POWDER RECOVERY SYSTEMS

Selecting cartridge filters for powder coating operations

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Cartridge filter collectors are the most popular types of powder separation and recovery systems available, helping to contribute to the rapid growth of powder coating. The focus of this article is on one of the most critical aspects of the recovery system—the cartridge filter. The article discusses the range of products available, the effects of different conditions and circumstances on filter performance, and the types of cartridges available for various situations. In doing so, the article emphasizes why cartridge filters used in powder coating equipment should be viewed as something more than just a commodity.

As air emission standards have become more stringent over the past 20 years, the trend toward powder coating—which typically eliminates the volatile organic compounds (VOCs) and hazardous waste generated by traditional painting methods—continues to grow as a percentage of the total coating marketplace. The advent of the cartridge filter recovery system in the early 1980's contributed greatly to this growth because this type of system enabled finishers to use as much as 99 percent of the powder they bought. This advancement in powder recovery technology dramatically enhanced powder coating productivity and allowed finishers to realize significant cost savings by switching from liquid to powder.

Cartridge filter replacement can be one of the bigger operating expenses in a powder booth system. Consequently, if you adopt an "I'll buy what came with the system" mentality, or if you choose a filter solely on price, you can be making a costly mistake. Buying the lowest-priced option can actually be more expensive in the long run because the cheapest items usually come with some undesirable reasons that account for their low price tag. Although the service life and price of the filter determine the cartridge replacement cost, improved filter performance, such as higher efficiency, lower pressure drop, reduced downtime for maintenance, and better quality reclaim, can have an even larger impact on the total cost of operating a powder system.

Consistent airflow, for instance, is a critical factor for efficient booth operation. Air velocity through the application booth should be between 100 to 120 feet per minute (fpm) to ensure good transfer efficiency and to prevent the powder overspray from drifting outside the booth. Selecting the wrong cartridge filter compromises airflow through a system.

Many powder cartridge filter products are available today (see Figure 1) that offer different media and various treatments, as well as customized manufacturing technologies, such as special gasketing, along with vari-

FIGURE 1

Various types of cartridge filters

ations in pleat count, design, depth, and spacing. To guarantee optimum performance and value, you have to consider the design capabilities and limitations of the filter, in addition to the application factors that may have an impact on a filter's performance.

Powder cartridges come in various media styles

There are three media styles typically used in powder cartridges: 1) cellulose, 2) spunbond polyester, and 3) expanded polytetrafluoroethylene (ePTFE) membrane.

Cellulose. One-hundred percent cellulose and 80/20 blend (80 percent cellulose and 20 percent polyester) are depth-loading media constructed with tightly packed pleats and an outer wire mesh screen for support. This is the least expensive media available, but it offers only moderate efficiency and is best suited for low- to mid-volume, spray-to-waste powder operations. Pulse-cleaning cellulose cartridges can be difficult because the powder tends to become trapped between the pleats, resulting in very high powder retention within the filter (20 to 45 pounds) and more rapid pressure drop than other filter types. Cellulose-style cartridges aren't appropriate for high moisture conditions or high-volume reclaim operations, as they tend to plug up much quicker than other cartridge types.

Spunbond polyester. One-hundred percent spunbond polyester is a continuous strand, surface-loading media that's tougher and slicker than cellulose and doesn't require outer screen support to maintain pleat rigidity and strength. Spunbond polyester cartridges also require 50 to 70 percent less surface area than cellulose filters to handle a given air volume. This allows for wider pleat spacing and more use of filter media compared with cellulose-style cartridges, which increases filter efficiency. Spunbond polyester cartridges can have advantages over cellulose cartridges, including the following:

- Lower pressure drop and longer service life
- Higher recovery rate of reclaim powder
- Less powder retention (80 to 90 percent less) within the cartridge
- Less compressed air needed (40 to 60 pounds per square inch [psi] to pulse clean filters)
- Less downstream contamination of system and plant air
- No linting contamination of reclaimed powder or finish
- Better resistance to aggressive and abrasive powder (such as frit or porcelain)
- Superior moisture resistance
- Reusability (can be washed)

Spunbond polyester media also offers several specialty treatments and membrane selections to enhance filter performance in more challenging conditions.

Aluminized polyester (antistatic). This treatment coats the face of the media with a thin layer of aluminum that dissipates the electrical charge of the filtered powder. This makes it an ideal filter for effective pulse cleaning when you're concerned about static electricity buildup.

Hydro-oleophobic polyester (moisture resistant). This type of cartridge is treated with a fluorocarbon or Teflon™ bath that provides an oil and water repellant to both sides of the media to ensure effective pulse-cleaning capability in humid and oily conditions.

Expanded ePTFE membrane. This is actually another type of spunbond polyester media. It consists of a thin membrane of expanded PTFE laminated over a polyester substrate that results in a slick and microporous surface providing 100 percent efficiency at 1 micron and larger. One of the best membrane cartridges available for powder is one[1] that laminates a conductive ePTFE over an aluminized polyester substrate to give it the lowest surface resistance (antistatic), highest efficiency, and best release properties in the powder cartridge market. It's suitable for ultrafines or high-moisture conditions, and doesn't require seasoning.

Another technology that's available only on spunbond and treated polyester cartridges, is the dual-dimple pleat design, which imparts opposing dimples along the entire length of each individual pleat. This dimpling technology significantly increases the efficiency of pulse cleaning and the capacity of the filter by preventing the pleats from pinching together regardless of the conditions or dust load. Figures 2 through 5 compare dimpled media with conventional media in various stages.

Operation affects cartridge filter selection

After you review product options, consider the conditions or circumstances that differentiate your powder operation from other ones because these qualities can affect the performance of cartridge filters. Possibly the biggest factor in cartridge filter selection is whether you're reclaiming powder or spraying it to waste.

One of the biggest advantages of switching from liquid paint to powder coating is powder reclaim and reuse capabilities after you've sprayed it. You lose this benefit, however, when you use cellulose cartridges; they typically retain between 20 to 45 pounds of powder that can't be extracted or reused. Polyester cartridges retain only 4 to 8 pounds of powder over the service life of the filter, and ePTFE membranes only 1 to 2 pounds. Therefore, simply by multiplying the dollar cost per pound of powder by the weight gain in each cartridge, you can estimate the potential cost savings to be realized by using polyester or membrane cartridges.

FIGURE 2

Comparing cartridge filters without airflow

Dimpled media | Conventional media

FIGURE 3

Comparing cartridge filters with airflow and loaded with powder

Dimpled media | Conventional media

FIGURE 4

Comparing cartridge filters during pulsing

Dimpled media | Conventional media

FIGURE 5

Comparing cartridge filters immediately after pulsing

Dimpled media | Conventional media

Another primary concern for powder reclaim systems is reclaim powder contamination and *linting*, which is the breaking off of fibers from cellulose-style cartridges during pulse cleaning. Lint and other sources of dirt that enter the booth airstream can not only contaminate the reclaim powder, but also bounce back onto the parts