

How Does Electrostatic Discharge (ESD) Relate to Labels?

By Dr. Jim Williams, CTO and Founder of Polyonics

ESD damage affects production yield, product reliability and profitability in the electronics market everyday. Although most OEMs and electronic manufactures have some form of static control program in place not many think about the potential ESD threat posed by the label that is being applied directly to small components, boards and electronic devices.

Static charges are generated when a label is removed from its liner, up to 1,000 volts/square inch, or more even when ESD workstation protection is observed. Since traditional pressure sensitive labels may act as an insulator, labels may retain or even accumulate a charge for a long period of time before it can dissipate. Given that many electronic components and devices are susceptible to damage at levels of under 200v, this presents bar code label users with a potential problem.

There are two challenges which must be addressed. The first is to eliminate the charge generated when the label is removed from the liner. The second challenge, is to ensure that the surface of the label is static dissipative once it is affixed to the board, so that it will not be a dielectric (storage) surface for any other charge which may be carried to it after the product is labeled.

Polyonics' "Anti static" or "low charging" label materials are specially designed to **minimize the charge** generated when the label is removed from the liner and **prevent a significant charge** from building up on the label surface after the label has been applied.

Voltage testing as the label is peeled

Per the definition of a static safe workstation in EIA-625, a static safe label must generate less than 200v when removed from the liner. Voltage testing was done In accordance with Polyonics' Test Methods. A label strip was cut into 1 sq. inch pieces, by a technician wearing proper static safe attire and grounding straps. Each of 10 pieces of label material was peeled and the voltage measured with a static discharge instrument. In all cases, TRIBOGARD® materials measured less than 100v per square inch when testing to this method.

TRIBOGARD® label technology allows any charge generated by the label as it is peeled from the liner, to dissipate virtually immediately making the label safe to apply directly to small components, boards and electronic devices without the high risk of an electrostatic discharge event. Our labels are designed without the use of conductive or dissipative adhesive and liners further eliminating the potential threat of a short circuit should the adhesive ooze or cross a conductive path (i.e. from a micro-crack or other feature).

Label Surface Resistance Testing

According to ANSI/ESD S541-2003, the criteria for surface resistance is:

- Resistance less than $1.0 \times 10^4 \Omega$ is “conductive”
- Resistance between 1.0×10^4 and $1.0 \times 10^{11} \Omega$ is “static dissipative”
- Resistance greater than $1.0 \times 10^{11} \Omega$ is “insulative”

Polyonics TRIBOGARD® label materials are considered static dissipative as defined by ANSI-ESD S541 “Resistance Material Property 7.2.2 Resistance of Dissipative Materials.” The test method used was EOS/ESD S11.11 “Surface Resistance Measurement of Static Dissipative Planar Materials.” Using this method, the surface resistance properties of Polyonics TRIBOGARD® label materials fall between 1.0×10^5 and $1.0 \times 10^{11} \Omega$, clearly in the static dissipation range.

TRIBOGARD® label materials do indeed utilize a topcoat for ESD dissipation (in accordance with EOS/ESD S11.11 standards) and printability. However, TRIBOGARD® materials are constructed such that a ‘standard’ pressure sensitive adhesive and liner can be used, rather than conductive materials. Surface resistivity gives an indication of the ability of the planar surface to dissipate an incipient charge, rather than a tendency to generate it. TRIBOGARD® constructions work on minimizing the generation of tribo-electric charges at the moment it can be generated, i.e. at the interface between the adhesive and release liner. Our reasoning is that in the world of microelectronics, a conductive adhesive provides a pathway for a short circuit if any ‘micro-cracks’ appear, since the labels are oftentimes applied directly over the circuit vias and components. Low surface resistivities are important, but for the dissipation of charge in a controlled fashion, not as a predictor of possible ESD formation when a label is peeled from its release liner.

Due to its nature, you cannot eliminate static electricity – however, you can control how much can be generated and how it is dissipated. TRIBOGARD® materials have a low charging topcoat designed not only to minimize the charge build up but allow any charge to bleed off slowly so it will not harm sensitive components or boards of electronic devices.