

# Rotational Molding

## Improving Part Cosmetics

Removing Surface Pitting, White Haze, Color Swirl & Dark Spots

# Part Cosmetics

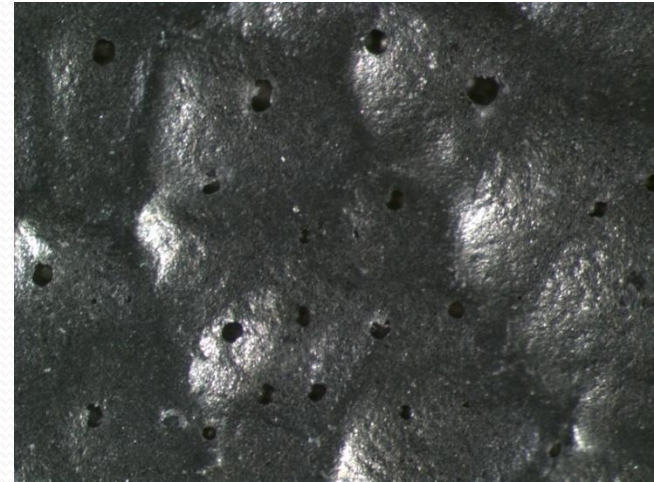
## Outline

- Pitting - Defined and root cause
- White haze - Defined and root cause
- Solutions to prevent pitting and white haze
- Color Swirl/Dark Spots - Defined and root cause
- Solutions to prevent color swirl/ dark spots
- Trends that lead to poor cosmetics – Break the cycle
- Procedures to maintain good part cosmetics

# Pitting and White Haze

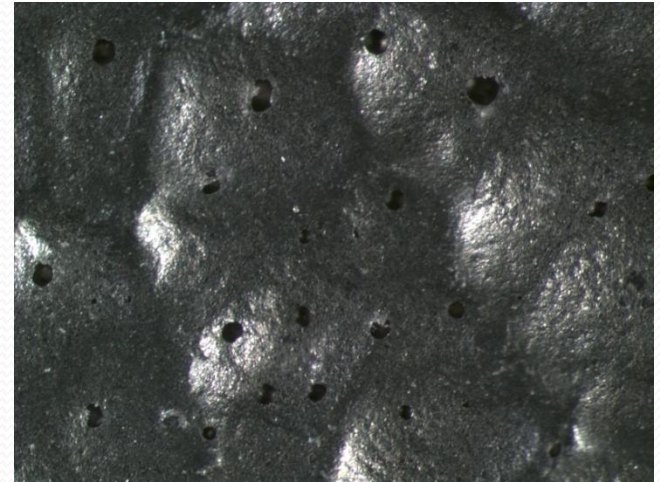
# Pitting/White Haze

- Pitting
  - Small pin holes in surface.
  - Can increase just after tool is cleaned or common with new tools.
  - Gradually lessens as tool is used.
  - Difficult to clean part when dirt gets into pinholes.
  - Causes appearance and cleaning issues.
  - Can appear with certain dry blended pigments.
- White haze
  - Usually increases as pitting decreases.
  - Can appear shortly after tool is cleaned.
  - Very common with stained tools.
  - Flame treating the part can usually remove, but secondary process is costly.
  - Severe cases will lessen with flame treat but not disappear completely.



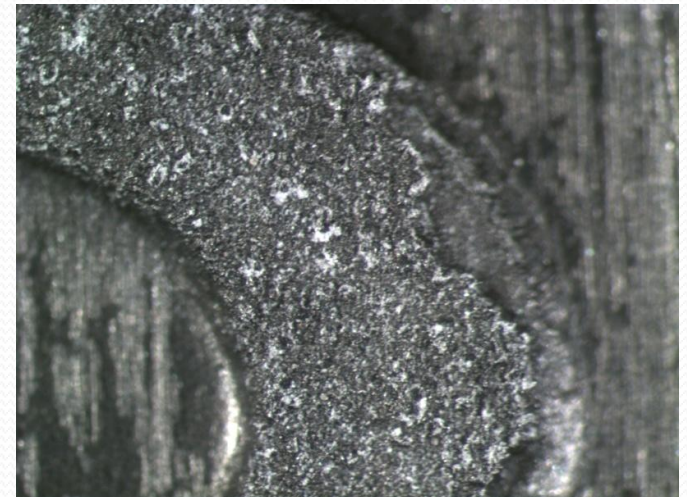
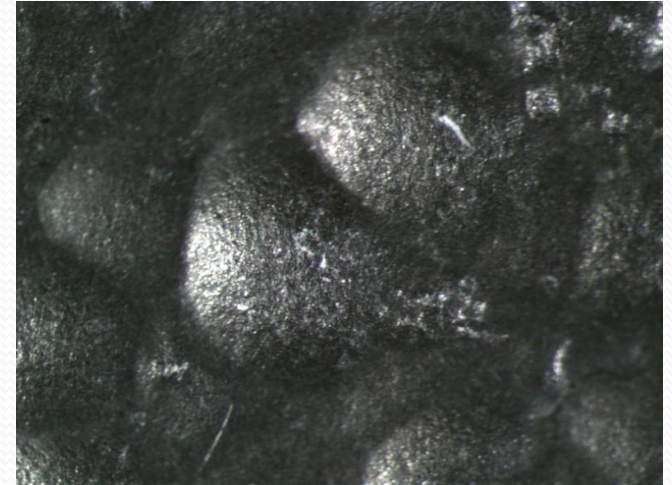
# Pitting – Root Cause

- Aluminum and steel (especially welds) have porosity.
- After mold is cleaned or in case of a new mold, the microscopic pores are exposed.
- Moisture is captured in pores usually by water-based mold release/anti-stats sprayed onto mold surface.
- Upon mold heating, water turns to steam and pushes into molten polymer.
- Moisture can be re-introduced on every molding with water-based released.
- Overtime aluminum pores can get coated so less moisture absorbed.
- Some pigments can cause pitting by off-gassing (moisture or ?).

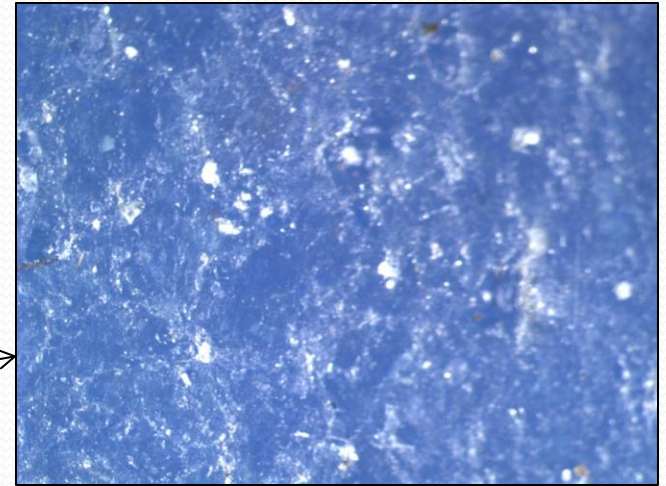
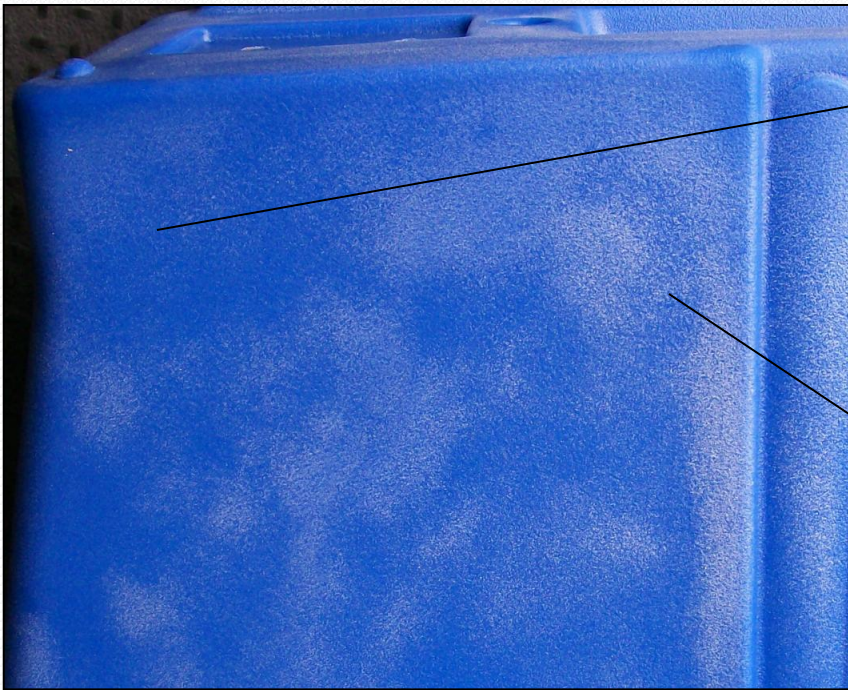


# White Haze Root Cause

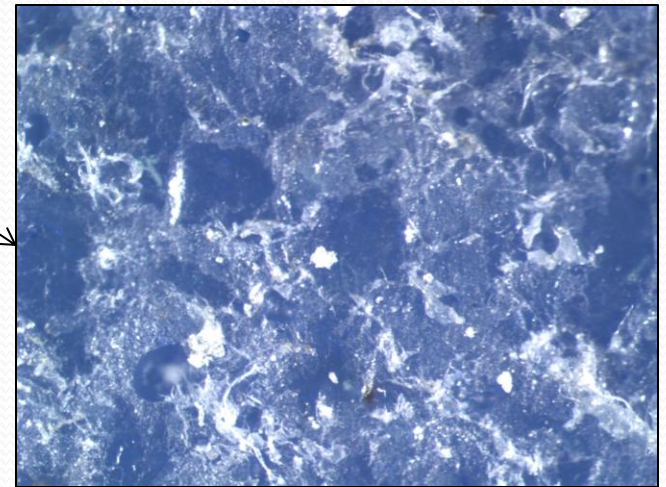
- Part sticks and is literally ripped away from mold surface, leaving thin film of material on mold surface.
- White haze is microscopic polyethylene fibers from part pulling away from mold surface.
- Flame treat will shrink/melt fibers back into part surface.
- Severe cases – flame treat causes fibers to form into small balls on surface thus haze does not completely disappear.



# White Haze



Flame treated



Severe White Haze

# Resolve Pitting/ White Haze

- If pitting with pigmented part, check natural material. If no pitting with natural material, check with pigment supplier. Do you dry the pigment?
- Use proper strength mold release
  - Proper mold release will seal tool to prevent porosity of mold absorbing moisture.
  - No moisture – no pitting
- Properly apply mold release
  - Proper strength and application will release part without sticking to mold walls .
  - Most mold releases do not have to be “baked on” but you do need to remove moisture. Thus short oven cycle to remove moisture before and after applying mold release.
  - Proper strength and application will keep good dimension stability (no warpage)
  - No sticking = no white haze

# Stained Tools

- Dry pigment cannot stain tools. (Anodized aluminum?)
- If tool stained, then there is a thin film of polymer on tool which is stained from pigment.
- Mold release was made to release from polymer, when applied to a stained tool, mold release is applied to polymer and will have very short life cycle.
- Applying mold release to a stained tool (PE surface) is less effective, increase use and cost of mold release.
- Clean stained tools before applying mold release.
- First signs of staining should be cleaned to prevent expensive process of cleaning severely stained tools.

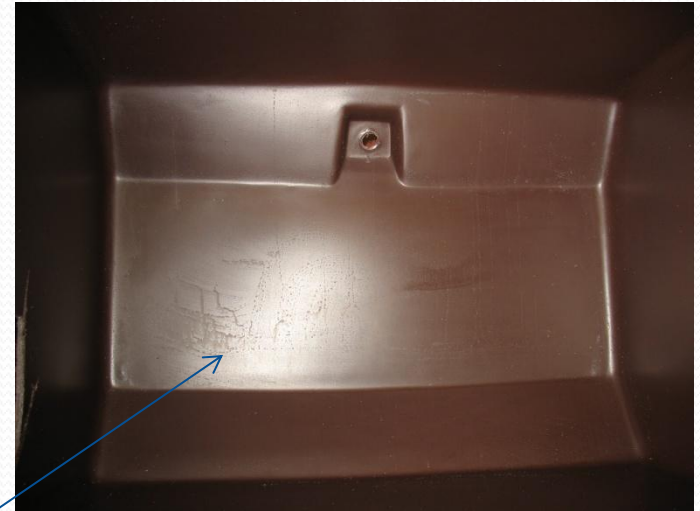
# Mold Release Study

- Degreased/cleaned complex tool.
- 440 & 442 from Stoner Inc.
  - 440 – Sides and lip.
  - 442 –Bottom.
  - No warpage.
  - Developed some white haze on sides.
- 442 on complete tool
  - No haze.
  - No warpage.
  - No pitting.
  - 36+ cycles until slight haze.
  - Touch up with short oven cycle.



# Applying Mold Release

- Do not spray/pour
- Do not allow to drip
- Use rag and wet entire surface of tool
- Run tool in oven (short cycle) to remove moisture
- Excessive mold release will mark parts





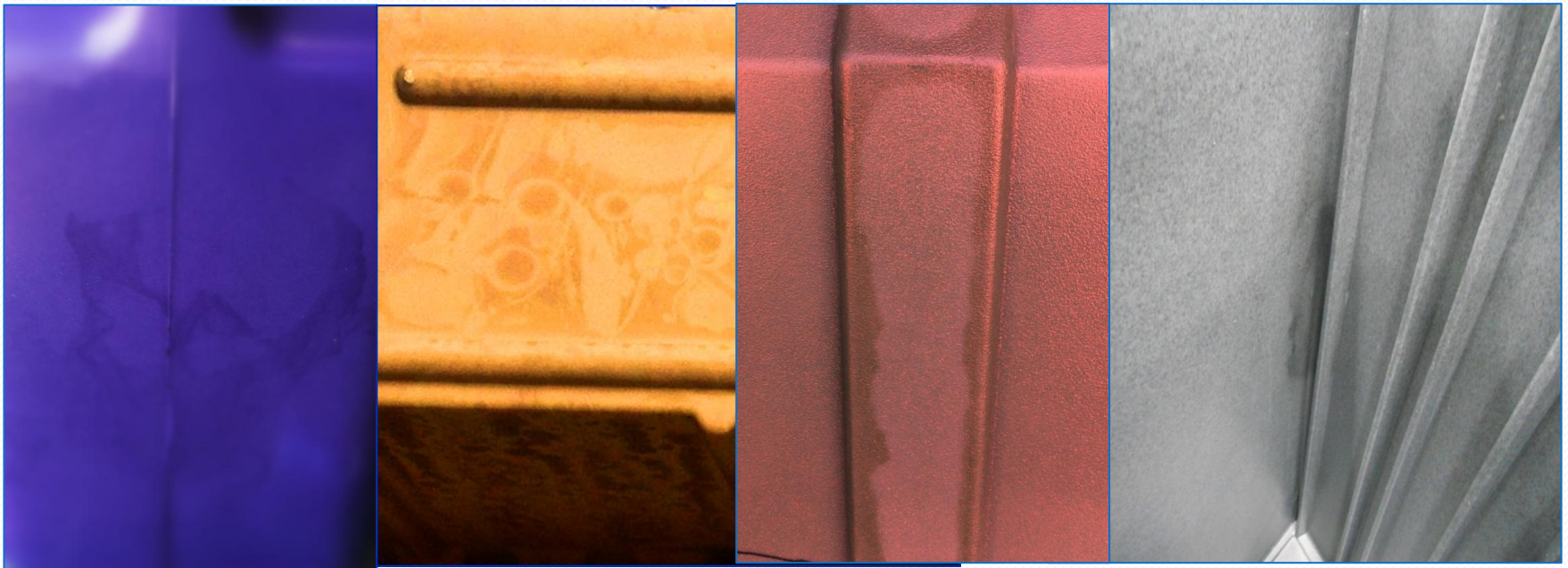
# Mold Release vs Sealer

- In our experience, mold release is sufficient as sealer but have heard of severe porosity in older aluminum tools.
- Can use sealer before mold release with high porosity molds. Heat treat before and after each application.
- Aluminum technology today can remove a great deal of porosity but not all.
- Mold release in resin may not seal tool/should use sealer.
- Avoid using mold release as sealer with resin with mold release to avoid warpage.

# Color Swirl /Dark Spots

# Color Swirl / Dark Spots

- Color Swirl / Dark Spotting can be:
  - A high concentration of dry blended pigment on part surface
  - Dust attracted to concentration of static charge on part



# Color Swirl

- Fines have more pigment per volume and will give darker/richer color.
- Higher percent of fines increases possibility of color swirl.
- Poor blending will allow fine particles with pigment and pigment to be attracted to static charge on tool and melt first and leave a high concentration of color.
- Poor blending of granites allow color separation.
- Static charge in powder concentrates pigment and fine particles in specific areas of a static charge on a tool.
- Low humidity and non-grounded equipment will increase stored static charge.
- Long/fast rotation creates static in powder before melt.
- Stained/PE coated tools retain static charge. No metal contact to dissipate static charges even with ground tools.



# Dark Spots /Odd Patterns

- Dirt/dust attracted to concentration of static charge on part after removal.
- Can develop odd patterns
- Usually can be removed with anti-stat wipes and soap & water to wash
- However, permanent staining can occur in high heat environments.
- Be aware of stretch wraps with heavy *plasticizers/tactifiers* that may pull contaminations into surface when absorbed into PE and cause permanent staining.



# Trend – Break the Cycle

- Cleaned tool/ New tool.
- Pitting appears because no mold sealer and/or poor application of water-based mold release.
- Polyethylene film begins to build on mold surface.
- Pitting decreases because of PE film seals mold in most areas.
- White haze on parts increases because now applying mold release on PE and mold release has very short life. Actually pulling PE from PE.
- Mold staining in/on PE film on tool surface begins with dry pigmented parts.
- PE film thickens, white haze increases, static charges build because charge insulation properties of PE film.
- White haze becomes severe and flame treatment does not remove all white haze.
- Color swirl now torments molder (especially if low humidity and have not been properly mixing pigments)
- Operators don't always relate low humidity with problem and are frustrated.

# Procedures for Good Cosmetics

- Clean tool
  - Remove polyethylene film / pigment staining.
  - Remove cutting oil/polishing compounds and cuttings.
- Remove moisture
  - Run tool through oven and remove all moisture
  - Apply mold sealer and/or mold release – be sure to remove all moisture after each application. Oven best source.
- Insure low fines in powder and use high intensity mixers on all dry blend applications.
- Use compounded color to eliminate color swirl, color bleed, and improve mechanical properties.
- Electrically ground all pulverizing equipment, high intensity mixers, material handling equipment, tools. etc.
- Use static charge dissipaters, antistatic additives, wipes for tools (avoid water based).

# Procedures for Good Cosmetics (cont.)

- Monitor parts for pitting
  - Pitting needs sealer and/or mold release.
  - Apply proper grade and apply properly (rag, bake off moisture).
- Monitor parts for white haze, color swirl and/or tool staining
  - PE film building on mold causes white haze. Will begin to stain tool.
  - PE film will cause more frequent color swirl issues.
  - Clean tool.
- Monitor humidity – recognize color swirl more likely with low humidity. Color swirl may not appear until low humidity.
- Consider anti-stats, ionic air discharge to avoid dust/dirt on electrically charged parts.
- Avoid plasticizers found in some stretch wrap or wiping dirt with solvents/aromatics .

Questions?