all directions, it is quite easy to see that some molecules which happen to be heading in the direction of the surface of the liquid can completely escape if they have sufficient velocity. Vapor pressure* is an indication of the rate of evaporation which a material will undergo. The evaporation process generally increases with increasing temperature.

EYELETS When applied to soldering, refers to small metal cylinders which are placed through holes in printed circuit boards and then flanged over top and bottom. These form a metal path between the top and bottom of the board and are used in certain assemblies to provide a metal and solder path through the board.

FILM RESISTOR A device whose resistive material is a film on an insulator substrate; resistance value is adjusted by trimming.

FLASH POINT Temperature at which a volatile liquid mixes with air in such proportions as to produce a flammable gaseous mixture. This mixture will flash when exposed to a flame or spark but will not necessarily continue to support combustion. Flash points are measured in two ways; Cleveland Open Cup method – giving a higher flash point, and in a closed cup.

FLATPACK Sub-assembly composed of two or more stages made up of integrated circuits and thin-film components mounted on a ceramic substrate. This semiconductor network is enclosed in a shallow rectangular package with the connecting leads projecting from edges of the package and is normally designed for surface mounting.

FLUIDITY The relative ease with which a liquid material will flow.

FLUOROCARBON A compound of fluorine and carbon. Large numbers of such compounds are known; in many of their properties they resemble the hydrocarbons, differing in their greater stability. The chemical inertness of the fluorocarbons makes them useful as solvents. Useful as non-flammable solvents.

FLUX As used in soldering, is a material which cleans metal surfaces of absorbed gases, oxide films and other tarnishes. The flux also reduces the surface tension* of the molten solder* and the metal to be soldered, so that the solder may flow and wet the metal surface. In addition, the flux at the soldering temperature provides a covering blanket over the material being soldered to prevent reoxidation of the surface during the soldering operation.

FREEZING POINT The temperature at which a liquid or gaseous material solidifies completely. It is the same as the melting point* of the material.

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FUSING FLUX Activated organic fluids, predominantly water soluble, used in either infrared or hot oil immersion fusing (reflow) of tin-lead plated printed circuit boards.

GLASS TRANSITION TEMPERATURE (Tg) The temperature at which an amorphous polymer changes from a hard and relatively brittle state to a viscous or rubbery condition. Important physical properties undergo extensive changes, these include hardness, thermal expansion and specific heat. In printed circuits, this change is significant and allows the boards to warp and sag, they lose much of their peel strength*, and the expansion of the z-axis* increases dramatically.

GLAZING OR SMEARING A condition in the drilled hole of a printed circuit board caused by improper drilling. The plastic is overheated in drilling and flows to form a very smooth, glassy layer. Some form of etching solution must be used to remove the glaze for good adhesion of the plated layers.

GROUND Represents common reference point for voltage measurements. Usually largest single circuit area on a printed circuit board.

HALIDES A compound* containing fluorine, chlorine, bromine, iodine or astatine. In soldering, these materials may be part of the flux system, mostly the activator. The residues of ionic halides are considered dangerous and must be washed. The lonograph* or Omegameter* are suitable to monitor traces of such ionic residues.

HALIDE FREE FLUXES These are a family of fluxes that contain no halides*.

HALOGENATED HYDROCARBON An organic compound* in which some, or all, of the hydrogen atoms linked to the carbon atoms are replaced by atoms of the halogen family. One of the largest uses for these compounds is as solvents.

HARD WATER Water containing calcium carbonate and other ions such as magnesium and iron, which tend to form insoluble deposits. These minerals may collect on the inside of cleaning equipment causing a scale that can clog piping. They also react with cleaning chemicals to form a non-soluble scum. The damaging ions in the feed water may be replaced by harmless sodium lens, in an ion exchanger called a 'Water Softener'.

HALOGENS A group of elements similar in their properties and chemical activities. These elements,

in order of decreasing activity, are fluorine, chlorine, bromine and iodine.

HEADER Base of a hybrid circuit package, holding the leads and providing a heat sink.

HOT-AIR LEVELING Process used in solder dipping of bare copper circuitry in which high-velocity air is used to blow solder clear from plated-through holes and to minimize solder thickness.

HOTCRACKING A cracking of a metal or alloy upon freezing. In relation to solder, this can occur as a result of stresses developed in the solder joint by uneven cooling. For example, if a very massive part is soldered to a very light part, the heat of a soldering will tend to flow more rapidly toward the massive part which acts as a heat sink. The stresses developed by this unequal cooling can crack or fracture the joint. This phenomenon may or may not be associated with a hotshort.*

HOT TINNING The application of a solderable coating by a molten solder/wetting process. Tinning is not limited to the application of pure tin, but can be achieved with any solder alloy.* Also see TINNING.

HOTSHORTNESS Brittleness which develops at elevated temperatures in certain metals and alloys.

HYBRID INTEGRATED CIRCUIT The physical realization of electronic circuits or subsystems from a number of extremely small circuit elements electrically and mechanically interconnected on a substrate.

HYDROCARBONS Organic* chemical compounds containing only hydrogen and carbon atoms*. The number of hydrocarbons that exist in nature or can be synthesized is almost unlimited. Many of the hydrocarbons are used as solvents.

HYGROSCOPIC This characteristic of a material describes its ability to absorb water, usually from the air. Examples of hygroscopic materials are quite common in ordinary life. Most salts are hygroscopic. This is manifested by their clumping or lumping together when exposed to humid conditions. The salts absorb water and form solutions which then causes the particles to be bound together. The rosin used in soldering fluxes is an example of a non-hygroscopic material. That is, after soldering and hardening, the rosin residues do not absorb water from the atmosphere.

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ICICLING The formation of solder 'spikes' resulting from poor drain-off of liquid solder following wave or dip-soldering of pc boards and assemblies. Poor solderability of the surfaces to be soldered and contaminated solder are frequent causes of icicling.

IGNITION POINT See Auto-Ignition Point.

IMPEDANCE The AC resistance of a circuit expressed in ohms. Since impedance is frequency dependent, the frequency at which it has been measured must be specified. Can be seriously affected by plating defects, such as very small blisters, particularly at frequencies above 50 Kh.

INDUCTION HEATING A heating process which utilizes a phenomenon associated with metallic or crystalline materials. Essentially, what happens is a high frequency electrical current is generated in a solid material by placing that material within the field of an externally applied high frequency magnetic field. The external current is matched within the material by the material absorbing electrical energy from the field. Individual atoms or molecules of the material will then vibrate in step with the frequency, and small local currents are generated in groups of atoms or molecules. The heat is generated by the electrical resistance of the material to the small local currents. The term high frequency is not a definite one, but refers to any alternating current above approximately 1,000Hz. This method of heating is extremely efficient and usually very fast. Since the heating is accomplished by the local currents which are generated in the body of the material (these are called eddy currents), the higher the resistivity* of the material, the faster it will heat up under the influence of an induction heating unit.

INFRARED FUSING The use of infrared radiation* to melt solder in paste*, cream* or electroplated form. It is extensively used in surface mount technology in reflow* processes. It is also a standard method for melting the electroplated solder on printed circuit boards.

INFRARED OVEN An inline or batch heating unit, which relies on infrared radiation* as the heat source. While infrared energy causes the temperature rise, only 20-30% of the energy absorbed by the work comes from radiation. The balance is transferred by convection of the atmosphere in the heat zone.

INFRARED RADIATION The band of electromagnetic wavelengths lying between the extreme of the visible and the shortest microwaves. The strong absorption

of infrared by many substances renders it a useful means of applying heat energy.

INORGANIC When applied to chemistry, refers to the chemistry of those compounds found in nature or synthesized by man which do not depend essentially upon the chemistry of carbon for their properties (see Organic). Examples of inorganic compounds are minerals, metals and gases such as those found in the air.

INSUFFICIENT HEAT JOINT A hand soldered connection, which was made with too little heat, due to short contact time, or low tool temperature. This is evident by poor wetting, poor solder rise and chalky appearance.

INTERMETALLIC COMPOUND (IMC) When a metallic solution becomes saturated*, additional quantities of the same solute* can form a new crystalline phase with accurate stochiometric proportions. These compounds can also form in interfacial layers and during solid state diffusion. The resulting compounds in the tin-lead solder system are hard and brittle and generally undesirable. They affect the quality of a bond and must be understood for long range reliability.

ION A particle, usually in solution, composed of a single atom or groups of atoms, bearing an electrical charge. These atoms or groups of atoms break down from compounds* when the compound is dissolved. An ion carrying a positive charge is called a cation, while an ion carrying a negative charge is called an anion. A solution containing ions is conductive and ionic residues in the presence of moisture can leak current* in a circuit. Ions formed outside of a solution usually are very short-lived unless they are high vacuum. Corrosion* is a process usually resulting from ionic reaction.

ION-EXCHANGE COLUMN Apparatus containing specially treated resin particles of two types, anionic and cations resins, which attract and remove both positively charged ions from solution. Also known as demineralizers and deionizers.

IONIZABLE A characteristic of a material which has the capability of breaking down into ions when in solution (see Ion).

IONOGRAPH A scientific and industrial instrument, designed to measure the amounts of ions present on a surface. The unit extracts all ionizable materials from the surfaces of the part to be measured and records the rate of extraction, as

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well as the quantity. The results are reported in ugm of NaCl per unit area as per MIL Std 28809. Also see OMEGAMETER.

ISHM The International Society for Hybrid Microelectronics.

INTEGRATED CIRCUIT A small, complete circuit built up by vacuum deposition and other techniques, usually on a silicon chip and mounted in a suitable package. Makes possible extremely high circuit board densities. Usually used with multi-layer circuit boards.

JUNCTION A joining of two different semiconductors or of semiconductors and a metal. Alloy, diffused, electrochemical and grown are the four junction types.

KARI BUTANOL VALUE Measure of the strength of a solvent, such as its ability to dissolve soils. The higher the value, the more effective the solvent and the greater its tendency to attack delicate plastics, for example.

LAMINATE The raw material for printed circuits. Consists of a sheet of plastic with copper foil adhered to one or both sides.

LARGE-SCALE INTEGRATION (LSI) Usually denotes arrays of integrated circuits on a single substrate that comprise 100 or more individual active circuit functions or gates.

LAYOUT Original design of a circuit board. Includes not only circuitry but locating marks, pilot holes, identification marks and number of units per board.

LAND See Pad.

LEACHING See SCAVENGING.

LEAD FRAMES Integrated circuits are connected to lead frames to facilitate making connections to and from the various solid-state devices of the package. The leads are generally flat ribbons, down to mils wide and from 2 to 10 mils thick. Lead frames are made of Kovar, nickel, Alloy 42, copper and other metals.

LEAD FREE ALLOY A solder alloy that does not contain any lead.

LEAKAGE Loss of insulation between conductors on a board. May be due to improper cleaning procedures that leave conductive residues. See also Dielectric Constant.

LID Leadless inverted device.

LIQUIDUS That temperature at which an alloy is completely molten. (See Solidus).

MASK A metallic structure similar to stencil used to screen on solder paste* or cream.* To improve the stability of the mask, it is often bonded to a metal screen.

MASK - SOLDER See RESIST and SOLDER RESIST

MEASLING A condition existing in the base laminate of printed circuits in the form of discrete white spots or 'crosses' below the surface of the base laminate reflecting a separation of fibers in the glass cloth at the weave intersection. **MEDIUM-SCALE INTEGRATION (MSI)** The physical realization of a microelectronic circuit fabricated from a single semiconductor integrated circuit having circuitry equivalent to more than 10 individual gates or active circuit functions.

MELF, abbreviation for 'Metal Electrode Faces' surface mount devices. These are round passive components, with a metallic cap termination located at each end.

MELTING POINT The temperature at which a solid material becomes liquid. For metals there is a sharp melting point only in the case of a pure element or a eutectic alloy. See LIQUIDUS and SOLIDUS for none eutectic metal alloys.

MENISCOGRAPH An instrument used to measure the solderability of surfaces, using the wetting balance method. It measures and plots the time and forces required for the test specimen to change from buoyancy in the solder to a downward (wetting) pull.

METALLOGRAPHY Study of the structure and properties of metals and alloys, principally by microscopic and X-ray diffraction methods.

METALLURGY The term comprises both the science and technology of metals. That area concerned with the extraction of metals for their ores and the refining of these metals is known as process metallurgy. Physical metallurgy, on the other hand, is primarily concerned with the uses of metals and deals with their physical and mechanical properties as they are affected by heat treating, mechanical working and alloying.

METALS Most surfaces that are chemically classified as metals have certain characteristics

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and almost unique physical properties. Among these are high electrical and thermal conductivity, attributed to free electrons; great opacity and high reflectivity for light, due to the same cause; malleability, a sort of plasticity by virtue of which a metal may be cold-worked and rolled into thin sheets; ductility, a combination of malleability and toughness which permits a metal to be drawn into wire. Metals in their normal state are crystalline.

MICROCIRCUIT The physical realization of a (hybrid or monolithic) interconnected array of very small active and passive electronic elements.

MICROPROCESSOR An IC package incorporating logic, memory, control, computer and/or interface circuits, the whole of which is designed to handle certain functions.

MOLECULE The smallest quantity of matter which can exist by itself and be recognizable as a particle of the original material. A molecule retains all the properties of the bulk substance from which it came.

MOS Metal-oxide-semiconductor. A technology for producing transistors that incorporates metal over oxide over silicon layers.

MULTI-LAYER BOARD (MLB) A printed circuit board that has more than two metallic patterns in the X and Y direction. The layers are interconnected by the plated through holes.

NITROGEN An inert gas used in reflow and wave soldering to reduce the oxygen and prevent oxidation.

NON-POLAR COMPOUND This type of compound has electrical charges symmetrically distributed over the surface of the molecule and, therefore, shows no electrical effects in solution or otherwise. (See Polar Compound).

NON-WETTING A defect condition where part or all of the surface did not wet during the soldering process. Non wetting is recognized by the fact that the bare base metal is visible, which differentiates it from De-Wetting.* It is usually due to the presence of an interference layer on the surface to be soldered. These could be un-reacted organic contaminates, tarnish and dirt, etc.

ORGANIC When used in reference to chemistry, relates to the chemistry of carbon compounds. Some carbon compounds, such as carbon dioxide gas, do not fall into this category but the vast bulk of carbon-containing compounds do fall into the organic chemistry class. The reason for the use of the word

'organic' in describing these compounds is that until fairly recently, all of the carbon-containing compounds were found only in nature as part of growing organisms.

ORGANIC HALIDES Organic compounds containing halogens. (see Halogens and Organic Compounds).

OXIDIDATION Oxidation can be considered in two senses. In the first and narrow sense, oxidation can be considered the simple addition of oxygen to a metal, e.g. the addition of atmospheric oxygen to iron to form familiar rust. In the broader chemical sense, oxidation is any process where a metal loses electrons and is converted from the metal form, zero electrical charge, to a metallic ion* with a positive charge. (See Corrosion).

OMEGAMETER An instrument used to measure ionic residues on the surface of electronic assemblies. It operates by immersing the sample into a predetermined volume of a mixture of water and alcohol with a known high resistivity. It records and measures the drop of resistivity due to ionic residue in a measured amount of time. The results are reported in ugr of NaCl per unit area as per MIL std 28809. Also see IONOGRAPH.

PAD Area of copper surrounding hole in board to be used for lead of component or for insertion of interconnecting wire. Provides area for solder bonding.

PASSIVATION Form of surface oxidation that acts as a barrier to further oxidation or corrosion.

PASTE See Solder Paste

PC BOARD The term used for a printed circuit at almost any stage in production, from raw material stock to the finished assembly complete with components.

PEEL STRENGTH In printed circuits and laminates, this refers to the force needed to peel a 1" wide strip of metal from the laminate in a 90° pull.

pH The measure of the acidity or alkalinity of a solution. A pH of 7 is considered neutral; that is, neither acid nor basic. Solutions having pHs below 7 are acid and those greater than 7 are basic. The further the pH measurement of the solution is away from 7, the stronger the acid (or base).

PHASE DIAGRAM A graphical representation defining the phase fields of a multiphase system,

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such as an alloy, in a coordinate system using the temperature and the compositions of the phases as coordinates. The tin/lead phase diagram, for example, shows the solidus and liquidus temperatures for a variety of tin/lead solder compositions.

PHOTOMASK A square, flat glass substrate, coated with a photographic emulsion of a very thin layer of metal on which appear several hundred circuit patterns (each containing thousands of images). The patterns are exposed onto semiconductor wafers.

PICK-AND-PLACE EOUIPMENT The automated pickup and placement of discrete active and passive devices on printed circuit boards and ceramic substrates. Systems typically consist of a rotary or linear pick-up and placement tool which can access components from a wide variety of feeders: tape, bowl, ski slope, waffle pack or stack feeders. Most substrate presentation systems consist of an indexing conveyor which transports sub-assemblies through a number of placement operations. In surface mounting, the input usually comes from screen-printing epoxy adhesive or solder paste to the boards and positioning the devices on the applied materials. At the end of the placement operation the epoxy gets cured, while the solder paste is dried and reflowed.*

PILOT HOLE Hole used to position board for other operations so registration will be accurate.

PIN HOLES A category of imperfections usually due to metal solidification patterns. Pin holes are hollow surface imperfections, with the bottom plainly visible. They do not weaken the metal structure and are easily washable. They should not be confused with Blow Holes.*

PLASTIC Commonly used to describe two entirely different concepts. One usage is to describe synthetic resin* materials which are formed into parts. The second usage of the term and the one used in soldering, is that condition of a material which allows it to deform and/or flow continuously without rupturing. The term, of course, applies only to solids. The creep properties (see Creep Strength) of a material are due to its plastic properties. That is, at elevated temperatures, under relatively low loads, tin/lead solders will deform to extreme lengths without rupture. This is a plastic characteristic of the solder at the temperature concerned.

PLASTIC RANGE Refers to a range of temperature in which a metal or allow can be mechanically worked without danger of cracking the material. The term is

sometimes used in reference to the range of temperatures between the liquidus* and solidus*, where the material is a combination of liquid and solid.

PLASTICIZER A material added to a resin* or rosin to prevent hardening of the resin and/or modification of its flow properties.

PLASTIC LEADED CHIP CARRIER (PLCC) Plastic encapsulated chip with external metal leads on four sides. The leads may be 'J', Gullwing or Butt configuration.

PLATED-THROUGH-HOLES Holes in printed circuit boards which have been metallized the entire thickness of the board, generally the electroplating of a metal, usually copper. Plated-through-holes serve the same purpose as eyelets. **POISE** A unit of coefficient of viscosity, equal to 1 dyne sec/cm₂.

POLAR COMPOUND A compound in which the electrical charges are not distributed symmetrically over the surface of the molecule. Ionizable* compounds, such as flux activators, are usually polar compounds.

POLYMERIZATION A process whereby compounds link together to form long chains. The compounds involved may be the same or be a mixture of several compounds, in which case the result is a copolymer, terpolymer, etc. When polymerization of the same compound results in long chains, the end result is called a polymer. Plastics are the most common example of this. The properties of the polymer are usually radically different from that of the compounds which make it up. Polymerization usually results in the formation of a resin* from simpler compounds.

POUR POINT Lowest temperature at which a viscous substance will pour.

PRINTED CIRCUIT Any circuit consisting of conductors produced on a backing by printing or additive techniques. Substrate does not have to be plastic (some circuits are produced on anodized aluminum or on steel coated with fluidized bed epoxy). Various types include single-sided monolayer, double-sided monolayer (through-hole), multilayer.

QUALITATIVE ANALYSIS Analysis of an unknown that determines what elements or compounds are present in an unknown. This type of analysis does

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not indicate the amounts of the components present.

QUANTITATIVE ANALYSIS Analysis that determines what elements and/or compounds are present in an unknown and the quantity of each.

RADIANT HEAT One of the modes of heat transfer. In the case of radiation, heat is transferred from one object to another without physical contact between the objects. The objects must be at different temperatures. At lower temperatures, the medium of the heat transfer from the hotter to the cooler object is through infrared radiation. As the temperature is raised, the radiation may extend into the visible range. For example, when metals are heated above approximately 1000°F, (538°C), they begin to show a red color which eventually changes from red through vellow to an almost white color at 3000°F, (1649°C). This color is a manifestation of the energy being transferred from the hot object. If the hot object can be raised to a high enough temperature, i.e. above 1000°F, (538°C) this method of heating is generally very efficient and much faster tan heat transfer by conduction or convection.

RAM Random access memory, a type of memory which offers access to storage locations within it by means of X and Y coordinates.

REDUCTION The chemical process opposite to oxidation*. In the narrow sense, reduction is the removal of oxygen from a compound* such as the reduction of lead oxide to metallic lead. In the general chemical sense, reduction is a decrease in the positive charge on an element* or ion.* The process of plating, for example, converts metal ions in solutions to the metallic form of the element by gain of an electron. This reduces the positive charge of the ion and is, thus, a reduction process.

REFLOW A term used to describe the melting of preplaced solder. For example, it applies to the fusing of electroplated tin-lead coatings, by infrared equipment or hot oil on printed circuit boards. It is also used to make solder joints – see REFLOW SOLDERING below.

REFLOW SOLDERING A method in which a solder joint is made by melting the solder coatings on the mating surfaces.

REGISTRATION Location of circuit with respect to fixed points. Successive operations must register properly so opposite sides of circuit will mate properly, holes will fall in center of pads and tabs will fit into connectors.

RESIN A solid or semi-solid organic* compound lacking a crystalline structure. Resins are characterized by not having definite and sharp melting points, are usually not conductors of electricity and many are transparent or translucent. Natural resins usually originate in plants, such as pine sap and are not water-soluble. The rosin used in soldering fluxes is an example of a resin. Synthetic resins may have many or all of the properties of natural resins.

RESIST A material used to mask some process action from a given part of an assembly. An example is the resist used in soldering to cover those parts of the bare conductor over which a solder coat is not desired.

RESISTANCE A measure of the difficulty of moving an electrical current through a material when a voltage is applied.

RESISTANCE HEATING A method of heating that depends on one of two principles: 1) the passage of large currents through a poor conductor like graphite or resistive alloys. Here the heat generated in the tool is transferred by conduction to the work – common in soldering. 2) the resistance of an air gap which causes an arc and rapid heating until the gap is filled by molten metal – common in brazing and welding.

RESOLUTION A measure of the thinness of a line a photoresist can successfully reproduce in a circuit.

ROM Read-only-memory; a random-access storage in which the data pattern is unchangeable after manufacture.

ROSIN A naturally occurring resin* usually associated as a component of pine sap. It is a mixture of several organic acids, of which abietic acid is the chief component. Available as gum, wood and Tall Oil Rosins, sometimes chemically modified, e.g. dimerized, hydrogenized, cehydrogenized and in various grades. The most widely used material in the manufacture of soldering fluxes for the electronic industry is water white (ww) gum rosin. Rosin alone is a mild flux for soldering operations.

SALT A compound formed by reaction between an acid and a base. The hydrogen ion* of the acid is replaced by the metal associated with the base and the hydroxyl ion of the base is replaced by the negative ion that was associated with the acid. The hydrogen and hydroxyl ions combine to form water. For example, a mixture of hydrochloric acid

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(hydrogen and chlorine) dissociates in solution into a hydrogen ion with a positive charge. When combined with sodium, bydroxide (a base, consisting of sodium and oxygen and hydrogen which breaks down in solution into a positive sodium ion and a negative hydroxyl ion), this combination results in common salt, i.e. sodium chloride. Separation of the salt from the solution can, of course, be made by evaporating the water.

SAPONIFIER A nonspecific term denoting an aqueous solution of organic or inorganic bases and various additives (e.g. wetting agents) for promoting the removal of rosin and sometimes water soluble fluxes. The removal of rosin-based fluxes is based on chemical reaction between rosin acids and a base in the saponifier, rendering it soluble and/or dispersible in detergent solution as the rosin 'soap'.

SATURATED SOLUTION A solution* in which the solvent can accept no more solute (see Solvent, Solute). The result of adding additional solute to the solution is the formation of the solute as a distinct phase e.g. solid particles suspended or precipitated to the bottom of the container in which the solution is held.

SCAVENGING The removal of thin finite layers or component end terminations from the surface by the molten solder due to the solution process. Silver scavenging or leaching is a common problem with thick film* conductors. The silver on the surface is rapidly dissolved in the tin of the solder, leaving a non wet glassy phase behind. The term also applies to the removal of gold and other soluble metals from thin films*, thick films* and electroplated coatings.

SEMICONDUCTOR DEVICE Any device based on either preferred conduction through a solid in one direction as in rectifiers; or on a variation in conduction characteristic through a partially conductive material, as in a transistor.

SHELF LIFE Length of time under specified conditions that a stored material in original, unopened containers retains its usability.

SILICON A brittle, gray, crystalline chemical element which, in its pure state, serves as a semiconductor substrate in microelectronics. It is naturally found in compounds such as silicon dioxide.

SILICONE A group of semi organic* polymers (organic radicals attached to the silicones) which have good heat stability and are water repellent. In soldering they are considered a poison to the joining process, because of their tenacity. Silicone oil, for

instance, cannot be totally cleaned off a surface with electronic grade solvents.

SILVER CHROMATE PAPER TEST A simple

qualitative test to determine presence of ionic halides. Usually used to check that a mildly activated flux, such as Type RMA, contains no ionic halides. The Silver Nitrate Test, a different available method, also serves the same purpose.

SILVER FIRED CONDUCTOR A thick film* processing step, where a mixture of glass frit and silver flakes are bonded to the surface. In the firing process, the glassy phase melts and wets the surface, with the silver suspended inside. This creates a conductive path with a small finite layer of metal on the surface. Also see SCAVENGING.

SILVER NITRATE TEST See SILVER CHROMATE TEST above.

SKIP A defect primary in wave soldering where there is no solder between the part and the pad.

SMALL-SCALE INTEGRATION A circuit of under 10 gates, generally involving one metallization level implementing one circuit function in monolithic silicon.

SO PACKAGAES (SO = Small Outline) Similar to miniature dual in-line package. Typical lead spacing, 0.050 in.

SOT Abbreviation for 'Small Outline Transistor'.

SOIC Abbreviation for 'Small Outline Integrated Circuit'.

SOFT WATER Processed water, where the hardness has been replaced with sodium ions. See HARD WATER. This grade of water is suitable for most electronic cleaning applications and is more economical than deionized* (DI) grade water.

SOILS In solder processing, refer to foreign matter that might exist on a surface to be soldered. The soils may be organic* or inorganic.* An example would be the residue left by a fingerprint on a clean copper surface. This would be a combination of both organic and inorganic soils which may interfere with soldering.

SOLDER A metal or metal alloy, usually having a low melting point, fused to join other metals having higher melting points than the solder. The action of the solder is of an adhesive type; that is, wetting* of the surfaces and forming the joint by

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molecular attraction between the solder and the base metals; or may involve some diffusion* of the solder metal or alloy into the base metals or vice versa. Solders are generally classified as soft solders and hard solders. Soft solders have melting points up to approximately 600°F, whereas the melting points of the hard solders are above 1100°F. The most common examples of soft solders are the tin/lead alloys.

SOLDERABILITY The ability of a metal to be wetted by molten solder.

SOLDER CREAMS (Solder Paste) Homogeneous combinations of solder, flux, solvent and a gelling or suspension agent for automated production of solder joints. Available with rosin or water-soluble flux bases.

SOLDER PREFORMS Manufactured solder configurations containing a predetermined quantity of alloy, with or without a flux or coating. Available as stamped discs and washers, spheres and formed wire.

SOLDER RESISTS (Permanent or temporary) Coatings which mask off and surface insulate those areas of a circuit where soldering is not desired or required. Also make possible the minimization of solder bridging between closely spaced conductors or runners.

SOLDER TAPES Solder alloys in the form of thin tape in widths generally from ¹/₄ to 3 in. Also called solder foil or strip.

SOLID STATE Technology utilizing solid semiconductors in place of vacuum tubes for amplification, rectification and switching.

SOLIDS When referring to rosin fluxes, solids - or solids content – is the percentage by weight of rosin in that formulation.

SOLIDUS That temperature at which a metal alloy* begins to melt. Basically, some components of the alloy melt or begin to melt, whereas the balance of the material is still solid. This mushy characteristic is taken advantage of, especially in solders, for forming 'wiped' joints. For example, the solder composition 30Sn/70Pb has a solidus of 361°F (183°C). Its liquidus is approximately 520°F (271°C). In the plastic range between them, the material can be mechanically worked and forced into joints. This wide plastic range is thus an advantage in plumbing and cable work for forming large solder joints.

SOLUTE That component of a solution* which is dissolved in solvent. Generally the solute is a solid, but can also be a liquid or gas.

SOLUTION A homogeneous mixture formed by processing, in which a substance which is solid, liquid or gas, is mixed with a liquid (or by extension with a solid or gas) called a solvent. The term is usually associated with liquids, but may include solids, as in alloys, or gaseous mixtures. Generally, a solution will be clear or transparent. A liquid mixture which is cloudy is not considered a solution (see Suspension).

SOLVENT One of the components of a solution. It is that component in which the other components, i.e. the solutes* are dissolved. In the case of a solution composed of several liquids, the liquid present in the greatest quantity is usually referred to as the solvent.

SPECIFIC GRAVITY The ratio of the density* of a material to the density of water. For example, a cubic foot of water weighs 62.4 lbs. If a cubic foot of another material weighed 124.8 lbs, the specific gravity of the second material would be 2. In the metric system, where the units of weight and measurement are grams and cubic centimeters, specific gravity and density would be identical. The reason for this is that water weighs 1 gram per cubic centimeter. Therefore, if a material has a density of 4 grams per cubic centimeter, its specific gravity would be 4.

SPECTROGRAPH ANALYSIS An analysis to determine elements present in an unknown. It may be quantitative* or qualitative.* This type of analysis is based on the fact that when an element or group of elements is placed in an electrical arc or spark, each element will radiate wavelengths of light, i.e. colors, peculiar to itself. The light from the arc is then passed through a prism or diffraction grating to break it into its component colors or wavelengths. By noting those wavelengths, the elements that were present in the unknown can then be determined. By suitable standardizing (see Standards, Spectrographic) of the apparatus, one can determine quantitatively how much of the element is present by noting the intensity of the various colors of light given off by the arc.

STANDARDS, SPECTROGRAPHIC A spectrographic standard is a sample of material whose precise chemical composition is known. A standard is used to calibrate the equipment used in quantitative spectrographic analysis.

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SUBLIMATION A physical process in which a solid evaporates directly into vapor, without passing through a liquid phase. The evaporation of dry ice is an example of this process.

SUBSTRATE A physical material upon which an electronic circuit is fabricated. Used primarily for mechanical support but may serve a useful thermal or electrical function. Also, a material on whose surface an adhesive substance is spread for bonding or coating or any material which provides supporting surface for other materials.

SURFACE CONDITIONERS Specially formulated liquid cleaners to restore the solderability of the most commonly used metals and alloys in the soldering process.

SURFACE INSULATION RESISTANCE (SIR) The electrical resistance of the insulating material, determined under specified environmental and electrical conditions, between a pair of contacts, conductors or grounding devices in various combinations. See COMB pattern. One of the most important parameters in determining the effect of solder flux residues on electronic reliability. Measured in ohms.

SURFACE MOUNT DEVICES (SMD) Electronic components, either active (transistors, integrated circuits, diodes) or passive (capacitors, resistors, coils) which do not have separate leads. The terminal leads are part of the component body, allowing direct mounting on the surface of the printed wiring board or hybrid substrate.

SURFACE TENSION A property of liquids, due to molecular forces existing in the surface film of all liquids, which tends to contract the volume into a form with the least surface area. That is, the molecules on the surface of a liquid are not acted upon by the same forces as those molecules in the interior of the liquid. For example, a given molecule in the body of a liquid will be acted upon by forces of identical molecules completely surrounding it. At the surface, however, in one direction the surface molecules will be acted upon by air or whatever the atmosphere is above the liquid. The particles on the surface film are inwardly attracted, thus resulting in a tension force at the surface of the liquid. This surface tension or force can be broken down by the addition of certain chemical agents to the liquid. The breakdown of the surface tension film results in a flowing out, or wetting action, by the liquid (see Wetting). One of the actions which must be accomplished by a soldering flux is a breaking down of the surface tension of the liquid solder. This

results in a wetting or complete flowing of the solder over the surface to be coated. An example of a non-wetting situation: raindrops hitting a highly waxed automobile hood. The liquid drops do not wet the wax finish, with the result that the water droplets ball up into spheres. This action is entirely due to the surface tension of the water.

SUSPENSION A mixture of liquid or solid in a liquid. It is not considered a true solution because discrete particles or droplets are visible and the mixture is not clear. (See Solution).

SYNTHETIC ACTIVATED FLUX (SA) A high activity organic flux whose post-soldering residues are soluble in commonly used halogenated solvents.

TEMPERATURE One definition is that temperature is the condition of a body which determines how fast it will transmit or accept heat from its surroundings; that is, the higher the temperature of the body in relation to its surroundings, the faster it will transmit heat. A second definition is that temperature is a measure of the energy held by the molecules of the material; that is, the higher the amount of heat energy absorbed and held in the molecules of the material, the higher the temperature of the body. Although the first definition is accurate, the second is more meaningful, as can be seen from consideration of the melting point of solder, for example, if enough heat is absorbed for the indicated temperature of the material to be the so-called melting point, the material will change from solid to a liquid state. For any given solder alloy, this temperature is fixed.

TENSILE STRENGTH That characteristic of a material which describes its resistance to fracture when the material is being stretched, i.e. is under a tensile load. For example, if a wire is attached to a rigid frame at one end and a succession of increasing weights are hung from the other end of the wire, it would be under a tensile load. The point, or the load, at which the wire breaks describes the tensile strength of the wire and the material of its construction.

THERMAL COEFFICIENT EXPANSION (TCE) The incremental change in dimension of a unit length due to a 1° temperature rise. This is an important property of materials in surface mounting because major mismatches may cause solder joint cracking and other damage.

THERMAL CONDUCTIVITY That property of a material or assembly which describes its ability to

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conduct heat. Metals, in general, are better thermal conductors than non-metals. Ag and Cu are the best conductors of heat. In general, thermal conductivity of a material parallels its electrical conductivity.

THERMAL EMF A measure of a phenomenon which takes place when two dissimilar metals are bonded together. If the temperature of the bonded area is raised, a voltage is generated. An example of this is a thermocouple. Two dissimilar metals are bonded together and the point of bonding is placed in the medium to be measured. The wires leading from the point of bond are then connected to an instrument that reads the voltage generated at the bond point. It should be added that for the voltage to appear and be read, the point of measurement and the bonding point must be at two different temperatures. When this temperature difference and the dissimilar metals are present, the thermal EMF is generated.

THERMAL INSULATION The inverse of thermal conductivity.* The ability of a material to thermally insulate or its ability to block or resist the flow of heat.

THICK FILM Conductive, resistive and/or capacitive passive network deposited on a substrate using a metallic or resistive film which is more than 5 microns in thickness.

THINNER (LIQUID) A non-activated solvent or solvent system which is added to a solder flux to replace evaporated solvent and to reduce solids content.

THIN FILM Conductive, resistive and/or capacitive passive network deposited on a substrate using a metallic or resistive film which is less than 5 microns in thickness.

THIXOTROPIC That characteristic of a liquid or gel that is viscous when static, yet fluid when physically 'worked'.

TINNING Coating of a terminal, lead or conductive pattern with tin or solder alloy to improve or maintain solderability or to aid in the soldering operation.

TOXICITY Relates to all forms of human exposure to substances that can cause distress: inhalation, skin contact and ingestion. The term TLV is a measure of the inhalation toxicity of a substance and establishes the maximum average concentration of vapors in air that a typical worker can continuously be exposed to without harm in an 8-hour day.

TRANSISTOR A current amplifying semiconductor.

UNDERCUT The narrowing of a circuit line during etching by a horizontal attack by the etching solution.

VAPOR PRESSURE That pressure exerted by a vapor in equilibrium with a solution, or the material from which the vapor emanated. For example, a quantity of water placed in a closed container will evaporate a certain amount of water vapor. The pressure exerted by the vapor at a given temperature is the vapor pressure of water at that temperature. Vapor pressure, naturally, is dependent upon temperature, i.e. the higher the temperature, the higher the vapor pressure. Vapor pressure is a good indication of the volatility of a material, i.e. the higher the vapor pressure of a material at a given temperature, the higher will be its evaporation rate. This is guite applicable of fluxes or cleaning solvents used in soldering process. Since these materials are generally mixtures of materials, the components with the highest vapor pressure will evaporate faster than the other components. The result, eventually, is imbalance of the flux or solvent.

VISCOSITY The measure of resistance of a fluid to flow (either through a specific orifice or in a rotational viscometer). The absolute unit of viscosity measurement is the poise (or centipoise).

VOLATILE Used to describe materials which have a relatively high evaporation rate or a tendency to evaporate (see Evaporation).

WATER BASED A description of a liquid system where the primary solvent* is water.

WATER DISPLACEMENT Characteristic of certain materials, such as lacquers and protective coatings, which replace water.

WATER EXTRACT RESISTIVITY Value in ohmcentimeters, principally for liquid rosin fluxes, obtained by carrying out a standard test that measures the amount of ionizable material present. The higher the value the higher the resistivity, hence the less ionizables present.

WATER SOFTENER A piece of equipment used to remove deposit forming ions by replacing them with non scaling sodium ions. This low cost process is used in residential as well as commercial applications. Also see SOFT WATER.

WATER SOLUBLE A description of a liquid system, where the prime solvent* is not necessarily water.

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However, the system is soluble in water, i.e. can be dissolved in or by water.

WATER SOLUBLE ORGANIC FLUX A non-specific term describing the composition of soldering of flux soluble in water and based on organic rather than inorganic chemical: organic acids, amine hydrohalides, polyglycols, polyhydric alcohols, etc.

WATTAGE A unit of electrical power. Mathematically, it is determined by multiplying the electrical current by the voltage. It is equivalent to other forms of energy. For example, 1 kilowatt is equal to 1.34 horsepower, a term describing mechanical power. Soldering irons are generally classified by wattage, which is an indication of the rate at which they will solder or the solder joint.

WAVE SOLDERING The technique of soldering components to a board by passing the board over a wave of solder in a soldering pot. The wave is maintained above the level of the pot by solder being pumped through a manifold in the bottom of the pot. Provides clean, oxide-free solder at all times by forcing dross to sides of pot.

WEBBING As applied to soldering, refers to a condition wherein the plastic basic material of the printed circuit board is softened as it passes over the solder wave, with a resultant pick-up of fine particles of solder onto the tacky surface of the plastic. This condition generally is a result of inadequate curing of the plastic materials going into the printed circuit board and can create difficulties on boards where conductor paths are closely spaced or a high voltage is present on the board. Also called spidering.

WETTING A physical phenomenon of liquids, usually in contact with solids, wherein the surface tension* of the liquid has been reduced so that the liquid flows and makes intimate contact in a very thin layer over the entire substrate surface. An example of this is the wetting of a metal surface by a solder. Flux reduces the surface tension of the metal surface and the solder, with the result that the droplets of solder collapse into a very thin film, spreading and making intimate contact over the entire substrate surface.

WETTING AGENT A chemical material added to a liquid solution to reduce surface tension.* The effect of this reduction of surface tension is to increase the power of the liquid mixture or solution to wet an object on which it is placed.

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