Selecting the Right Mat Material

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There are a variety of static table and floor mats. You can make an informed decision about which to use by understanding how a mat works, and the abilities of each mat type.

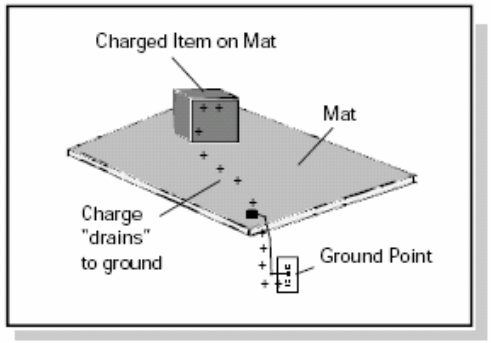
How A Mat Works[1]

A static mat is designed to drain the static charge from items placed on the mat. Removing static charge is important because static can damage electronic devices. Mats also protects bench tops from damage and wear.

For a mat to effectively ground an item on its surface, the item must be electrically conductive or dissipative. Electrically insulative items, like most plastics, will not allow their charge to drain to ground.

Mat Electrical Properties

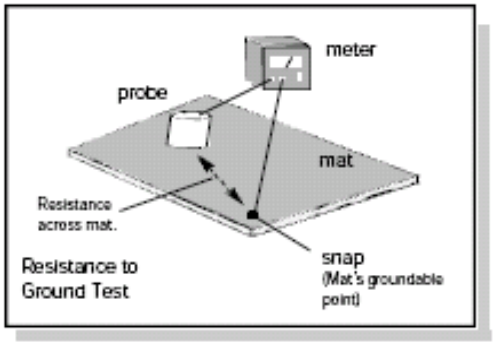
To work properly, a mat must be able to conduct electricity. However, the range of conductivity is important. If the mat's resistance is too low, static transfers to the mat so fast that a spark is created. This spark is an electrostatic discharge (ESD) and will damage electronic devices.



If the mat's resistance is too high, static transfers so slowly that items placed on the mat will not loose their charge. When the item is removed from the mat, it will still have a static charge and be capable of discharging to other items.

Test Method

EOS/ESD Standard 4.1 outlines the proper test methods for mats. The two electrical measurements to be made are Resistance Top to Top (RTT) and Resistance Top to Ground (RTG).

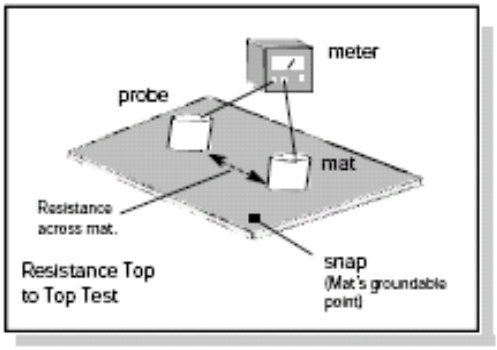


Resistance Top to Ground (R_{TG})

This is the most important electrical test for mats. It shows a mat's ability to conduct static from a point on the mat's surface to the mat's ground point. EOS/ESD Standard 4.1 guideline for R_{TG} is $<10^{10}$ ohms. A revision of S4.1 will likely change the R_{TG} range to 10^6 to 10^9 ohms.

Resistance Top to Top (R_{TT})

By measuring the resistance between two widely separated points on a mat's surface, we can be certain that all of the areas of the mat conduct static at the same rate. This measurement will also expose cut or damaged center layers in multi-layer mats. EOS/ESD Standard 4.1 guideline for R_{TT} is $>10^6$ ohms. A revision of S4.1 will likely leave R_{TT} unchanged.



[1] This is a simplified description of static decay from a material. For a more technical description of decay please see STATech G1.

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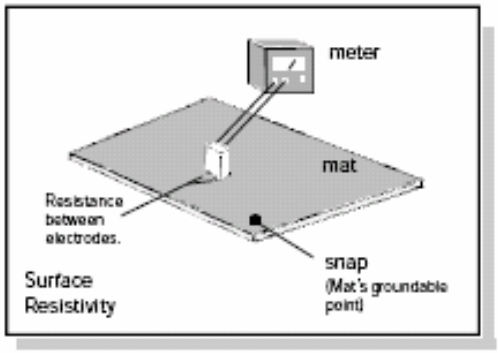
Surface Resistivity
A surface resistivity test for mats does not reveal much about the mat's ability to perform correctly. The only practical benefits of surface resistivity tests for mats are first, to differentiate between ESD mats and non-ESD mats, and secondly, to monitor the mat for cleaning. Dirt can act as an insulator on the surface of a mat. By monitoring the surface resistivity a cleaning schedule can by arranged. However, the R_{TG} and R_{TT} test can also serve this function.

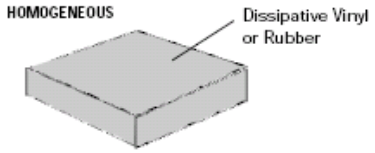


Mat Materials
A mat's performance is based on the material used to make it. Performance includes electrical values, tolerance to heat, chemicals, mechanical abrasion, and cost.

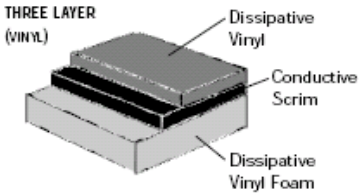
Vinyl
Vinyl is the plastic most widely used to make mats. The material is cost effective, easy to render static dissipative, takes color well, and remains pliable and easy to cut to shape.

Rubber
Rubber is being used in situations that require high resistance to heat and chemicals. Only recently has this material been available at a low enough cost to make it a consideration.

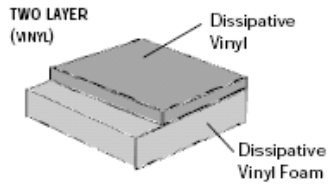
Construction
Mats are made from solid sheet, multiple layers, and suspended particles. Below we will review the different constructions.



Homogeneous (vinyl and rubber)
Homogeneous or solid mats consist of the same material throughout. These mats usually provide good mechanical service. Electrical performance is usually limited because antistat can only provide about 109 to 1010 RTG.

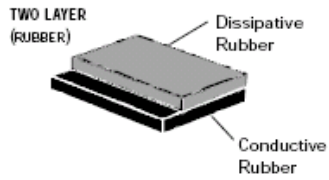


Three Layer (vinyl)
Three layer mats sandwich a conductive metal or carbon layer (called a scrim) between a top surface of homogeneous vinyl and a layer of foamed vinyl on the back. The conductive scrim layer improves the electrical properties by acting as a fast track to move static charge to ground. The foam back layer provides a cushion for operators and makes picking up parts easier.



Two Layer (vinyl)
This two layer mat barrows the foam from the three layer mat and the homogeneous top from solid mats. Since it contains no scrim layer, this mat provides only average electrical performance. It has the advantage of being cost effective.

Two Layer (rubber)
The top layer of rubber is static dissipative and the back layer of rubber is conductive. This accomplishes the same electrical performance goals as the vinyl three layer mat. Combined with tolerance to heat and chemical,
the rubber mat is an over achiever. However, these features come with a cost premium.



Hard Mats (Fiberglass reinforced plastic)
This sheet material was used primarily for flooring. Its expense and the difficulty in sizing the material have limited its acceptance.

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Mat Usage
Mats are generally divided into table and floor usage categories. Some mats are advertised as useable in either place. However, these mats are a compromise and lack features of dedicated mats.

Table Mats:
Use light colors to make finding small parts easier. Have smooth or lightly embossed surfaces. Are usually thinner than floor mats.

Floor Mats:
Use dark colors to hide dirt. Have heavy embossing or groves to improve traction. Are usually thicker than table mats to absorb more wear. Are available in anti-fatigue style to reduce stress.

Selection Guide
Use this chart to select the material(s) appropriate for your application(s)

Mat Type	***Electrical Properties***		***Usage***	***Features***
	RTG			
Homogeneous	10^{9-10}	10^{9-10}	Versions for Table and Floor	Durable material
Three-Layer	10^{7-8}	10^{7-8}	Table	Excellent electricals
Two-Layer (vinyl)	10^{10}	10^{10}	Table	Low cost.
Two-Layer (rubber)	10^{7-8}	10^{7-8}	Table	Heat/solder tolerant Chemical resistant Excellent electricals
Anti-Fatigue	10^{9-10}	10^{9-10}	Floor	Relieves stress from standing

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