

*Published, now and again*

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There are several areas in which vacuum metallizing problems may occur. These problems may exist separately or in combination. Your challenge is to determine whether you should be checking with your molder, paint supplier, or in some cases, people like ourselves who supply the filaments, evaporants, and pump oil. The purpose of this **TIPs** is to give our customer an idea of where to look for the solution to his metallizing problems.

### **ADHESION FAILURE**

1) If the basecoat fails to adhere, it is probably due to material contamination, either within or on the surface of the substrate. To identify surface contamination, wash one-half of a part with alcohol, and leave the other half as is before basecoating. You may be able to identify an internal contaminant by squeezing the uncoated part in your hands as hard as you can. If your hands become sticky, there is a good chance that an internal lubricant is the culprit. If not, it may be that you are using the wrong basecoat for this particular substrate. Try one piece with a different coating.

2) If the topcoat fails to adhere, it is probably undercured. If you are using an oven, the temperature may not be consistent throughout. If it is a batch oven, check it with a recording thermometer; you may find hot or cold spots.

Oxidation of the aluminum can also be a problem when the parts are exposed for an extended period to a dry atmosphere prior to the topcoating. If you have properly cured the topcoat and if the aluminum is not severely oxidized, then you may be using the wrong topcoat.

### **BALLS**

Balls of evaporant hanging on the filament create two

problems: (1) they cause the filament to deteriorate more rapidly than it should, (2) it is difficult to get an even, uniform distribution of evaporant over the part. Balls are caused by an improper firing sequence. The evaporant should flow over the wire in a uniform manner and wet it. Depending on the size of the chamber and the degree of vacuum, this takes an average of six seconds. Rapidly increase your amperage to fire. (For more information, see our other **TIPs** on Vacuum Metallizing).

### **BLISTERS**

A coating that is baked will have a flash-off time to allow the evaporation of solvents. If the flash-off time is insufficient and you have latent solvents in the coating, they will pop and make a blister when they come to the top.

Blisters can also be caused by outgassing of the substrate from volatiles in the plastic that escape during the metallizing process.

A sure knowledge of your coatings, retarders and thinners will assist you in regulating your coating, helping you to pinpoint and eliminate many of your metallizing problems.

### **COBWEBS**

Cobwebs appear as distortions in the coating which look like cobwebs and mean your solvent system is drying too quickly and the viscosity is probably too high. Cobwebbing occurs more frequently with vinyl coatings than other coatings. Either see our movie on proper viscosity or check our **TIPs** on solvents.

### **CRATERS(FISH EYES)**

Once you have seen these small craters, or "fish eyes" as they are called, clustered about specific

areas, you will always remember them. These are caused by silicones either on the part or airborne. See our **TIPS** on silicones and remember they should not be anywhere near the molding machine or the spray department. Silicones cannot be removed with elbow grease or chemicals. You may achieve a partial success in removing silicones by washing the parts thoroughly with a household detergent and then washing with solvents that will not harm the plastic.

### **CRAZE**

Crazing is a cracking in the coating that is reminiscent of the cracking found in a ceramic glaze. Possible causes are:

- 1) The solvent system is too strong.
- 2) The coating is too heavy on the parts; in this case you should reduce your coating further.
- 3) More flash-off time is required.
- 4) Reground material was used in the molding.

### **CURE, SLOW**

If the cure is too slow, the coating will not set up and will remain sticky. If you are using an oven, you may have a lack of air going into the oven, or you may have cold/hot spots in your oven.

If a coating uses a catalyst, there is a possibility that your catalyst is old and of no value, or insufficient catalyst was used when mixing the coating.

### **SPLAY**

Splay is the pattern of cracked lines on the parts after topcoating; splay is deeper than craze. This can be caused by water in the molding powder, in which case the splay looks like a comet. Another cause of splay is a solvent attacking the material, resulting in the lines popping up.

### **DARK SHOT**

We call any part which has a blue, gold, straw or black appearance after vacuum metallizing a "dark shot." On occasion this will show up after the part has been topcoated. The dark shot is the most common cause

of rejects. Possible causes of dark shots are:

- 1) Outgassing of the substrate.
- 2) A leak in the vacuum system.
- 3) Broken filaments in the metallizer.
- 4) The basecoat is not completely cured and solvents are still escaping.
- 5) The racks and fixtures are heavily coated and require cleaning.
- 6) The coating itself is outgassing. Check to be sure you are using the proper coating.
- 7) Occasionally parts will be too close to the filaments and receive a burn that can be a straw color. Keep your parts at least a hand-span away from the filament.
- 8) You may be pumping down too long and too low. This may cause outgassing on some of the jigs or fixtures, or even substrates, that would not normally out-gas when you are down to standard pressures. Remember, there is such a thing as pumping down too far. We've even seen metallizers pump down far enough to cause portholes to leak.
- 9) You are firing at a pressure higher than you believe you are. A bad vacuum gauge may be at fault.
- 10) The diffusion pump can be giving you poor results because the oil needs changing.
- 11) A leak may exist in the system. When a leak in the system shows up as a black area, you can figure that the cause is pump oil if the burn is in the back of the chamber. Or, if the burn is in the front of the chamber, the cause is a door or porthole leak. If it is in the front of the chamber, there is a possibility that you have oil coming off the rotating gears.

### **DIRT**

Dirt comes from many places. This is one of the reasons that the metallizing department should be

sealed off. The floors are sealed, the walls are sealed, and fresh cardboard is not allowed into the department. Other causes are:

- 1) Dirt in the air lines. You should have in-line filters.
- 2) The exhaust in the spray booth may be so powerful that it is acting like a vacuum cleaner sucking the dirt from the area into the spray booth.
- 3) The coating itself could have fine particles of dirt in it. The coating is not always as clear as you would like; it should always be filtered before it goes into the pressure pot.
- 4) You may have dirty filters in your make-up air for the area.

### **DULLNESS**

- 1) Lack of basecoat or too thin a basecoat can cause dullness. The function of the basecoat is both adhesion and brilliance.
- 2) Chlorinated solvents may be in the area. This is one reason to keep the cleaning of the metal away from the coating of the plastic.
- 3) The wrong solvent, or too strong a solvent, can attack the substrate and give you dullness.
- 4) There is also the possibility that you have a substrate which is variegated. For example, a glass-filled or talc-filled part may have resin-starved areas and filler-starved areas which will show up dull.

### **STRESS LINE**

Stress is, in a manner, related to splay, except the mark will always be in the same place. Stress is a molding problem. Anti-stress solvents can be used, or the part can be annealed or normalized prior to finishing.

### **IRIDESCENCE**

Rainbow iridescence is most frequently caused by a shift in the coatings; that is, the basecoat or the topcoat will move physically. This gives a prismatic effect. Possible causes are:

- 1) The topcoat was cured at a temperature equal to, or higher than, the basecoat. Check your oven for hot or cold spots and/or timing.
- 2) The make-up air or circulation in the oven was shut off.
- 3) The basecoat may have been very light and the topcoat very heavy.
- 4) The part may have been distorted as it was cured at a higher temperature than the softening point of the material.
- 5) Newton fringe is often confused with a prismatic iridescence. Here, however, the colors are not in the normal spectral rainbow pattern. Newton fringe colors are random and look more washed out than pure spectral colors. Generally speaking, rainbow iridescence is a coating problem and Newton fringe is an evaporant problem caused, for example, by too thin an aluminum shot.

### **SAGS**

If you are using a spray gun, sags may form from holding the gun too close to the part. It may be you have the wrong coating, but usually the gun is held too long and too close to the area (see our movie on spraying). There is also a possibility that if you're in a cold climate and your materials are exposed to the cold, the paint thinned out as it reached room temperature, thereby changing its viscosity. Always allow materials to reach room temperature before mixing.

### **SHADOWS**

The evaporant actually lays in small platelets on the part. When these platelets lay flat, they give the parts a reflective brilliance. This is especially true in the case of aluminum and copper. If the evaporant strikes a vertical wall and has no chance to lay flat, it produces what we call "swords and sabers" The platelets now stand on end and the result is a shadowy effect. An example is a filament firing into a deep box. The sides will probably have shadows. To

correct this, try changing the position of your parts, or the position of your filaments.

### **ORANGE PEEL**

An orange peel effect in the coating is a flow problem; your solvent may be too fast or the viscosity of your coating may be too high.

### **SOAK-IN**

When a coating soaks into substrate, the problem is a low density area in the substrate. Either speak to the molder or re-apply the basecoat for sufficient coverage.

### **WRINKLES**

The most common cause of wrinkles is the lack of flash-off or air-dry prior to going into the oven. Also, if the coating is excessively thick it can shrink when cured which will again result in wrinkles.

### **FINALLY**

If you have a problem, be sure to take note of details such as:

-At what point during the finishing operation did the problem occur?

-The location of bad parts in the chamber, e.g. always in the rear of the chamber, always in the front of the chamber, or randomly distributed?

-Location of flaw on the parts. Is the problem always in the same place? Does it occur on all parts?

-Types of flaw, e.g. pinholes, shadows, wrinkles.

-Knowing this information will help us to diagnose your problem and pinpoint its cause.

-Please feel free to call Midwest Tungsten Service with any problems or questions you may have with your batch metallizing. We are always happy to help our customers.

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