

## STATIC CHARGE CONTROL

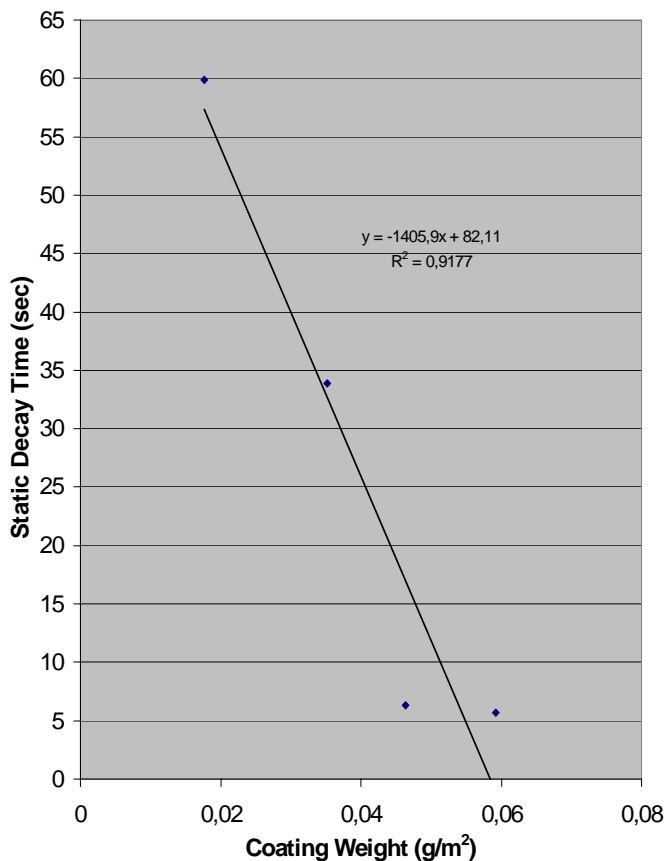
The retention of static charge on a packaging film can be a disadvantage in a variety of converting and packaging processes. A converter may need to dissipate any static charge on packaging films to reduce the risk of potential fire hazards when working with solvent-based materials such as inks, coatings and adhesives. Additionally, a packager may need to dissipate any static charge on a packaging film or lamination of films in order for packaging machinery to properly feed the film and package at efficient rates.

Generally, many polymeric packaging films are manufactured with an internal anti-static additive specific to the polymer, and compounded into the polymer during the film making process. These additives typically have a polar and a non-polar component and they work by migrating through the polymer over time to the surface of the film. The polar end of the molecule lays on the surface of the film while the non-polar component lays embedded in the bulk of the polymer. The polar ends will attract a thin layer of moisture on the surface of the film. This layer of moisture can dissipate any triboelectric charge that the film may pick-up during a converting process. The high degree of polarity inherent to PLA does not allow the more traditional anti-static additives to be effective when compounded into PLA polymer. Migration of these additives tends to be slow and when they do migrate, it is believed that the polar end does not always come to the surface. Static decay testing of PLA with traditional anti-static additives has shown that there is minimal improvement in static decay times of PLA with these additives blended into the polymer. Further research in this area is ongoing to identify an additive that will bring the static decay time of BOPLA to less than 60 seconds while allowing for direct food contact.

Another means by which to control static charge on BOPLA film is to apply a very thin coating of an anti-static chemical. These chemicals lay on the surface of the film and attract enough moisture to the surface to dissipate any static charge that is generated. These chemicals are typically fatty oils and may contain small amounts of other additives that will attract water to the coating surface. When coating any film for food packaging, the use of an anti-static coating that is approved for direct food contact is critical. The down side to using a topical anti-static coating is that the surface energy of the film becomes very low, causing wet-out issues for many coatings and adhesives. Water based coatings and adhesives seem to be the most affected, forming “fisheyes” immediately upon application. Solvent based and solventless coatings and adhesives are less affected, however the amount of adhesion a coating or adhesive has when applied on top of an anti-static coating can be greatly reduced. For this reason, it is recommended that the anti-static coating be applied after any printing or coating process to insure good adhesion to the film.

Cellophane™ is considered to be “naturally” anti-static in nature due to the amount of water required in the polymer to effectively plasticize it. Many of the cellophane films used today are coated with nitrocellulose or PVDC coatings. These coatings also impart anti-static properties to the film. Coated cellophane films typically have static decay times, the time it takes for a 5000-volt charge to be dissipated to less than 50 volts, of less than 10 seconds. Using these typical static decay times for cellophane™ coated films as a bench mark, BOPLA film was coated with Pationic 1004, an anti-static chemical coating comprised of a blend of glycerol esters and metal salts of fatty acids. This anti-static chemical has been cleared for food contact following FDA guidelines. The Pationic 1004 was diluted to a 0.3% solution in methanol to obtain the desired coating weights of the chemical on BOPLA film. Figure 1 shows the relationship of coating weight for the Pationic 1004 on BOPLA film to static decay time. These data show that approximately a 0.056g/m<sup>2</sup> coating weight of the Pationic 1004 anti-static chemical is needed to produce static decay values similar to coated cellophane film. Static testing was conducted at 12% RH and 75°F (23°C) using the method Electrostatic Decay Analysis according to Federal Test Method 101C, Method 4046.1, as described in EIA-541, Appendix F, “Measurement of Electrostatic Decay Properties of Dissipative Planar Materials”.

**Figure 1.**  
**Patonic 1004 Static Decay**  
**at 12% Relative Humidity / 23C**



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**Safety and Handling Considerations**

Material Safety Data (MSD) sheets for PLA polymers are available from NatureWorks LLC. MSD sheets are provided to help customers satisfy their own handling, safety, and disposal needs, and those that may be required by locally applicable health and safety regulations, such as OSHA (U.S.A.), MAK (Germany), or WHMIS (Canada). MSD sheets are updated regularly; therefore, please request and review the most current MSD sheets before handling or using any product.

The following comments apply only to PLA polymers; additives and processing aids used in fabrication and other materials used in finishing steps have their own safe-use profile and must be investigated separately.

**Hazards and Handling Precautions**

PLA polymers have a very low degree of toxicity and, under normal conditions of use, should pose no unusual problems from incidental ingestion, or eye and skin contact. However, caution is advised when handling, storing, using, or disposing of these resins, and good housekeeping and controlling of dusts are necessary for safe handling of product. Workers should be protected from the possibility of contact with molten resin during fabrication. Handling and fabrication of resins can result in the generation of vapors and dusts that may cause irritation to eyes and the upper respiratory tract. In dusty atmospheres, use an approved dust respirator. Pellets or beads may present a slipping hazard. Good general ventilation of the polymer processing area is recommended. At temperatures exceeding the polymer

melt temperature (typically 170°C), polymer can release fumes, which may contain fragments of the polymer, creating a potential to irritate eyes and mucous membranes. Good general ventilation should be sufficient

for most conditions. Local exhaust ventilation is recommended for melt operations. Use safety glasses if there is a potential for exposure to particles which could cause mechanical injury to the eye. If vapor exposure causes eye discomfort, use a full-face respirator. No other precautions other than clean, body-covering clothing should be needed for handling PLA polymers. Use gloves with insulation for thermal protection when exposure to the melt is localized.

**Combustibility**

PLA polymers will burn. Clear to white smoke is produced when product burns. Toxic fumes are released under conditions of incomplete combustion. Do not permit dust to accumulate. Dust layers can be ignited by spontaneous combustion or other ignition sources. When suspended in air, dust can pose an explosion hazard. Firefighters should wear positive-pressure, self-contained breathing apparatuses and full protective equipment. Water or water fog is the preferred extinguishing medium. Foam, alcohol-resistant foam, carbon dioxide or dry chemicals may also be used. Soak thoroughly with water to cool and prevent re-ignition.

**Disposal**

DO NOT DUMP INTO ANY SEWERS, ON THE GROUND, OR INTO ANY BODY OF WATER. For unused or uncontaminated material, the preferred options include recycling into the process or sending to an industrial composting facility, if available; otherwise, send to an incinerator or other thermal destruction device. For used or contaminated material, the disposal options

remain the same, although additional evaluation is required. (For example, in the U.S.A., see 40 CFR, Part 261, "Identification and Listing of Hazardous Waste.") All disposal methods must be in compliance with Federal, State/Provincial, and local laws and regulations.

#### **Environmental Concerns**

Generally speaking, lost pellets are not a problem in the environment except under unusual circumstances when they enter the marine environment. They are benign in terms of their physical environmental impact, but if ingested by waterfowl or aquatic life, they may mechanically cause adverse effects. Spills should be minimized, and they should be cleaned up when they happen. Plastics should not be discarded into the ocean or any other body of water.

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