



Electrostatic Coating of Thermoplastic Powder Coatings

Several methods are used to apply thermoplastic powder coatings. The two most common are fluidized bed dip coating and electrostatic spray coating. Fluidized bed coating is preferred when a coating thickness of 15 mils (0.015") and higher is desired, part geometry allows excess powder to be easily removed, and production volumes can justify the cost of initially charging the bed. Electrostatic spray coating lends itself to much thinner coating thickness of 6 to 12 mils, relatively easy color changes, and automated/continuous coating lines.

In an electrostatic powder coating process, coating application is achieved by spraying powder through an electrostatic field, charging the particles, which are then deposited on a grounded part. Heat is applied, the powder particles fuse into a continuous film, and the part is then cooled. Electrostatic spraying of thermoplastic powder coatings is very similar to that of conventional thermoset powder coatings and many applicators use both on the same coating line performing multiple changeovers in a single day with minimal process changes.

Equipment Settings

Since most coating processes are initially set up for thermoset coatings, let's take this as our starting point. Once you have tried the settings used for conventional thermoset coatings, the following are the most common adjustments to consider:

Feed System Fluidization Air – When using thermoplastic powder coatings, one is generally using particle sizes 3 to 10 larger in diameter than conventional powder coatings. These larger particles require more air to achieve a fluidize state in the feed hopper. Turning the feed hopper fluidization air to the maximum setting is not uncommon. Not achieving sufficient fluidization in the feed hopper is most commonly encountered problem when switching from thermosets to thermoplastics. If your system does not have a fluidized feed hopper and is only equipped with a wand box feed system, you may have to shake the box periodically.

Nozzle and Connection Sizes – In some cases, nozzle and other restriction points in the powder delivery path will need to be changed out to have larger openings to accommodate the larger particles. This was a more prevalent issue with older equipment and is becoming increasingly rare.

Electrostatic Settings – Start with setting that have worked in the past. If back ionization begins to occur or if large dry film craters appear, try backing the KVA setting down approximately 10%.

Film Thickness

Maximum and minimum film thickness achieved in electrostatic powder coating process is largely determined by particle size. Regardless of particle size, there is a maximum number of like charged particles that can be stacked on top of one another that limits the maximum film thickness when coating an ambient temperature part. Conversely there is a minimum number of particles required to achieve a continuous film that determines the smallest possible film thickness. As the particle size increases or decreases, the max/min film thickness increases and decreases. Many thermoplastic powder coatings are available in both spray grade and fluid bed grade with maximum particles sizes of 70 mesh (210 microns) and 50 mesh (297 microns) respectively. Film thickness of 6 mils (0.006") to 12 mils are very common when electrostatic spraying 70 mesh powder onto cold parts. Although typically named fluid bed grade, 50 mesh powder is routinely sprayed at film thickness between 9 mils and 15 mils on room temperature parts.

Preheated Parts

Since we're working with thermoplastic systems and not concerned with premature curing of the coating, preheating the part can be used to dramatically increase the maximum achievable film thickness when spraying. An electrostatic charge will completely dissipate during the phase change from solid to liquid allowing additional layers of charged particles to be applied. However, since the electrostatic charge is a particle surface phenomenon even the earliest stages of this phase change where the powder particle's outer surfaces become glossy, typically around 190F, is beneficial. If enough heat is used to completely melt the powder particles (250F and higher), extremely high film builds can be applied. This is typically called hot flocking and film thickness of 100 mils and higher can be achieved if enough heat can be maintained in the part.

Recoating

The ability to recoat is another option thermoplastic chemistry makes available to us. Since reheating the part brings the coating back to its molten state, additional coating can be applied to increase film thickness or to repair damaged areas. Keep in mind, it is imperative that the original coating layer be in a molten state before the application of next layer. This is only way to ensure inter-coating adhesion has been attained.

Techniques

Electrostatic spray application techniques of thermoplastic systems are virtually identical to conventional thermoset powder coatings. The fundamentals include: Keeping the gun perpendicular to the substrate; Pay extra attention to inside corners and other Faraday cage areas; Knock down as many sharp corners and burr edges on the substrate as possible prior to coating; Use slow even passes that allow the electrostatics to work most efficiently.

Cooling

Since many electrostatic spray processes are part of a continuous coating line, differences in thermoset and thermoplastic cooling needs to be mentioned. Thermosetting coatings irreversibly harden during the curing reaction. Thermoplastic coatings harden only after they have cooled below their melt point,

and only truly gain their full mechanical properties after they cooled below their vicat softening point. For many thermoplastic coatings, this means the part should cool to 160F before contact is made. As somewhat of a trade off, most thermoplastic systems do not suffer any drawbacks from a forced water quench which can be used to accelerate cooling.