ASCEND PERFORMANCE MATERIALS

Problem:

Burn Marks

Burn marks are dark brown and black discolorations or charring located on the molded part surface.

TECH TIPS

Your Vydyne® technical services team offers step-by-step troubleshooting tips to help locate and solve problems that may occur during injection molding in order for you to get production back up and running.

Burn marks

Problem:

Burn Marks

Root causes

Several factors can cause burn marks. These factors can be related to the mold, machine, process or material. Some of the more common causes are:

- Inadequate venting
- Excessive temperatures in the barrel, nozzle and hot runner system
- Excessive shear in the nozzle, runner, gate or part
- Excessive moisture and/or air entrapment in the material
- Extended residence time in the barrel
- Material contamination
- Poor part/gate design and location
- Irregular regrind shape/size
- Excessive injection speed

How to troubleshoot

Evaluate the molding process

Overheated material is one of the most common causes of burn marks. When nylon overheats, it can degrade, resulting in burned areas in the part.

Follow the temperature guidelines recommended by the material manufacturer.

- Check the melt temperature using a thermocouple to find the actual melt temperature.
- If using a hot runner system, temperatures in the manifold and drops should be equal to the desired melt temperatures. The goal is not to add more heat in this area, but to keep the material in the recommended temperature range.
- Optimize the shot-to-barrel size ratio. When using Vydyne material, two to five shots in the barrel are recommended. Having more than five shots in the barrel runs the risk of material overheating and degrading. Conversely, less than two shots in the barrel can cause poor mixing and melting, creating inconsistent fill pressures.
- Adding a second-stage fill at a lower injection velocity will allow trapped air to vent without causing burns.

Evaluate the mold design

Poor gate and runner design can cause excessive shear stress on the molten polymer, in turn causing burn marks on the molded part surface.

- Check for adequate mold venting. Vents should be cut into the mold every 2 in. (50 mm) along the parting line from the gate to end of fill. The runners should also be vented to remove air prior to entering the cavity. The following table indicates typical vent sizes for Vydyne PA66 resins.

Vent Size Requirements	
Depth	0.0005–0.0015 in (0.0127–0.0381 mm)
Length of Vent Land	0.03–0.04 in (0.762–1.016 mm)

- Check the gate size. Gate diameter and land length are critical dimensions when designing molds for nylon materials. Gates that are too small can cause the material to experience high shear rates during fill, which can lead to burn marks. Some materials contain additives (flame retardants) that are shear sensitive and can degrade under high shear rates. Proper gate design is critical to many aspects of a quality molding cycle.
- Sharp corners on ribs, walls and other stand-offs can be areas of high shear stress. Add generous radii at the intersections of the stand-off and the nominal wall. When designing for nylon parts, a minimum radius of 1 mm (or half the nominal wall thickness) is used at corners and the bases of ribs and bosses. Parts will fill more easily and will be less prone to burning. Additionally, the part has less molded-in stress and improved functionality.
- Blind holes or ribs should be well vented to keep air from entering the melt flow front and creating burn marks.

Evaluate the material

Excessive moisture during processing is a frequent cause of burn marks. Water vapor is trapped at the end of fill and can cause burn marks to occur. Proper drying techniques, combined with well-maintained drying equipment, are crucial to ensure moisture levels in the recommended range of 0.1% to 0.20% moisture. If you suspect wet material, check the following items:

- Temperatures at the hot-air hopper inlet are typically in the range of 160°F to 180°F (71°C to 82°C).
- Maintain dewpoint temperatures in the range of –20°F to –40°F (–29°C to –40°C). If the dewpoint is too high, make sure the desiccant beds regenerate properly.
- Foreign-material contamination also causes burn marks, particularly if the material degrades at nylon processing temperatures. Maintaining a clean drying hopper, grinder and proper material handling can reduce the risk of contamination.
- Regrind particle size is very important. Regrind that is too large or irregular in shape can cause poor material feed and allow unwanted air to travel the barrel.

About Ascend

Ascend Performance Materials is the world's largest fully integrated producer of nylon 6,6 resin. We manufacture and reliably supply world-class plastics, fibers and chemicals that are used in thousands of everyday applications such as car parts, electronics and cable ties.

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