Anti-static products

Static electricity can be brilliantly useful: photocopiers and laser printers wouldn't work without it. But think about lightning for a moment and you'll see it can also be pretty frightening. Although static isn't harmful by itself, when large amounts of it build up and suddenly discharge you can get dramatic and dangerous sparks (it takes about 3000 volts to make a spark just 1mm long). Set off a spark where there's something flammable (such as gasoline fumes) and, before you know it, you've got yourself a fireball and an explosion. You don't need lightning-sized amounts of static to cause problems: even a tiny spark can be problematic in some situations. If static has built up on your body through walking on a rug, and you start handling delicate electronic components, the sudden discharge of current from your body can be enough to cause some very expensive damage. That's where anti-static products can help. Let's take a closer look at how they work!

Photo: This alarming fire was caused when a spark ignited the gasoline fumes from a fuel truck. Photo by Adrian Cadiz courtesy of US Air Force.

Where does static come from and where does it go?

If you've read our main article on electricity, you'll know that static electricity is (as the name suggests) a kind of electric charge that stays in one place. It's the opposite of current electricity (also called electric current), which is electricity that moves from one place to another along a definite path called a circuit.

Static generally builds up when insulators (materials that don't conduct electricity very well, like plastics, rubber, and so on) or insulated conductors are rubbed, such as when you rub a balloon repeatedly on your clothing. You'll sometimes see this referred to as the triboelectric effect—from the Greek word tribos meaning rubbing—though that fancy expression doesn't really add much to our understanding.

Photo: Unfortunately, static electricity isn't always as entertaining as this. Photo courtesy of Sandia National Laboratories/US Department of Energy.

Static electricity can be really useful and we harness it in all kinds of practical ways. When you take a flash photo with your camera, for example, you have to wait a few seconds for static electricity to build up in a capacitor (an electricity storage device). Once the capacitor in your camera is fully charged, a light comes on, and when you press the shutter button, the capacitor discharges rapidly through a powerful xenon bulb, creating a brief flash of light and often a surprisingly loud crack, like a mini bolt of lightning. What's happening here? To get rid of static electricity, we have to turn it into current electricity by creating a circuit. That's what happens in lightning: so much electric charge builds up in a cloud that the air between it and the ground no longer acts as an insulator. Effectively, the air suddenly turns into a giant circuit that becomes visible—as a lightning strike—as the electricity flows down it to Earth.

How anti-static products work

To stop static, you have to ensure electricity never has a chance to build up. In other words, you have to make sure there's an electric circuit of some kind to carry any electric charge harmlessly away. Anti-static products do this in all kinds of different ways, sometimes physical and sometimes chemical.

Physical methods

You've probably seen cars driving along with little black strips dangling down from the back touching the road. A car's metal body, riding on rubber tyres, builds up a static charge as it drives down the road with air rubbing past it. The theory is that strips like this prevent static electricity from building up on the car body, reducing radio interference, electric shocks when you open the doors, and car sickness. Do these things work? I have no idea. To do anything useful, they must be connected both to the metal car body and touching the ground, completing an electric circuit between the two—and if they're dangling in mid-air (as many of them are) they're a waste of time.

Photo (left): An anti-static car strip. Look closely and you'll see a zig-zag of copper wire running across the surface. This is what carries the static electricity to the ground.

In much the same way, if you're soldering sensitive electronic components into a circuit, you can wear an electrically conducting wrist-strap to carry any static safely to Earth. Factories and work places often use anti-static flooring (rubber mats or carpets) to save the need for everyone to wear straps. They look just like normal floor coverings, but they're made with a good proportion of electrically conducting carbon fibers dotted among the ordinary rubber or nylon (synthetic plastic) fibers.

Photo (right): Handling electronic components with an anti-static wrist strap. A wire runs from the strap to ground (Earth). Left: Vuplex®: a plastic cleaner and polish with anti-static properties.

Chemical methods

These are physical solutions to the problems caused by static electricity, but there are chemical solutions too. Anti-static spray coatings typically consist of a conducting polymer (plastic) and a solvent made from deionized water and alcohol. When the solvent evaporates, it leaves behind an invisibly thin conducting "skin" on the surface of the object that prevents static build-up. Some washing detergents also have additives to reduce static crackling in synthetic fibers (used in clothes made from materials such as polyester). They work by allowing the fibers to retain a little moisture, which makes them more electrically conducting and reduces the chances of static building up. Very simple—and very effective!