Dear Joe,

I have some brake calipers that I powder coated, and I would like to add lettering and then add a clear powder coat and put in the oven and bake it. I would like to know of any material (vinyl, decal or anything) that can withstand 400°F to be powder coated over.

Thanks,

Ismael

Dear Ismael:

This is a tricky proposition. First of all, PVC (vinyl) decals will not take 400°F, so they're out. There are a number of materials used to make decals, and the table below provides type and heat resistance.

<table>
<thead>
<tr>
<th>Polymer Type</th>
<th>Synonyms</th>
<th>Heat Resistance (F°)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Polycarbonate</td>
<td>PolyCarb</td>
<td>150</td>
</tr>
<tr>
<td>Polyester</td>
<td></td>
<td>250</td>
</tr>
<tr>
<td>Polyvinyl Chloride</td>
<td>PVC, vinyl</td>
<td>300</td>
</tr>
<tr>
<td>Polyethylene Terephthalate</td>
<td>PET</td>
<td>360</td>
</tr>
<tr>
<td>Polymide</td>
<td></td>
<td>1000</td>
</tr>
</tbody>
</table>

For your application, I would consider PET or polyimide as the decal polymer. PET may be borderline for heat resistance; however, you should be able to use a clear powder coating that can cure around 350°F and avoid exceeding its heat resistance threshold.

Otherwise you will have to use a polyimide-based decal, which easily outperforms all other decal materials for heat resistance. Polyimide tapes are regularly used as masking for powder coated articles, so I can attest to their resistance to typical powder curing temperatures.

Preparing the surface for the decal and choosing a powder coating are also important considerations for the success of your project. The surface should be wiped clean with a good solvent. I recommend either denatured alcohol or acetone. Both are readily available at your house paint store or DIY.

I would recommend a low-temperature cure polyester powder coating as your clear coat. Epoxies discolor with heat, and polyurethanes have a tendency to outgas at thick films. Polymers capable of low temperature (i.e., around 325° to 340°F) are commonly available. These products have good heat resistance and can be applied at relatively thick films to give a high gloss with excellent distinctness of image. Please ensure that the coating is fully cured to make certain that it provides full durability performance.

Please let me know if you need anything more.

– Joe Powder
Seeing The Light

Dear Joe Powder,

I carry out jobbing, currently doing batch oven curing. I understand that UV powder coating materials are different, but what will be the temperature required for the first stage of melt? After this, can the parts be touched before transferring to the UV curing? Are UV powders more expensive than normal epoxy powders? How about the energy costs?

Can you give some insights about UV cured powder coatings. How is this process carried out?

Augustine P.

Dear Augustine:

Indeed the powder must be melted, and it cures best at an elevated temperature. The melt phase can be accomplished by any source of heat—convection, infrared or a combination of both. This can take anywhere from a few seconds to a minute or two, depending on the source and the intensity of heat.

The melt temperature depends on the formulation and can range from about 212°F to 257°F (100°C up to 125°C). The parts can be touched; however, the coating should not be touched.

UV powders are generally more expensive than epoxies, but not outrageously so. Energy costs are quite low, however the process is more complex. Heating a substrate to 110°C instead of 180 to 200°C obviously saves cost. The UV process requires high energy but it is very compact saving floor space and capital equipment expenditure.

UV cure is “line of sight,” meaning the UV energy must penetrate the coating. Shadows and unexposed spots do not cure. The UV curing typically takes seconds—very few seconds. Too long and the coating will burn. In addition, it is important that the coating is warm and relatively fluid when exposed to the UV energy. This allows for better molecular mobility and more complete cure.

Any substrate that can be powder coated can most probably be coated and cured with a UV powder. The key is to melt the powder without damaging the substrate. Metals substrates are relatively easy to finish with UV powders. More difficult are plastics especially those possessing low heat distortion temperatures (HDTs).

—Joe Powder

The above image shows UV-curable powder coatings on molded plastics.

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 in trouble for tipping over his water dish, he loves to answer readers’ questions. Go ahead and send him one at askjoepowder@yahoo.com... he doesn’t bite. Maybe it’ll end up in the next issue!