MIDWEST TUNGSTEN SERVICE

Tips

Maximizing Metallizer Throughput

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This Tips is more theoretical than most, but it is our sincere hope that you will be able to make practical use of this information in your own metallizing operation.

When we talk about throughput from a metallizer, we are really talking about how many good parts we can produce in a given unit of time. Expressed as an equation we have:

throughput = good parts ÷ unit of time

This equation forms the basis of our discussion, for it shows that we can increase *throughput* by increasing the number of *good parts* or by decreasing the *unit of time* it takes to make them.

How can we increase our *good parts*?
Three ways. We can:

- decrease the number of rejected parts
- load more parts into our existing chamber
- increase size or number of chambers

The first option, decrease rejected parts, has been the focus of many programs such as QS-9000, TQM, and SPC. We will not elaborate further on it here except as it relates to the second item, loading more parts into the existing chamber. Loading more parts into the existing chamber is a valid way to increase throughput. If you increase the number of parts in each load from 200 to 250, you have increased your throughput by 25%. Congratulations - unless you have now increased your rejects due to poor coverage, or increased your pumpdown time due to the increased gas load. If this is the case, you may have gained nothing or actually be worse off than before. Buying a bigger chamber will assure you good coverage for the extra parts, but will also assure you a longer pumpdown time. Buying more chambers will also increase throughput, but requires capital, personnel, and floorspace.

Let's look at the other part of the equation.

How can we decrease our *unit of time*?
Many ways. Any innovation or change which speeds or eliminates loading and unloading of parts, basecoating or topcoating of parts, or preparation and packaging of parts will have a positive effect. In order to have the greatest effect, however, we should first look at where the most time is used up, the chamber pumpdown.

The pumpdown time can be reduced in three ways. The gas load can be reduced. This is the primary thinking behind cleaning your chamber, heating your chamber, adding a Polycold™ unit, and

eliminating leaks. The less gas that needs to be pumped , the faster pumpdown will be. Cleaning the chamber reduces the surface area available for gases, especially water, to cling to. Heating the chamber drives off moisture from the surface by giving water molecules the energy they need to become a gas and escape from the surface. A Polycold™ unit will trap water vapor and other gases inside the chamber, and eliminate the need to pump them away.

Reducing the gas load is also the thinking behind loadlock systems that keep the deposition section under vacuum at all times. The loadlock eliminates the need to pump the entire chamber down from atmosphere each time parts are loaded. There are two types of loadlock systems, batch and continuous. In a batch system, the deposition section is kept at the proper vacuum level while parts are put into the loading section. The loading section is then sealed from atmosphere and may be partially pumped down before exposure to the deposition section. The resulting rise in pressure in the deposition section is small, especially if the deposition section is large in volume. In a continuous load lock system, several chambers are placed side-by-side. The outermost chambers are at higher pressures. As one moves toward the center, a higher vacuum is encountered. This means that as a part is passed through the system, it is brought from atmosphere to vacuum and back again in a series of small steps. Since pumpdowns are small and occur simultaneously, considerable time is saved.

Another way to reduce the gas load is to make the chamber smaller. This also reduces the number of parts the chamber can contain, but if done correctly, as in some of the small press-side metallizers being made today which only metallize a couple of parts at a time, the results can be satifactory. The real advantage here is the pump size or capacity in relation to the size of the chamber. The small press-side metallizers come out ahead since it is easier and cheaper to fit a small chamber with oversize pumps than it is to fit a large 48” or 72” chamber with them.

Basecoating and topcoating deserve mention here as well. The application of basecoats and topcoats add to the length of time needed to produce a finished part. Several things can be done to reduce the time spent on basecoating and topcoating. UV coatings cure faster than lacquers. The ultimate condition would be to eliminate basecoats and topcoats entirely. Can it be done? In some cases the answer is yes. If the substrate is make from the correct materials, and is molded with a smooth finish, then a basecoat may not be required. Glow discharge cleaning in the chamber can prepare the surface for deposition and improve adhesion. After deposition, a quick curing ultraviolet topcoat can be applied. Even better, in some applications, a plasma polymerized topcoat or a silicon monoxide topcoat can be applied right in the chamber.

If you would like more information on this topic, contact us or refer to these other Tips:

- Plasma Polymerized Topcoats
- Basecoats for Vacuum Metallizing
- Maintaining Your Metallizer
- Water Vapor and Vacuum Metallizing
- Contamination

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