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Application of Powder Coatings for Electronic Component Protection

Understanding the correlation between components, coating powder and coating equipment has become increasingly important in recent years. With pressure to improve productivity, increase yields and minimize downtime, it will be essential to maintain a working knowledge of application techniques, possible problems and, of course, solutions to those problems.

Coating powders for the insulation and protection of electronic devices are designed to be compatible for use with a full range of equipment including fluid bed machines, cascade coating machines and inline wheel coating equipment.

Powder coating of electronic devices and components is a process that depends heavily on the configuration of the device.

Application equipment and the coating powder should be designed to work together. Component temperature limits should also be considered when choosing coating powder for a specific application.

The following are descriptions of various powder application equipment available as well as some difficulties which may be encountered.

LARGE FLUID BED MACHINES

The large fluid bed equipment method for coating radial leaded components gives excellent control over the amount of pantleg. Pantleg is used to describe the coating that occurs on the leads. Excess pantleg creates a problem when the part is to be mounted to the circuit board. Excess pantleg must be removed and in turn creates an extra cleaning step. By using a method referred to as “dead bed dipping” pantleg can be controlled.

Dead bed dipping involves fluidizing the powder, shutting off the air and vibration, scraping the surface of the powder smooth and flat, dipping and removing the preheated parts. The powder is fluidized again while the devices are reheated. The process is repeated until the desired coating thickness is achieved.

Some application difficulties that may be encountered with large fluid bed machines are as follows:

1. Fluidization

The term fluidization is used to describe what happens when a finely ground powder is subjected to air and vibration in prescribed quantities. With accurate adjustments, the powder performs in the fluid bed equipment similarly to a liquid or fluid.

Factors contributing to optimum fluidization are:

1.1 Vibration: Sufficient vibration is needed to break up geysers (columns of air) that may build up in the powder.

1.2 Air: Insufficient air results in a dense bed of powder. Too much air causes geysers, excessive dust and erratic bed settling times.

1.3 Particle Size Distribution: To assure consistent coating, particle size distribution must be maintained. Fines depletion can cause problems in consistency from dip to dip. Bed density will increase as the fines are lost, either through non-recirculating dust collection systems or selective deposition which is caused by the vibration not being set correctly. This causes the powder to segregate, with the coarser particles going to the outside and the fines moving toward the middle where they are picked up by the heated part. As the fines are lost the bed becomes more dense requiring more air and causing inconsistent coatings.

2. Uneven Pantleg

Uneven pantleg can occur when equipment is out of alignment. For example the fixtures that hold the parts may be in need of adjustment. Other possibilities are a misadjusted scraper blade, uneven bed stops or excessive air flow during fluidization. Excessive air could cause the powder to settle too slowly allowing further settling after the scraper blade goes by. Short pantleg on parts in the middle of the rack can be caused by scraping the powder too soon after turning the air off. If the powder is scraped too soon, it will continue to settle in the middle of the bed resulting in shorter pantleg there.

3. Large Parts

Large parts may require deviating from the standard dead bed coating technique. Low bed air and vibration will generally improve the coating of large components.

4. Lead Spatter

Lead spatter or small particles of unwanted material on the leads above the coated area can be caused by inserting the devices into the powder too quickly. This may cause the coating powder to splash onto the leads.

5. Pinholes

Pinholes can be caused by many conditions including contamination from flux residue, dust, or inadequate cleaning of the parts. Porous and wrapped devices can be difficult to coat. If the preheat, reheat and cure temperatures are not kept close to each other, the air in the part will either expand, blowing out through the surface, or contract, causing air from the outside to collapse through the coating. Quick gel and increased coating thicknesses may help eliminate pinholes.

6. Orange Peel

The cosmetic coating defect identified by its rough surface resembling the outside surface of an orange can be caused by insufficient heat, or short flow due to aged material or excess moisture in the powder.

7. Bed Life

Ways to improve bed life of a powder include:

7.1 Maintaining long enough reheat times to insure that the bed is well fluidized. This will keep powder well blended allowing for an even heat distribution throughout the powder. Ultimately this will lower the risk of a crust forming on the top edges of the powder.

7.2 Reducing fines loss will keep the powder uniform and make for more consistent production.

7.3 Store unused powder at cold temperatures to insure flow stability. In order to minimize moisture contamination of the powder, allow the material to reach room temperature before opening containers. Moisture contamination can affect the gel and cure rates of the powder.

7.4 Keeping the bed at cooler temperatures will slow the heat aging of the powder.

8. Insufficient Build Rate

Poor build can be attributed to insufficient preheat for the specific coating powder. Other factors which contribute to insufficient build rates are heat exposure or aging of the powder. Both these conditions could cause the material to lose flow and result in insufficient build.

9. Heat Sources

Efficient preheating and reheating of devices are critical factors for consistent coating application.

Non-uniform heating can cause inconsistent coating thicknesses from component to component regardless of the equipment used.

LINEAR COATING MACHINES

Typically the combination of the long narrow fluid beds of linear coating equipment and fine powder grinds result in poor fluidization. A coarsely ground powder usually provides more uniform fluidization in this type equipment which are limited to coating only one or two strips at a time.

AXIAL LEADED DEVICE COATERS

There are two types of equipment used for coating axial leaded parts; cascade coaters and wheel coaters.

Cascade Coaters

In the cascade coating process, after devices are arranged on a conveyer, and passed through the heating zone, powder is deposited on the rotating device before passing through a second heat zone to gel and cure.

Wheel Coaters

Similar to cascade coating, electronic devices are arranged on a conveyer and carried through the first heating zone to a rotating wheel. A trough in the wheel contains the powder which is deposited to the preheated part. More than one preheating zone and wheel may be used to achieve the desired coating thickness.

The device is then reheated, shaped by a rotating wheel and a fixed shoe, and is cured in a final heat zone.

Some of the difficulties that may be encountered with both Cascade and Wheel Coaters are as follows:

1. Insufficient Build

Insufficient preheat of the devices can result in poor build of the coating powder. If temperatures cannot be increased, a lower melt coating powder may be needed. Short flow may require replenishing the coating powder.

2. Aged Material

Proper care and handling of coating powders require cold storage until ready for application. Keeping powders away from heat sources will extend their useful life.

3. Moisture Contamination

It is important to allow the material to reach ambient temperature before opening the container in order to avoid condensation on the powder. Moisture absorbed by the powder may affect gel, cure time and/or integrity of the coating.

4. Shape Retention

The inability of a device to retain its shape during the cure process is an indication the cure temperature may be too high or the flow of the compound may be too long.

5. Auger Jamming

Auger jamming is caused by a large influx of fines into the reservoir of coating powder. The recycle from the dust collector should be added gradually to avoid this problem.

CONCLUSION

Product consistency and improved performance during the application will result in increased productivity and enhanced performance characteristics of the components.

Additional technical and applications support is available by calling your local Dexter sales representative or Dexter Electronic Materials Olean facility at (716) 372-6300.

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