Electric & Dielectrical Lab: Dielectric Constant and Dissipation Factor (Dk/Df)

Principle

Dielectric constant (Dk) is a measure of how readily a material absorbs energy while in the presence of a field. Dissipation factor (Df) is a measure of how readily that material gives up the stored energy after the field has been removed. For lower frequencies, Dk can be measured as the ratio of the capacitance through the material to that across a vacuum, while Df can be measured as the ratio of the current through the resistive branch of the circuit to that through the capacitive branch. For higher frequencies, both are calculated by measuring the resonance peak and the quality (Q) value.

Capabilities

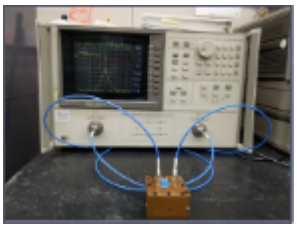
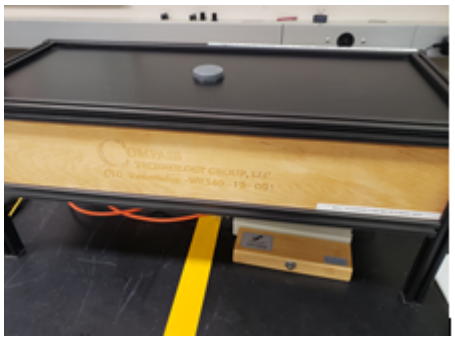
Capacitance Measurement and via Resonance Cavities

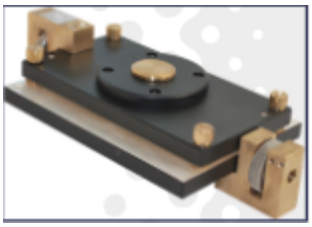
- ASTM D150 utilizes a parallel plate electrode assembly in conjunction with an LCR meter
- ASTM D2520 utilizes rectangular prism and split-post resonators
- IPC-TM-650 utilizes split-cylinder resonators
- Sample sizes for the D150 method are 2" round or square (minimum 5 required)
- Sample sizes for the other methods are specific to each resonator and frequency (minimum 5 required)
- Testing temperatures (lab ambient)

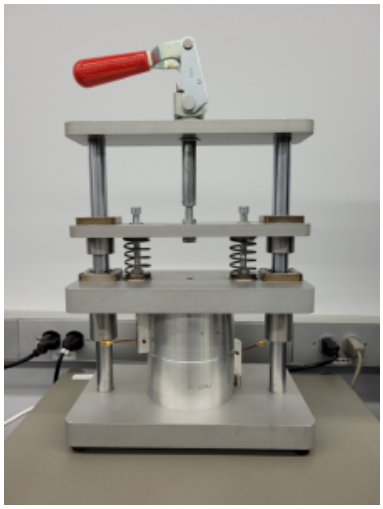
Equipment

	Equipment Type	Information
	Agilent LCR Meter	• Frequency range 20Hz - 2MHz • Measures Dk as ratio of material to vacuum capacitance • Measures Df as ratio of current through resistance and capacitance circuits

	Agilent Parallel Plate Electrode 16451B	• Can be tested as contact or gap method • Four different electrodes, depending on material type and method

	Agilent VNA 8722C Custom Rectangular Prism Resonance Cavities	• Frequency range up to 40GHz • Resonance cavities: 1, 1.5, 2, 2.4, 2.5, 3. 5. 6. 10, 20, 30, 40GHz • Measures Dk/Df by shift in resonance peal and quality factor (Q)
	Compass Technology Custom Rectangular Prism Resonance Cavity	• Valid only for 2.45GHz • Measures Dk/Df by shift in resonance peal and quality factor (Q)

	Equipment Type	Information
	QWED Split-Post Resonance Cavity	• Valid only for 2.45GHz • Measures Dk/Df by shift in resonance peal and quality factor (Q)

	Custom assembly for Split-Cylinder Resonance Cavities Cavities are custom made for each specific frequency	• Resonance cavities: 5, 10, 15, 20, 25, 30, 35GHz • Measures Dk/Df by shift in resonance peal and quality factor (Q)