6630 The Best device for Dielectric Permittivity Fixture and Material Measurement

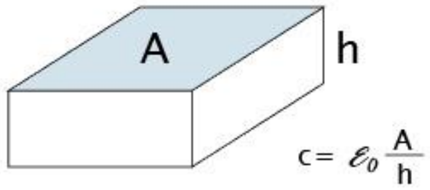
6630 material dielectric permittivity measuring fixtures are applicable for exchangeable electrode connectors in different sizes, hardness, and thin film coating types. The fixtures can connect directly to BNC port of 6630 Impedance Analyzer to avoid the distortion due to line interferences and has an inherent high -accuracy micrometer to measure material thickness. 6630 Impedance Analyzer has a built-in dielectric permittivity calculator to display dielectric constants and value D after operating, entering the diameter information of electrode connectors and material thickness. It also can plot these two parameters figure with frequency scan function.

Usually PCB made of several different materials such as multi-layer or upper and lower layer thin film coating .The dielectrics of these materials would be measured different permittivity in different frequency, which often misleads the engineers to design faulty PCB layout because of a lack of information on material dielectric constants. MICROTEST 6630 Impedance Analyzer provides fixtures for material dielectric permittivity measurement that allows PCB designed engineers to reduce the faulty conditions with the comprehensive information of permittivity while designing PCB layouts.

What is dielectric permittivity?

When a capacitor plate is charged by the material with a permittivity value ε, the capacitance would become larger.

Dielectric has the property to make the space look like a little large or small, for example: if you put a dielectric material between two electric charges, the applied force would be reduced to make them move apart from each other. When an electromagnet wave passes through a dielectric material, the wave speed should be slower and the wavelength also should be shorter. Relative dielectric constant εr can be measured in the electrostatic field by following method: Step 1. Measure the capacitance C0 in free space between two conducting plates. Step 2. Apply the same test conditions and distance as step 1 but add a dielectric between two plates, then measure the capacitance Cx. Finally, you may calculate relative dielectric constant using this formula $\varepsilon r = Cx/C0$. In time-varying electromagnetic field, the dielectric constant of a material is related to the frequency and is called relative permittivity. Dielectric permittivity, denoted by ε, also known as dielectric constant, relative permittivity or permittivity. It is a ratio that indicates insulation capability. Permittivity is measured in Farad/meter(F/M).



The characteristics of dielectric materials

When a dielectric medium is placed in an applied electric field, it will produce inductive charges to weaken the electric field. Permittivity is the ratio of the electric field in vacuum to compare with that in consists of dielectric medium. If the dielectric material with high permittivity is placed within an electric field, the magnitude of the electric field would be considerably reduced. Dielectric materials are usually non-conductive e.g. porcelain, mica, glass, plastics and various metal oxides. Some liquid and gas are excellent dielectric materials such as dry air, which is used in variable capacitors and certain types of transmission lines; Distilled water is also a good dielectric material if it does not contain any impurity. The relative dielectric constant of distilled water is about 80F/M.

Relative permittivity of materials:

Material	**Relative permittivity**
Vacuum	1 (Defined value) [2]
Air	1.00054
Teflon	2
Polyethylene	2.2-2.4
Polystyrene	2.4-2.6
Carbon disulfide	2.6 (68° F)
Paper	2.0
Silicon dioxide	4.5
Pyrex Glass	4.3-5.0
Rubber	3.0
Diamond	5.5-10
Salt	3-15
Graphite	12-15
Silicon	11 - 12
Ammonia	25 (-74° F)、18.9 (40° F)
Methanol	32.6 (77° F)
Furfural	42.0 (68° F)
Glycerine	47.2 (32° F)

Water	88 (32° F)、55.3 (212° F)
Formamide	84.0 (68° F)
Sulfuric acid	84.0 (68° F)
Hydrogen peroxide	84.2 (32° F)
Hydrogen cyanide	2.3 (70° F)
Titanium dioxide	110.00
Conjugated polymer	6-100000[3]
μm-nm Heterostructure	1000-100,000[4] (10-10 at 100 Hz)