



Resolving Processing and Part Performance Issues by Changing Materials.

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“The Fixers”



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- 21 years experience
- Plastics Engineering Technology – Pittsburg State University
- 6 Sigma Black Belt
- Process Engineering Background
- Automotive/Micro molding

Dr. Cliff Watkins

- 39 years plastics industry veteran
- Graduate of The Citadel
- Past owner of TP Composites – sold to Techmer in 2013
- PhD in Chemistry
- 14 years with PPG Fiber Glass

Resolving Processing and Part Performance Issues by changing materials.

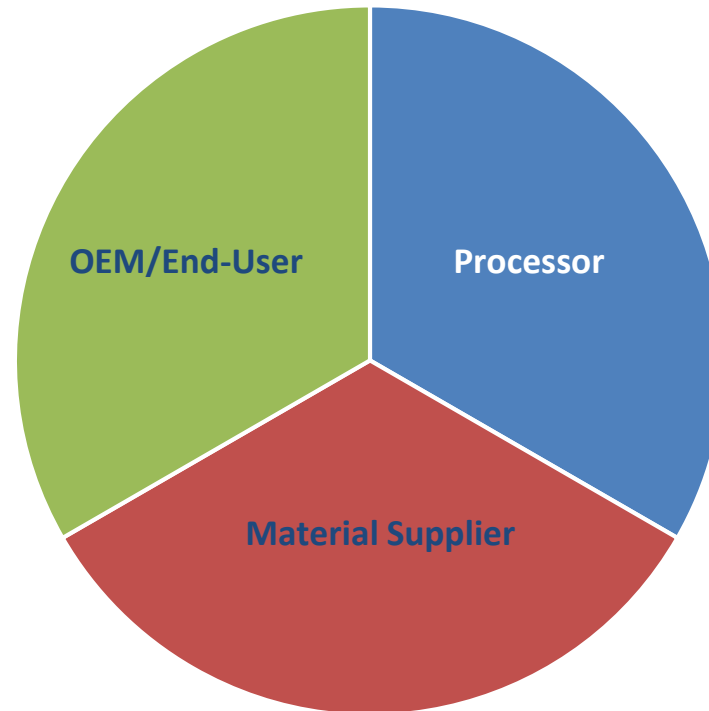
- Many times, too many times, processors will bang their head against the wall trying to resolve processing and part performance issues by adjusting and changing processing parameters.
- Despite these efforts, the issues still exist.
- Unfortunately, the processors customer, the OEM, who specified the material, will make this the processors issue, where in fact the issue is the material being used. No processing changes can resolve the issues.
- This webinar will highlight the four important steps to successfully problem solve injection molding issues. We will show case studies where processors struggled with resolving these issues and where changing material was the ultimate solution.



Potential Processor/Molder Issues

- *Cracking/breakage*
- *Material Degradation*
- *Short Shots*
- *Part imperfections*
 - *Burning*
 - *Splay*
 - *Black Specks*
 - *Blemishes*
 - *???*
- *Flash*
- *Sticking in the Tool*
- *Extended Cycle Time*
 - *Nucleation*
 - *Filler*
- *Part Warpage*
- *Dimensional Stability*
- *Shrinkage*
- *???*

Development Partnership



Four Pillars to Resolve Plastic Issues

Part Design Mold Design Processing Material



Short cuts in the design process can result in processing issues

Four Pillars to Resolve Plastic Issues

Part Design



- **Nominal wall**
 - **Thin to thick**
- **Sharp angles**
- **Flow length**
- **Weld lines**
- **Sink marks**
- **Gate vestige**
- **FEA simulation**
- **ETC;**
- **ETC;**

Four Pillars to Resolve Plastic Issues

Mold Design



- *Cooling line placement*
- *Gate size*
- *Cold runner/hot runner sizing*
- *Cavitation*
 - *Flow length*
- *Draft*
- *ETC;*
- *ETC;*

Four Pillars to Resolve Plastic Issues

Processing



- **Machine selection**
 - *Barrel capacity*
 - *Clamp tonnage*
 - *Screw design*
- **Drying of material**
- **Processing conditions**
 - *Melt temp (set VS actual)*
 - *Mold temp (set VS actual)*
 - *Injection speed*
 - *Pack time*
 - *Pack pressure*
 - *Screw speed*
 - *Back pressure*
 - *Cooling time*
 - *Decompress*
- **ETC;**



Four Pillars to Resolve Plastic Issues

Material



- **Material**
 - **Variation/consistency/uniformity**
 - **Within a lot**
 - **Lot to lot**
 - **Is it the right material?**

Material - The Design Funnel

Physical

Dimensional Stability
Flatness & Warp
Color & Appearance

Chemical

Exposed to Chemicals
Environmental Humidity
Immersion / Splash Contact

Thermal

Use Temperature
Min / Max Boundaries
Spike Temperature

Mechanical

Impact	Static & Dynamic Load	Weathering
Strength	Sliding or Rotating	Flammability
Stiffness	Snap-fit, Screw Boss, Threads	Electrical Properties

Regulatory

UL, ATEX, FDA, USP Class VI, ISO 10993, EU 10/2011, Auto

Material Options

1 ??
2 ??
3 ??

***Lots of Upfront
Questions,
to Generate Answers
That lead to a Better
Design***



Case Studies

Case Study #1

Application

- Structural Housing
- OR Large flat parts
 - Bezels
 - Housings
 - Internal structural parts
- Currently using 30% glass reinforced PA6
 - House resin
 - Met price point
 - Met ALL performance criteria

Issue/Problem

Analysis

Results – “The Fixers”

Case Study #1

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Analysis

- Part design – OK
- Mold design – OK
- Processing - OK
- Material - ???
 - Crystalline – warpage?
 - GF – fiber alignment?
 - No initial mold flow completed

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Results – “The Fixers”

- ***PolySource recommended mixed glass or mineral/glass PA6 compound***
 - Reduced fiber alignment
 - Maintains shrinkage
 - Continued to meet all other performance criteria despite
 - Reduced strength
 - Reduced toughness

With Slightly Reduced Mechanicals Part Still Met Specifications

Case Study #2

Application

- Optical lens
- Currently using 20 melt polycarbonate
- Multiple cavitation

Issue/Problem

Analysis

Results – “The Fixers”

Case Study #2

Application

- Optical lens
- Currently using 20 melt polycarbonate
- Multiple cavitation

Issue/Problem

- Could not fill the part
- Using 80% of the barrel...had to use this machine
- Increased temperature resulted in:
 - Material degradation
 - Black specks
- Inject faster
 - Splay
 - Maximized machine pressure
 - Flash
 - Brittle parts
- Blocked off cavities to resolve issue but increased cost

Analysis

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- Part design – OK
- Mold design – OK
- Processing – Tried everything with negative results - OK
- Material
 - within specification
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Results – “The Fixers”

- ***PolySource recommends a higher flow/lower viscosity 32 melt polycarbonate***
- Able to fill the part with recommended processing conditions.
- No material degradation/black specks/flash/brittle parts
- Able to use all cavities to meet original cost quotes.
- Part still met all mechanical requirements
- No increased cost on resin

A Simple Change Within Resin Family to Lower Viscosity

Case Study #3

Application

- Automotive Seat Adjustor
- 50% GF PA66
- Unscrewing mold

Issue/Problem

Analysis

Results – “The Fixers”

Case Study #3

Application

- Automotive Seat Adjustor
- 50% GF PA66
- Unscrewing mold

Issue/Problem

- Part sticking on the unscrewing core
- Unscrewing motor burning out ~ 100 shots
- Processing changes
 - Less pack
 - parts small/Increased torque on unscrewing/Parts weak due to voids
 - Overpack (some improvement but flash)
 - Cold mold –high internal stress/dimensional changes with stress relaxation.
 - Melt temp
 - Up – shrunk more-more sticking
 - Down – short shots/not-filling

Analysis

Results – “The Fixers”

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Unanticipated issue when molding in production

Results – “The Fixers”

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Unanticipated issue when molding in production

Results – “The Fixers”

- *PolySource recommended addition of mold release to existing formulation (200 ppm)*
- Inconsequential change by OEM, still made automotive specification....reviewed critical dimensions
- No plate out
- No secondary operations concern, IE; painting, decorating, ETC
- Unintended improvement of reduce torque in end use.

Slight Modification to Existing Formulation

Case Study #4

Application

- Radiator Fan
- Currently using GF PA66

Issue/Problem

Analysis

Results – “The Fixers”

Case Study #4

Application

- Radiator Fan
- Currently using GF PA66

Issue/Problem

- No processing window with material variability
 - Flash
 - Short shots
 - Parts had splay
 - Variation - within lot
- Would start off OK and then after 4-5 hours issues began
- Processor focused on material

Analysis

Results – “The Fixers”

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Application

- Radiator Fan
- Currently using GF PA66

Issue/Problem

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Analysis

- Part design – OK
- Mold design – OK
- Processing
 - Analyzed moisture content – out of range to meet customers part requirements.
 - Customer does not have drying capacity to meet production needs
 - Needs to add more dryer capacity....OR change material
- Material – reviewed application requirements and determined GF PA66 was over specified/engineered

Results – “The Fixers”

Case Study #4

Application

- Radiator Fan
- Currently using GF PA66

Issue/Problem

- No processing window with material variability
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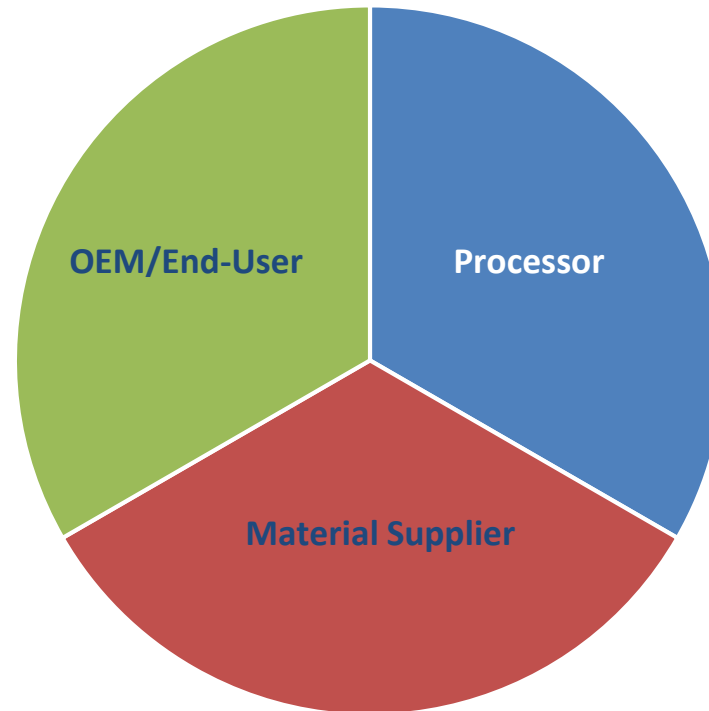
- *PolySource recommended glass reinforced PP*
- Meets applications requirements
 - Stiffness
 - Impact
 - Heat resistance
- Cost reduction
 - No need to dry material
 - < \$/lb.
 - < Specific gravity

PolySource Performed a Deep Dive on Actual Application Requirements

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Material Supplier can be a Resource Direct to the OEM on Material Issues

Four Pillars to Resolve Plastic Issues

Part Design Mold Design Processing Material



Use your Resin Supplier to work with your Customer/OEM in reviewing Issue



Questions ??



Thank You

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