TECHNICAL PAPER

Glossary Of Terms Used in the Tantalum Industry

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Abstract:
Terms used in the tantalum industry can often be confusing to the layperson. The purpose of this paper is to allow someone to look up any terms of which he or she is unsure. It is directed at the reader of technical literature in particular.

GLOSSARY

μ Symbol used to represent the term micro, meaning x 10-6.

Aqueous solution A chemical solution made using water as the solvent.

Ambient temperature Temperature of the air surrounding the capacitor, usually considered to be 20°C if in open air.

Anode The positive electrode of a polar capacitor. Also used to refer to the capacitor during the manufacturing process.

Bias The DC voltage onto which an AC signal is superimposed.

Capacitance The technically correct term for capacity. It is the measure of the amount of electrical charge stored in a capacitor, usually expressed in units of microfarads. One farad is one coulomb of charge at 1 volt. For Tantalum capacitors, nominal rated capacitance is measured at 20°C using a measuring bridge supplied by a 120 Hz source, free of harmonics, with a 2.2 volt DC bias.

Capacitor Two conductive plates separated by an insulator, or dielectric which is tantalum pentoxide in a tantalum capacitor.

Category voltage This is the maximum voltage that may be applied continuously to a capacitor. It is equal to the rated voltage up to 85°C, beyond which it is subject to linear derating, to 2/3 of rated voltage at 125°C.

Chip Term loosely used to describe surface mount capacitors.

Conductor A material with very low resistance, like most metals.

Counter electrode The negative plate material of an electrolytic capacitor.

Current A specific quantity of electrons passing a certain point per unit time.

CV The capacity and voltage of the capacitor. CV is often used as an arithmetic product to classify a particular range.

Date code Most capacitors are stamped with a code that gives the date and week of manufacture; for example 9410 would mean the capacitor was manufactured in the tenth week of 1994. There are several date coding systems, but year and week is the most common.

DCL DC leakage current.
See leakage current.

Dielectric The insulation material that separates the two plates of the capacitor.

Dielectric constant (K) The measure of the effectiveness of a dielectric material in making a capacitor size efficiency. The higher the dielectric constant the higher the size efficiency of the capacitor. A vacuum is defined as having a K of 1; tantalum pentoxide has a K of about 27.

Dispersion A uniformly distributed particle suspension of a solid in a liquid carrier.

Dissipation factor (DF) A measure of the losses in the capacitor, or the extent to which the capacitor is not a perfect capacitor. DF is usually expressed as a percentage or a decimal equivalent. DF for a tantalum capacitor is measured at 120 Hz at 20°C using a measuring bridge supplied by a 120 Hz source, free of harmonics, with a 2.2 volt DC bias.

Electrolyte The electrically active liquid (or gel) that provides the connecting path between the anode oxide layer of a wet tantalum capacitor and the cathode termination. For example, an aqueous solution of sulphuric acid.

ESL Equivalent series inductance. The extent to which the capacitor acts as though there was an inductor in series with the capacitor. ESL is generally only important at high frequencies.

ESR Equivalent series resistance. The extent to which the capacitor acts like a resistor when charging and discharging in an electronic circuit expressed as a resistance in series with the capacitor.

Extended range Capacitors that are manufactured with a higher density than standard capacitors (i.e. higher capacity per unit volume), usually selling at premium prices.

Failure rate A scientifically measured reliability rating usually expressed in units of percent per thousand hours (under maximum voltage and current, and a set circuit resistance condition) at a specified statistical confidence level (typically 60% or 90%), or expressed as mean time between failures (MTBF).

Formation The process of building the oxide layer onto the tantalum metal. Higher voltages (with thicker oxide layers) require longer forming.

Formation ratio The ratio of the voltage to which a capacitor is formed, against the capacitor's rated voltage.

Formation voltage The voltage at which the power supply used in the formation process changes from constant current to constant voltage. The formation voltage is proportional to the dielectric thickness.

Impedance Opposition to the flow of AC current. Impedance is particularly a concern with capacitors that are intended for high frequency applications. In a tantalum capacitor it is measured at 20°C using a measuring bridge supplied by a 100kHz source, free of harmonics, with a 2.2 volt DC bias. Values are in ohms or milliohms. Three factors contribute to the impedance of a tantalum capacitor; the resistance of the semiconducting region, the capacitance value and the inductance of the leads.

Leakage current Current flowing from one conductor to an adjacent conductor through an "insulating" layer. The leakage current is measured after 3 minutes at 20°C, through a 1KΩ resistor connected in series with the capacitor, with rated voltage applied. Typically in microamps or nanoamps.

Low profile Specially designed capacitors which mount onto circuit boards with less than standard height. Low profile styles are usually more expensive than standard profile.

Microfarad (µF) Most common unit of capacity for tantalum capacitors.

Mikes "Mikes" is jargon for microfarads.

Open circuit A term used to define a failed capacitor which has become of such a high impedance that it no longer functions as a capacitor. Such failures are rare.

Operating voltage The actual circuit voltage that the capacitor sees in the circuit application.

Pick-and-place Equipment used to put surface mount capacitors (and other components) onto circuit boards.

Polar Capacitors that must be inserted into circuitry with the anode on the positive side and the cathode on the negative side. If connected with the wrong polarity across the capacitor, it will conduct a far higher current and will ultimately become a short circuit.

Pyrolysis The decomposition of a substance by heat.

Power factor The ratio of real power to reactive power in a capacitor.

Rated voltage This is the DC rated voltage for continuous operation up to 85°C.

Reform The process of reducing leakage current by removing manganese dioxide from sites which conduct a high current and producing a dielectric to cover the opened site.

Reverse voltage The voltage applied to a polar capacitor in the opposite direction of the indicated polarity. Reverse voltage has the potential effect of causing the capacitor to fail.

Resistivity A measure of the ability of a unit cross-sectional area and unit length of a material to resist the flow of an electric current through it.

Ripple current The current passing through a capacitor when an alternating voltage is applied across its terminals. This generates heat. The maximum ripple current permissible is determined by the maximum power dissipation of the capacitor body.

Ripple voltage The voltage across the terminals of a capacitor when an alternating current is passed through it (see also ripple current).

Short circuit Description of a failed capacitor that results in essentially a bypass of the dielectric enabling high currents to pass.

Sintering To coalesce under the influence of heat, without actually liquefying.

Slug Term given to a tantalum capacitor before it is molded into the encapsulation. It is sometimes used to refer to the capacitive element which is held in the encapsulation material.

SMT Surface mount technology. An acronym for the broad field of leadless surface mounting electronic components. SMT carries with it the idea of high speed "pick-and-place" manufacturing processes, as opposed to the hybrid approach of slow assembly under a microscope.

Solid tantalum A sintered tantalum pellet with a solid counter electrode.

Steady-state This refers to the conditions under which the capacitor is operating once power has been applied. It assumes constant temperature, voltage, and circuit resistance and the absence of any voltage or current transients.

Stringer Term given to a metal strip containing many tantalum slugs.

Surface mount A category of unleaded capacitors that use "pads" (instead of wire leads) to mount directly on the printed circuit board. A strong implication in the word is the idea that the components can be automatically placed with high speed "pick-and-place" machines; it is in this sense that the word is narrower in meaning than "chip".

Tantalum A metal element in the transition group of the periodic table. The ore is mined in many parts of the world.

Temperature rating The temperature (usually in Celsius) over which the capacitor may be safely operated. With tantalum capacitors there is a lower (derated) voltage at the high end of the temperature rating.

Voltage derating Using a capacitor below its rated voltage. The percentage of derating applied is given by the equation:
(1 - circuit voltage) x 100% rated voltage.

Volumetric efficiency A measure of the size or volume of a component relative to its capacitance and voltage. It takes into account the surface area of circuit board covered by the component and the height of the component.

Wet tantalum A sintered tantalum pellet in a liquid acid electrolyte, as compared with solid tantalum.

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