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# Ask Joe Powder

## The Partial Cure Conundrum

**Q** Dear Joe Powder,  
I want to put a debate to bed. What exactly does a partial cure, 50% - 70% cure mean? Does it mean, get the part temp within curing range, then cure for only 50% of the recommended time? In other words, ~355°F for 15 min. or ~400°F for 5 min.? Or does it mean 50% of the overall curing cycle? As in let the parts reach the gel or flow out stage, roughly 50% through the curing cycle? I've heard it both ways, but which way is the right way?  
Mason, Tuscaloosa, AL

**A** Hi Mason,  
I am glad that you asked as this is an age old description that has been bandied about in our industry since thermosetting powder coatings were first commercialized over 50 years ago.  
From a scientific standpoint, percent of cure refers to how many of the available chemical reactions have occurred between the resin and crosslinker. Chemists formulate powder coatings so there are roughly the same number of chemically reactive groups on both the resin and crosslinker. So theoretically all of them are reacted after the powder coated part is exposed to a specified amount of heat.

Mother Nature doesn't exactly work that way, however. In reality 100% of all theoretical reactions do not occur. In addition, chemical reactions occur pretty fast at the onset of heating the powder coating because there are lots of chemically reactive groups to react. As the bake progresses the reactivity rate slows down because there are fewer chemical groups available to react.

Back to the scientific realm, we have sophisticated thermal analytical methods to characterize the curing behavior of a powder coating. Most common is DSC (differential scanning calorimetry) which demonstrates melt behavior (T<sub>g</sub>) and fingerprints the exotherm associated with the thermosetting reaction that makes a powder coating tough. Data generated by DSC allows us to extrapolate how much time and temperature is needed to cure a powder; however practical testing, i.e. a cure study on test panels, always provides more definitive information.

So back to your percent of cure conundrum. Typically, we establish a recommended cure schedule of time at metal temperature then backtrack to a guesstimate of what we would call 50% (or any other percent of cure). Typically 50% of cure means half the time at the recommended temperature. Because chemical reactions do not progress at a linear rate we're just giving you an approximation when we quote this.

My explanation might not put this issue completely to bed, but I hope that it gives you a better appreciation what is meant by less than 100% cure.

Best regards,

*- Joe Powder*

## A Mist in Our Midst

**Q** Dear Joe,  
I have a question about the influence polyurethane acrylic wet paint may have on our powder (polyester, epoxy-polyester and epoxy) paint booth. Since acrylic contamination can form craters, can we

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have a problem if we are painting the parts with polyurethane acrylic wet paint near (approx. 30 meters) the powder paint booth?

Thank you in advance!  
Ivan C., Smederevo, Serbia

**A** Dear Ivan,  
Thank you for your question. The answer is maybe. I have seen contamination from liquid paint sprayed about 30 meters from a powder booth that caused crater defects in finished coating. In this case it was a silicone paint that was sprayed into the outdoor environment near a powder spray facility. The paint mist would drift toward the air intake of the powder coating operation and contaminate the booth air. This only happened when the liquid paint applicator sprayed his parts in the open area (common parking area).

Whether a liquid acrylic polyurethane would do the same is unknown. I recommend that you get a sample of the liquid paint and do some testing. Spray a mist of the paint onto a scrap part or test panel then apply a powder coating onto it. Just use a light mist to simulate what could happen in the nearby environment. Cure the powder and observe the results.

If it does contaminate the powder coating then find a solution to isolate your spray area and incoming air from the liquid paint. You may be able to do this with the use of filters.

I hope that this helps. Please let me know if you have any questions.

Best regards,

— Joe Powder

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**Editor's Note:** Letters to and responses from *Joe Powder™* have been edited for space and style.

### Not Your Average Joe...

Each issue, we take the padlock off the PCI® Test-Lab door for a few minutes so our favorite technical editor and "powder guru" *Joe Powder™* can run in the yard. When he's not gnawing on a rawhide bone, he loves to answer readers' questions. Go ahead and send him one at [askjoepowder@yahoo.com](mailto:askjoepowder@yahoo.com)... he doesn't bite. Maybe it'll end up in the next issue!

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