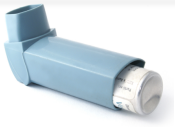
Electrostatic Composites Polymers Guide

The build-up of charge on an insulative material such as plastic will remain in the localized area of contact. The electrostatic voltage can often discharge via an arc or spark when the plastic material comes into contact with a foreign body of different potential. This discharge can create problems as simple as decreasing the life of an electrical device to as serious as a fatal explosion.

Added benefits over using metals include design flexibility, manufacturing system cost reduction, and weight reduction.

Surface Resistivity (Ohms/Sq.)*

10^{16}
10^{15}
10^{14}
10^{13}
10^{12}
10^{10}
10^{9}
10^{8}
10^{7}
10^{6}
10^{5}
10^{4}
10^{3}
10^{2}
10^{1}
10^{0}
10^{-1}
10^{-2}
10^{-3}
10^{-4}
10^{-5}

	Characteristics	Example Applications
Base Polymer	• Insulative • Examples include: PP, POM, ABS, PC, PC/ABS, PBT, PEI, PEEK, etc.	Application requirement specific. The base polymer's neat characteristics are a good place to start prior to selecting ESD performance.
Permanent Antistatic Composites	• Initial Charge Suppression • Reduce Tribo-charging • Insulates against moderate to high leakage currents	 *Uniform Particulate Dispersion*
Statically Dissipative Composites (Carbon Powder/Carbon Fiber)	• No Initial Charge • Prevents Electrostatic discharge to/from human contact • Insulates against moderate to high leakage currents	 *Fuel Line Charge Dissipation*
Conductive Composites (Carbon Powder/Carbon Fiber)	• No Initial Charge • Dissipates tribo-charging (high speed) • Provides grounding path for charge bleed-off.	 *Roller & Bearing Charge Dissipation*
Shielding Composites (Carbon Fiber, Stainless Steel)	• Electromagnetic Attenuation up to 60 dB.	 *Communication Device EMI Shielding*
Carbon Powder & Fiber	Note: Additional additives can be compounded with conductive compounds for features such as wear resistance, processing aids, flame retardants, impact modifiers, etc.	
Metals		

Disclaimer: The product suggestions outlined above may are meant to be general suggestions. Each application should go through a thorough material selection assessment by a Conventus Polymers representative prior to material purchase.

Pertinent Test Method and Design Information

Test Methods

Surface Resistivity (SR): For Composites that are intended to dissipate electrostatic charges, SR is the most widely accepted test method (ASTM D257 & ASTM D4496). The test consists of measuring the resistance between two electrodes applied under load to the surface being tested.

SR = Resistance (Ohms) x Electrode Perimeter (m) / Distance Between Electrodes (m)

Important Note: Due to the heterogeneous nature of composites, point probes will give incorrect part readings. Ample pressure is needed to maintain adequate contact between the electrodes and the part.

Volume Resistivity (VR): Commonly used to describe the dispersion of the conductive media (carbon powder, carbon fiber, stainless steel, etc.) throughout the part. This test consists of measuring the resistance between two electrodes on **opposite** sides of the part.

VR = Resistance (Ohms) x Surface area (m^2)/Part Thickness (m)

Static Decay (SD): This is the time required for a charge placed on the surface of a material to decay to a percentage of the original charge. Common tests include MIL-B-81705B which requires 5000 Volts to discharge to 0 volts in less than 2 seconds at 15% R.H. The NFPA code 56A standard calls for a decay 5000 Volts to 500 Volts in less than .5 seconds at 50% R.H.

Design Considerations:

	Carbon Fiber	Carbon Powder	Stainless Steel Fiber	Antistatic Additive
Strength	Increase	Unchanged	Unchanged	Unchanged
Elongation	Low (2-3%)	Moderate (4-20%)	Moderate (4-6%)	Moderate (10-30%)
Shrinkage	Anisotropic	Isotropic	Isotropic	Isotropic
Particle Generation	Non-Sloughing	Some Particle	Non-Sloughing	Non-Sloughing
Colorability	Limited	Not Colorable	Colorable	Colorable
Relative Cost	High	Low	Med/High	Med