

Safe Tips for Handling, Processing and Tooling when using Ultramid[®] Red Phosphorus Grades

Overview

This document is a summary of the existing information and recommendations which also appear on the MSDS and packaging label regarding the potential hazards of red phosphorous.

In addition to the processing recommendations on our data sheets, additional details for proper processing and handling of these products are covered in the following pages.

Current Active Red Phosphorus FR Grades

- ❑ **Ultramid® A3X2G5 – PA66, 25% GF**
- ❑ **Ultramid® A3X2G7 – PA66, 35% GF**
- ❑ **Ultramid® A3X2G10 – PA66, 50% GF**
- ❑ **Ultramid® A3XZG5 – PA66, 25% GF**
- ❑ **Ultramid® T KR 4365 G5 – PA6/6T, 25% GF**
- ❑ **Ultramid® 66 H2 G/25-VO KB1 – PA66, 25% GF**
- ❑ **Ultramid® 68 H2 - VOH – PA66,**

Ventilation / Handling of Ultramid FR Grades

Proper ventilation is a must



- ❑ **Ventilation** - When processing these resins, toxic vapor levels of phosphine can potentially be emitted.
 - Adequate ventilation of the process and the work areas must be ensured.
 - We recommend a vent hood over the injection molding machine purge guard.
 - Proper processing conditions must be ensured.
 - Reducing shear is the goal for each of the process variables.
- ❑ **Resin material handling** - Upon opening the package there will be an odor / smell.
 - Open the material container in a well ventilated work area.
 - Open containers of resin in production areas should be covered and the vacuum feed opening should be as small as possible.
 - Open material containers returned to storage should be sealed and covered.

Processing of Ultramid FR Grades

Proper drying is important as excessive moisture can create additional out gassing of FR additive



- ❑ **Moisture levels** – Moisture content during processing is critical
 - Material should be tested before molding.
 - High levels of moisture (above *0.05 %*) can contribute to increased vapors, especially when combined with higher melt temps.
 - The optimum moisture level range is *0.03%-0.05% max.*
- ❑ **Drying conditions** – When the level is above **0.05%**
 - If drying is needed to achieve the proper moisture level, the drying recommendation is *160F-176F (70C- 80C) for 2-4 hrs.*
 - Out-gassing may occur from the dryer exhaust and should be properly vented away from work areas.

Processing of Ultramid FR Grades

Temperature control is critical; all process variables that have an effect on temperature need to be controlled.

Melt temperature – Ranges

- A3X grades range is 545F - 572F (285C – 300 C)
- T KR grades range is 590F - 626F (310C - 330C). **Always process at the lower end of the melt range if possible. This is especially important with the T KR grades.**
- Barrel settings, shot size utilization and RPM's should all be considered and balanced in achieving the final melt temps. (*Melt temp is an actual air shot measurement.*)

Back Pressure - Minimize shear

- Use 50-100 psi.
- Reduce back pressure at higher rpms.

Screw recovery- RPM's - Minimize shear

- Use 25 – 50 rpms
- Maximum peripheral screw speed of 8 inches per second (0.2 m/s).
- Stop screw rotation 2-3 seconds before the cooling time expires.

Residence time - Minimal residence time in the barrel is key.

- Eight minutes at the low to mid range of the melt temp and less than two minutes at the mid to upper end of the melt temp.

Purging of Ultramid FR Grades

Hot material produces fumes and in some cases small flame ups can occur. See the (MSDS).



□ Purging - Minimize the amount of material that you purge.

- It is best to produce parts until the barrel is completely empty.
- In purging the machine, these steps can reduce the chance of flame up.
 - Lower the injection pressure and injection speed as much as possible.
 - Increase the shot size and back pressure during screw rotation to allow the hot melt to be extruded out versus injected out.
- For temporary shut down, empty the barrel and screw and bank the heats at < 300F - (150C).
- For total shut down, purge with a non FR grade of a similar material.

□ Purge puddle – The purge is hot and will continue to smoke and fume

- The purge puddle should immediately be placed into a water bath or removed from the immediate work area. This is particularly important if a flame up occurs.

Material Change and Part Handling of Ultramid FR Grades

Material change over – To and from different resins / grades

- When changing materials requires purging, follow the same purging steps as noted on the previous slide.
- Purging with a similar grade without a flame retardant is recommended.

Part handling - Parts directly out of the molding machine are still warm and can emit vapors during cooling.

- Parts should be staged to allow cooling and not packaged immediately out of the mold.
- Final package sealing should be delayed until all parts reach room temperature.
- Packaged parts should be stored in a well ventilated area.

Regrinding of Ultramid FR Grades

Regrind handling – Proper handling

- Dust can occur from the grinding operation and, at a minimum, a dust mask should be worn.
- Regrinding should be done in a well ventilated area as the material can heat up during the process and vapors may be emitted.
- It is best to feed regrind immediately back into the molding machine.
- If regrind is stored, it should be packaged in a sealed container.
- Regrind should be kept clean and free from any foreign contamination.
- Stored regrind may require additional drying time to achieve the desired moisture content as described in the drying section.

Tooling Suggestions for Ultramid FR Grades

To minimize corrosive effects and deposits if phosphine is generated during injection molding:

□ Tooling considerations – Gating and steel selection

- Gating - The goal in gating design is to minimize the shear rate.
 - The best design scenario would be a generous edge gate.
- Venting - The mold should be vented at equal and regular intervals around the parting line.
 - Vents should also be added at the end of runners and cold wells.
 - Vents should be cleaned at regular intervals. Polishing vents will allow them to remain open longer.
- Steel selection is key and corrosive-resistant / high chrome alloy steels should be used. (All steel manufacturers have listings of such steels)
- Surface coatings are recommended if corrosive resistant steel is not used. (This should be reviewed with the toolmaker and coating suppliers)
- Beryllium copper should not be used unless it is surface coated.

Hot Runner use with Ultramid FR Grades

Hot runners can contribute to additional shear, creating thermal instability and should be avoided.

Hot Runners – Sizing and temp control

- Other creative gating design options should be considered first.
- If not possible, an externally heated system is a must.
- Manifold and nozzle drop channel size should be designed to reduce shear while also minimizing the residence time.
- Channel paths should be streamlined to eliminate all areas for hang ups which can create dead spots.
- Additional care should be taken with thermocouple locations as accurate temperature control is key.
- Since corrosion could occur, manifold and nozzle drop steel selection is important and should be considered.

Tips for Success for Ultramid FR Grades

Tips for success

- Ensure adequate drying to the recommended moisture levels.
- Keep all temperatures at the lower end of the recommended range.
- Provide good ventilation of the machine and all work areas.
- Select proper steels and coating materials for tooling.
- Size runners and gates to minimize shear degradation
- In general, avoid hot runners, but if not, follow the guidelines.
- Ensure proper material and part handling practices.
- Have periodic reviews of these guidelines, especially for new hires.

Phosphine Health Effects *Information*

Occupational exposure limits:

- 0.3 ppm PEL-TWA *Permissible Exposure Limit Time - Weight Average* (8 hours per day)
- 1 ppm STEL – *Short Term Exposure Limit* (15 minutes)

Short-term overexposure effects:

- Irritating to nose, throat, lungs
- Headache, dizziness, nausea, abdominal pain, vomiting, diarrhea
- Tightness of chest, cough
- Fatigue

Long-term overexposure effects:

- Similar affects as noted on short term list above
- Liver and kidney damage (**Not expected if the short term effects listed above are addressed**)

Final note on monitoring *Information*

- *It has been shown that when a workplace is adequately ventilated and when proper processing conditions and work practices are used, the concentration of harmful gases (phosphine) will not exceed the maximum allowable concentrations of (0.3 and 1 ppm).*

Routine monitoring of the workplace is recommended some suggestions:

- Drager Color Detector Tubes: Part No. 8101 611 & CH 31101
- Drager Acura Pump: Part No. 6400000
- ASC Master Tech: 1-800-327-4260

Monitoring Companies *Information*



- ❑ **Companies who do in plant monitoring typically charge by the hour plus all additional travel expenses.**
 - *Taylor Point Technical Inc. 170 N Taylor Point Dr, The Woodlands, TX 77382-1241 (936-321-0475)*
 - *Champeda Inc. 5 Fead St, Orangeville, Ontario L9W 1A6 (519-941-9013)*
 - *Enviro-health Inc 1690 Woodlands Rd, Maumee, Ohio 43537 (419-866-9783)*

Questions and follow up:

Contact your local BASF Technical Representative

This information is provided for your guidance only. We urge you to make all tests you deem appropriate prior to use. No warranties, either expressed or implied, including warranties of merchantability or fitness for a particular purpose, are made regarding products described or information set forth, or that such products or information may be used without infringing patents of others.