

Powder Coating

What is Powder Coating?

Powder coating is a type of coating that is applied as a free-flowing, dry powder. The coating is typically applied electro-statically and is then cured under heat to allow it to flow and form a surface film on the metal.

There are two main categories of powder coatings: thermoset and thermoplastic polymers. The most common polymers used are polyester, polyurethane, polyester-epoxy, straight epoxy and acrylics. The exact components of a powder coating may vary slightly from one manufacturer to another.

The powder is used to create a hard, continuous coating on aluminum sections that will protect the metal against corrosion and provide a long-lasting attractive appearance during exposure to a variety of weather conditions.

Powder coating is mainly used for applications such as household appliances, aluminium extrusions, but also for automotive and industrial applications.

Properties of Powder Coating

Because powder coating does not have a liquid carrier, it can produce thicker coatings than conventional liquid coatings. The coating process emits few volatile organic compounds (VOCs). Several powder colours can be applied before curing them all together, allowing colour blending and special effects in a single layer.

While it is relatively easy to apply thick coatings which cure to smooth, texture-free coatings, it is not as easy to apply smooth thin films.

Powder coatings have a major advantage in that the overspray can be recycled. Many of the perceived advantages of powders over liquid coatings (except PVDF) such as hardness and gloss are actually characteristics of the polymer.

The powder coating process

1. Preparation process and pre-treatment

Prior to the powder coating process, cleaning of the aluminium can be done by a variety of chemical and mechanical methods. The selection of the method depends on the size and the material of the part to be powder coated, and the performance requirement of the finished product.

The pre-treatment process both cleans and improves bonding of the powder to the metal. Chemical pre-treatments often occur in multiple stages and consist of degreasing, etching, de-smutting, various rinses and the final chromating of the substrate.

Recently, processes have been developed that avoid the use of chromates. Ones based on titanium and zirconium chemicals and silanes offer similar performance against corrosion and adhesion of the powder.

Another method of preparing the surface prior to coating is known as abrasive blasting or sandblasting and shot blasting.

2. Powder application processes

The most common way of applying the powder coating to metal objects is to spray the powder using an electrostatic gun. The gun imparts a positive electric charge to the powder, which is then sprayed by mechanical or compressed air spraying and accelerated towards the grounded workpiece by the powerful electrostatic charge. The object is then heated so the powder melts into a uniform film, and is then cooled to form a hard coating. It is also common to heat the metal first and then spray the powder onto the hot substrate.

Powder can also be applied using specifically adapted electrostatic discs.

Another method of applying powder coating, called the fluidized bed method, is by heating the substrate and then dipping it into an aerated, powder-filled bed. The powder melts and sticks to the hot object. This method is generally used when the desired thickness of coating is to exceed 300 micrometers.

Electrostatic magnetic brush (EMB) coating is another coating method for flat materials that applies powder with a roller, enabling relatively high coating speeds and an accurate layer thickness between 5 and 100 micrometres.

3. Curing

When a thermoset powder is exposed to an elevated temperature, it begins to melt, flows out, and then chemically reacts to form a higher molecular weight polymer in a network-like structure.

This cure process requires a certain temperature for a certain length of time in order to reach full cure and establish the full film properties for which the material was designed. Normally the powders cure at 200°C (390°F) for 10 minutes.

Applications for powder coated aluminium

Powder coated aluminium is a construction material used in the creation of a number of building projects. The powder coating on the aluminium helps to enhance the metal's ability to resist corrosion from the elements. This property makes the material ideal for use in outdoor projects.

Architectural powder coatings offer a wide range of colours including whites to create the desired effect.

Industrial uses are one of the largest markets for powder coatings. Applications in the automotive industry are also recording a dynamic growth.

Conclusion

The choice of finish depends on the application, and is not merely a matter of personal preference.

The powder coating is solvent free and the coating process does not generate hazardous waste. Powder coatings have a major advantage in that the overspray can be recycled, which makes powder coating an environmentally friendly method.