Scope of Powdercoating Operations D. Botos
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Introduction

Powdercoating is the process of applying (and curing) polymer or epoxy coatings to parts and assemblies to add color, electrical or corrosion resistance, or - in the case of some specialty powders - texture or friction-reducing properties.

Most people are familiar with liquid paints, which consist of binder, pigment, and solvent. Binder is the "body" of the paint that actually forms the coating on objects, pigment is the color, and the solvent is what keeps the paint in liquid form for application. During cure of a liquid paint, the solvent evaporates away to leave behind a film of binder and pigment that is bonded to the surface of the part(s).

Powdercoating, on the other hand, lacks the solvent component, which makes it much more health and environmentally friendly. As the name implies, powdercoating is simply binder and pigment in a powdered form. Getting this powder to stick to parts is accomplished by electrically grounding the part and applying a static charge to the powder as it is directed at the surfaces of the part. Curing of the applied powder is facilitated by heating the part to moderate temperatures for a prescribed length of time.

Powdercoatings are typically more durable than conventional liquid paints and have the advantage of being fully cured after their relatively short exposure to heat, whereas liquid paints can take days to reach full cure as more and more solvent evaporates out.

Equipment

I employ a modest amount of equipment given the space available in part of a 2-car garage. It would certainly fall under the category of hobby-scale. Equipment for powdercoating can be broken down into three main categories: preparation, coating, and curing. Below is a list of my equipment in each of those categories with further details on each piece:

Preparation

Sandblaster

My sandblaster consists of a steel enclosure approximately 2' x 4' x 5' that features a viewing window, lighting, integrated gloves, and a door for inserting and removing parts. The actual sandblasting gun is a simple siphon-feed model that uses compressed air to suck up abrasive media and which is then expelled along with the air. For controlling dust in the blast cabinet, I use a cyclonic separator. It consists of a cone-shaped chamber than sits atop a plastic bucket and uses a shop vacuum to spin dust and particles out of the air, just like the Dyson brand vacuum cleaners advertised on TV.

Figure 1 - Sandblaster. View of door end prior to installation of gasketing.

Air Compressor

My air compressor is a small Ingersoll-Rand Garage Mate model that is used to power the sand blaster and also provide low-pressure air to the powdercoating application gun. It is approximately the size of a water cooler and runs on 110 V electricity.

Figure 2 - Air Compressor

Application

Powder Coating Gun / Power Supply

I use an Eastwood brand "cup" gun and power supply. Low pressure air is directed into the cup of powder where it puffs up some of the powder and pushes it out the barrel, past a small electrode charged by the power supply. The electrode is at a high voltage relative to the grounded part (as is the case with most static charges), but the maximum output current of these power supplies is so small (microamperes) that it is not dangerous. The scale of the system can be seen below based on the handle of the gun.

Figure 3 - Eastwood cup gun and power supply

Booth

The main point of a booth is to contain any excess powder during application and provide a place to hang parts while coating. My booth is constructed of 3 polycarbonate panels with a wooden frame that form a 3.5' x 3.5' x 6.5' volume. The framed panels are easily disconnectable so they can be stored flat. Capture of excess powder is accomplished with a variable-speed fan that draws air through a 20" x 20" filter rated for capture of sub-micron-sized particles (for reference, powder coatings have a particle size in the range of 30 to 50 microns).

Figure 4 - Powder booth, during construction. Fan and filter install on opening in back wall.

Curing

Ovens

I have two ovens, both electric. The smaller oven is a approximately 3' x 2' x 2' and employs a single 3000 W element. The larger oven is 3' x 3' x 5' and uses two 3000 W elements (same total element power as a typical kitchen oven). Both are controlled by digital temperature controllers and utilize 230 V electricity.

Figure 5 - Small oven. Shown test-fitting a wheel to be coated.

Figure 6 - Large Oven

Materials

Powdercoating powder is typically either polyester or epoxy chemistry and milled to a particle size of 30 to 50 microns. New powder and waste powder are considered non-hazardous, with the only real safety precautions being to keep them sealed in order to avoid creating nuisance dust.

Some powders contain a chemical called TGIC (triglycidyl isocyanurate) as a cross-linker. In pure, concentrated form, this chemical poses some health risk, but not in the amounts present in the powder under normal handling, application, and curing.

Process

Powdercoating is a fairly simple process that can be broken down into the three categories mentioned earlier: preparation, coating, and curing. Below is a brief summary of the process of coating a part:

Preparation

-remove any loose dirt or flaking of existing coating with wire brush
-sandblast part to remove any existing coating and roughen surface for powder adhesion
-use compressed air to blow off any dust or abrasive media off from sandblasting
-mask any surfaces not to be coated

Coating

-hang part from grounded hook in booth
-coat with powder

Curing

-pre-heat oven to prescribed cure temperature for particular powder (usually 350-400 ℉)
-hang part in oven
-check part surface temperature periodically with infrared thermometer
-when part surface has reached cure temperature, start timer for prescribed cure time
-at end of cure time, turn off oven and open door slightly to allow for gradual cooling of part

During the process, I wear a 3M 6000 series half-mask respirator with cartridges and prefilters to avoid inhaling any dust from the sandblasting and coating operations.

Conclusion

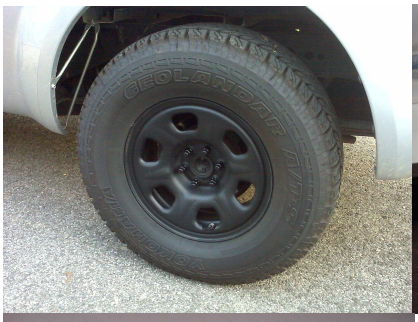
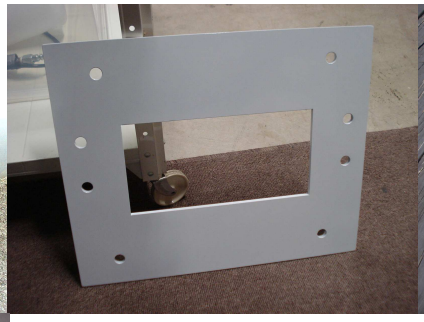
As you can see, the powdercoating process is fairly simple, with the equipment and skills certainly within the range of a home hobbyist or home business. The material and process are safe, with only minor personal protective equipment required and no elaborate environmental concerns associated with shipping, application, or disposal of materials.

Based on the definition of a minor home occupation in the Christiansburg town code, I feel that I meet that classification under the grounds that:

-any goods / services sold would be made / performed on site
-none of the powdercoating equipment or materials utilized are considered hazardous materials
-any customer parking would most likely be one person at a time and limited to my driveway or street frontage
-no signage exists for the business
-the business is not one that requires group instruction, assembly or activity

Sample Work

Given the detailed discussion of the process and equipment, I would be remiss not to include a sense of the finished product. Below are some samples of my work to give an idea of the benefit a custom coating business would be to the community, both for individuals (automotive and vehicle parts, outdoor items, tools) and other businesses (small to medium parts, equipment housings, panels, etc.).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