

7. DEFINITIONS

The following definitions may help clarify the meaning of a variety of terms used in relation to electrostatics. Several of these definitions are based on BS 7506: Part 1: 1995. Others reflect the views of the author. A start has been made in the IEC to create a list of definitions relating to the microelectronics industry [1].

Antistatic material or treatment: A material or treatment that either allows easy migration of charge (i.e. is dissipative) so that when bonded to earth no static charge is retained or one that does not easily acquire charge at contact with other surfaces.

Antistatic additive or filler: A substance added to a liquid or solid that makes this an 'antistatic material'

Note: For plastics this usually involves providing enhanced surface charge dissipation by absorption of atmospheric moisture. Performance is then susceptible to ambient humidity.

Bonding: The use of an independent connection between conductors or between a conductor and a dissipative material to provide a path of low electrical impedance for easy migration of charge where this cannot otherwise be ensured

Breakdown: The loss, at least temporarily, of the insulating properties of a medium (gas, liquid or solid) under electrical stress

Breakdown voltage: The minimum voltage at which breakdown occurs in a given situation.

Capacitance loading: the surface potential achieved per unit of charge for a thin film of a good dielectric divided by the surface potential achieved per unit of charge with a similar surface charge distribution on the test material

Charge decay: the migration of charge across the surface or through a material leading to a reduction of surface potential at the area where the charge was deposited

Charge decay time: the time required for the local surface potential to fall to a selected fraction of its initial value

NOTE: Convenient decay times for comparison between materials are the time from the initial peak surface voltage to $1/e$ of this (e is the base of the natural logarithm 2,7183) and to 10% of this. As the rate of charge decay may vary greatly during the progress of decay it is very useful to record the form of the variation of surface voltage with time.

Conductive material: a material with a high mobility of charge so that the potential on the surface is retained for only a very short time

NOTE: The charge decay time of conductive materials is generally less than 0,05 s.

Conductivity: The reciprocal of resistivity. (S m^{-1} equals $(\Omega \text{ m})^{-1}$)

Conductor

A material providing a sufficiently high conductivity that all parts of it are always at the same potential

Corona: the generation of gas ions of either polarity from a high localised electric field

Dissipative material: a material which allows charge to migrate over its surface and/or through its volume in a time that is short compared to the time scale of the actions creating the charge or the time within which this charge will be effective or will cause an electrostatic problem.

NOTE: For general avoidance of risks and problems in operations involving manual activities the decay time from the initial peak surface potential to $1/e$ of this needs to be less than 0,25 s. To avoid risk of drawing direct sparks from the surface the decay time needs to be greater than 0.01s and surface resistivity needs to be 10^8 ohm or more.

Earth/Earthing: The electrical connection (bonding) of a conductor to the main body of the earth to ensure that it is at earth potential.

Earth bonding point: A dedicated point for earthing people by a wrist band cord or for earthing equipment.

Electrostatic discharge (ESD): The sudden transfer of electrostatic charge between bodies at different electrostatic potentials by direct electrical contact or by breakdown of an air gap

Electrostatic discharge sensitive device (ESDS): A discrete device, semiconductor, integrated circuit or other assembly that can be damaged by an electrostatic discharge directly to the device or nearby

ESD 'common earth bonding point': A common connection point to which all items in an ESD protected area are connected.

ESD protected area (EPA):. An area in which ESDS can be handled without risk of damage from electrostatic discharges or fields.

ESDS voltage sensitivity: The maximum voltage at which the ESDS does not suffer any ESD damage (? % immunity)

ESDS voltage sensitivity of an assembly: The ESDS voltage sensitivity of most sensitive device in an assembly will determine the sensitivity of the assembly.

Field work: Handling ESDS within a temporary EPA with permanently controlled boundaries.

Flammable material. A gas, vapour, liquid, dust or solid that can react continuously with atmospheric oxygen and that may therefore sustain fire or explosion when such reaction is initiated by a suitable spark, flame or hot surface. In normal usage 'gas' and 'vapour' are synonymous.

Flammable mixture: A mixture of a gas, mist or suspension of dust with air (or air enriched with oxygen) in which combustion will propagate.

Flammable range: The range of concentrations in air of a flammable material within which combustion can occur.

Garment: A coat, jacket, smock, hood, trousers, overall or cap is regarded as a garment for the purpose of this document

Ground: The uniform potential established in the work area ensuring uniformity of potential of all objects.

Ground cord: An electrical connection between the earth bonding point and the ESD earth facility.

Hazardous area: An area in which flammable or explosive gas-air mixtures are, or may be expected to be, present in quantities such as to require special precautions against ignition.

Incendive: Capable of igniting a prescribed flammable mixture.

Insulator/insulative material: a material with very low mobility of charge so that charge on the surface is retained there for a long time

NOTE: The charge decay time of insulative materials is generally greater than 10 s.

Ion: An atomic or molecular particle carrying electrical charge.

Mass charge density: The nett quantity of charge carried by unit mass of a material.

Materials for packaging: Any material in which ESDS are packed in intimate contact for transportation or storage - including bags, boxes, crates, wraps, magazines, cushioning, foams, loose fill, etc.

Minimum ignition energy: The smallest quantity of energy that can ignite a mixture of a specified flammable material with air or oxygen, measured by a standard procedure.

Non-conductor: see insulator

Relative capacitance: (see capacitance loading)

Relaxation: the migration of charge over and/or through a solid, liquid or gaseous material (see charge decay)

Relaxation time constant: (see charge decay time constant)

Resistivity: (see surface and volume resistivity)

Surface charge density: The net quantity of charge per unit area of surface of a solid or liquid (C m^{-2}).

Surface potential: the potential as measured with a non-contacting electrostatic fieldmeter, either with the field sensor close to the surface and its potential adjusted to give zero electric field or measured by the electric field created at the sensing aperture of an earth potential fieldmeter at a defined distance.

Note: It is convenient to express the reading of a nearby non-contacting fieldmeter in terms of the potential on a large plane conducting surface at a defined perpendicular distance. Corrections are needed when the area tested is small. In particular test situations it is appropriate to relate readings to the potential of a conducting surface covering the specific test area of the material

Surface resistivity: The resistance between opposing sides of a square on the surface of the material with account taken of fringing field effects (BS??)

Triboelectric charging: The separation of charge occurring at separation of contacting surfaces and from relative movement between two surfaces.

Volume charge density: The net quantity of charge per unit volume of a solid, liquid or gas (C m^{-3}).

Volume resistivity: The resistance between opposing sides of a cube of the material with account taken of fringing field effects (BS??)

References:

[1] “ Electrostatics – Part 1-2: Definitions of all parts of the electrostatics series 61340-x-y” IEC 61340-1-2