101
Multi-Layer
Extrusion Blow Molding

Presented by Jens Schlueter

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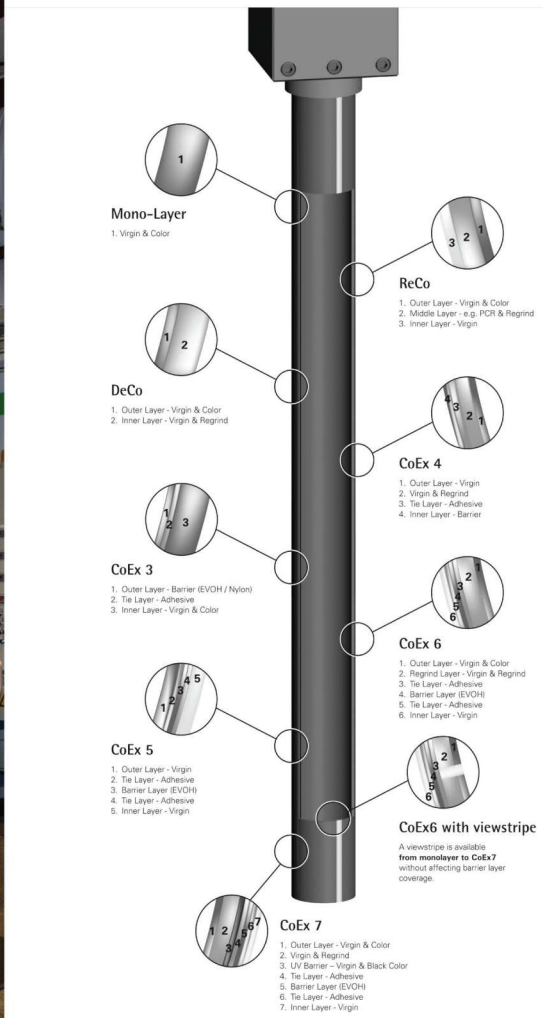
PITTSBURGH
SEPTEMBER 8-10
2025
OMNI WILLIAM PENN PITTSBURGH HOTEL AT STATION SQUARE

Technical Basics



Mono-Layer
1. Virgin & Color

ReCo
1. Outer Layer - Virgin & Color
2. Middle Layer - e.g. PCR & Regrind
3. Inner Layer - Virgin

DeCo
1. Outer Layer - Virgin & Color
2. Inner Layer - Virgin & Regrind

CoEx 4
1. Outer Layer - Virgin
2. Virgin & Regrind
3. Tie Layer - Adhesive
4. Inner Layer - Barrier

CoEx 3
1. Outer Layer - Barrier (EVOH / Nylon)
2. Tie Layer - Adhesive
3. Inner Layer - Virgin & Color

CoEx 6
1. Outer Layer - Virgin & Color
2. Regrind Layer - Virgin & Regrind
3. Tie Layer - Adhesive
4. Barrier Layer (EVOH)
5. Tie Layer - Adhesive
6. Inner Layer - Virgin

CoEx 5
1. Outer Layer - Virgin
2. Tie Layer - Adhesive
3. Barrier Layer (EVOH)
4. Tie Layer - Adhesive
5. Inner Layer - Virgin

CoEx6 with viewstripe
A viewstripe is available **from monolayer to CoEx7** without affecting barrier layer coverage.

CoEx 7
1. Outer Layer - Virgin & Color
2. Virgin & Regrind
3. UV Barrier – Virgin & Black Color
4. Tie Layer - Adhesive
5. Barrier Layer (EVOH)
6. Tie Layer - Adhesive
7. Inner Layer - Virgin

Multi-Layer Blow Molding – Basics

- **Aesthetically Appropriate**
- **Durable**
- **Protective**
- **Sustainable**
- **Cost Effective**

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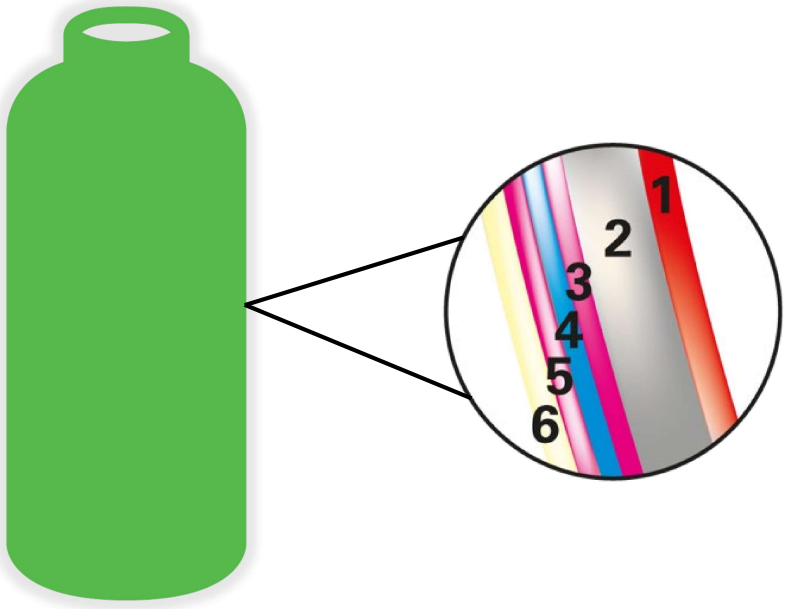
Multi-Layer Blow Molding – Basics



1. Virgin Outer Layer
2. Regrind/PCR Layer
3. Adhesive
4. Barrier Layer
5. Adhesive
6. Virgin Contact Layer

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Multi Layer Extrusion Head Design Process

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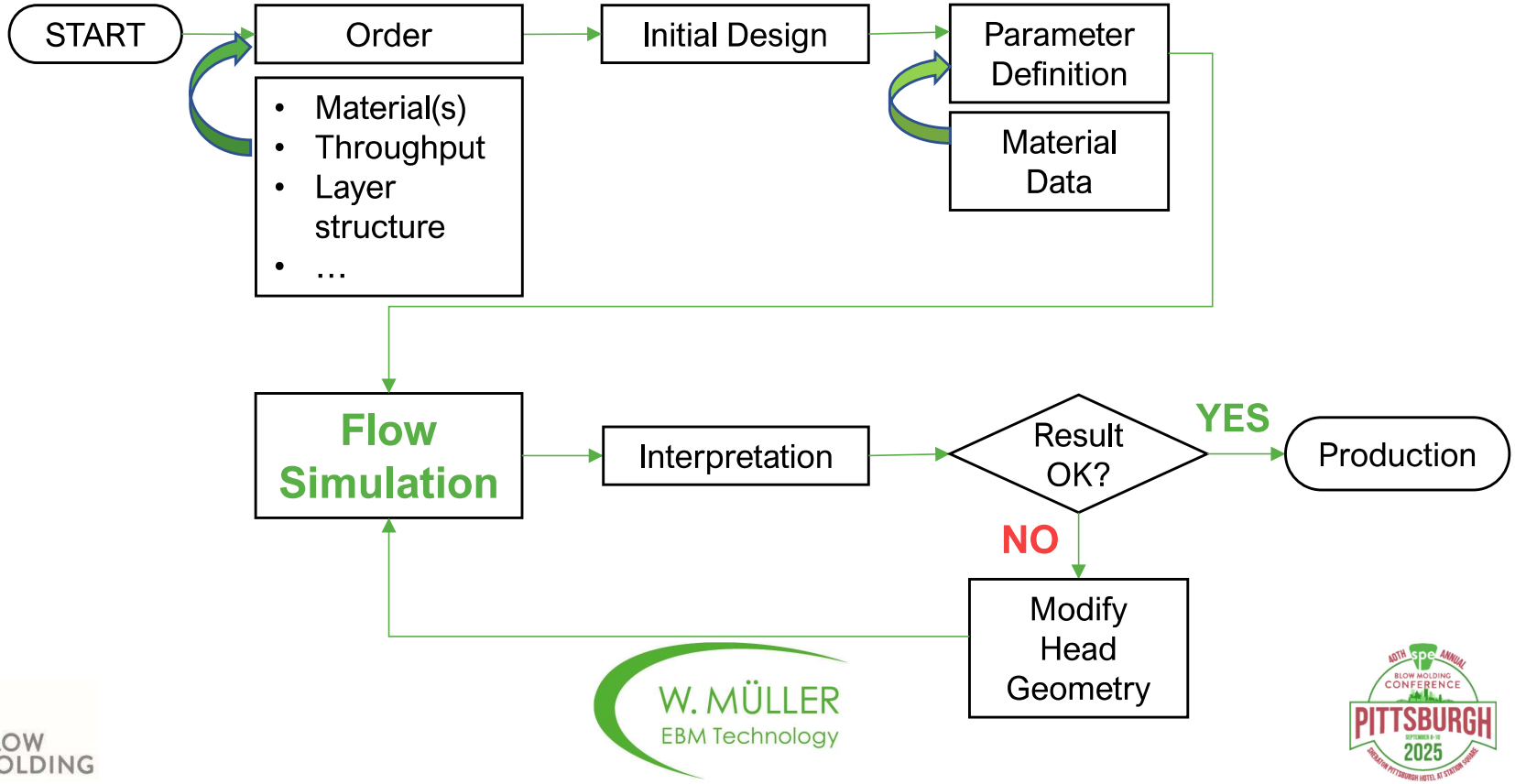
Multi-Layer Blow Molding – Design Process



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Multi-Layer Blow Molding – Evaluation of the Simulation Results

- Melt Pressure
- Stagnation Zones
- Parison Quality (Wall Thickness Distribution)
- Layer Velocity
- Melt Temperature

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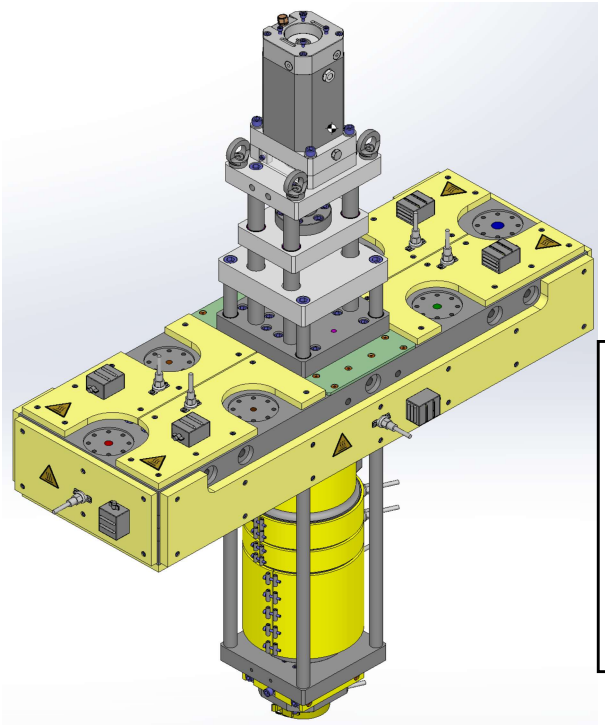
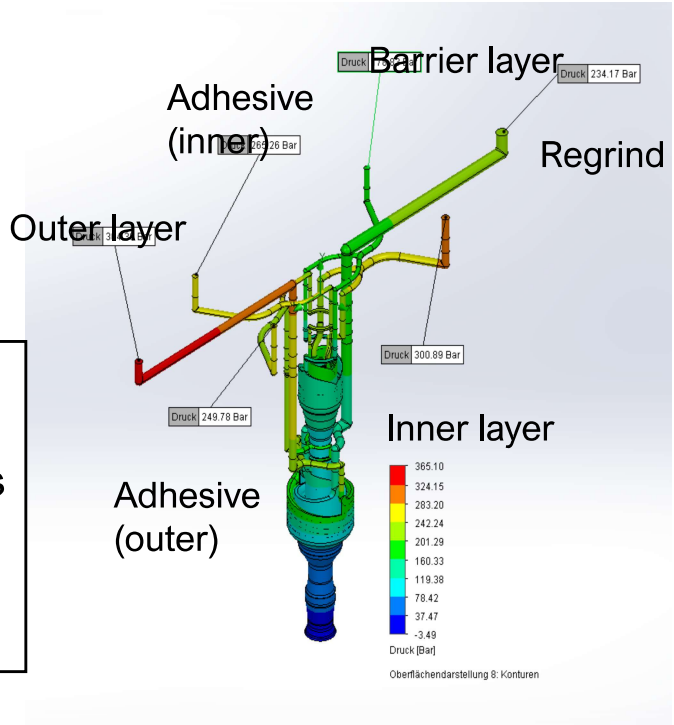
Multi-Layer Blow Molding – Melt Pressure Evaluation

CoEx 6-Layer Head – One Parison



Simulation



Flow channels are optimized so that the melt pressure is always under a critical level at highest given throughput.

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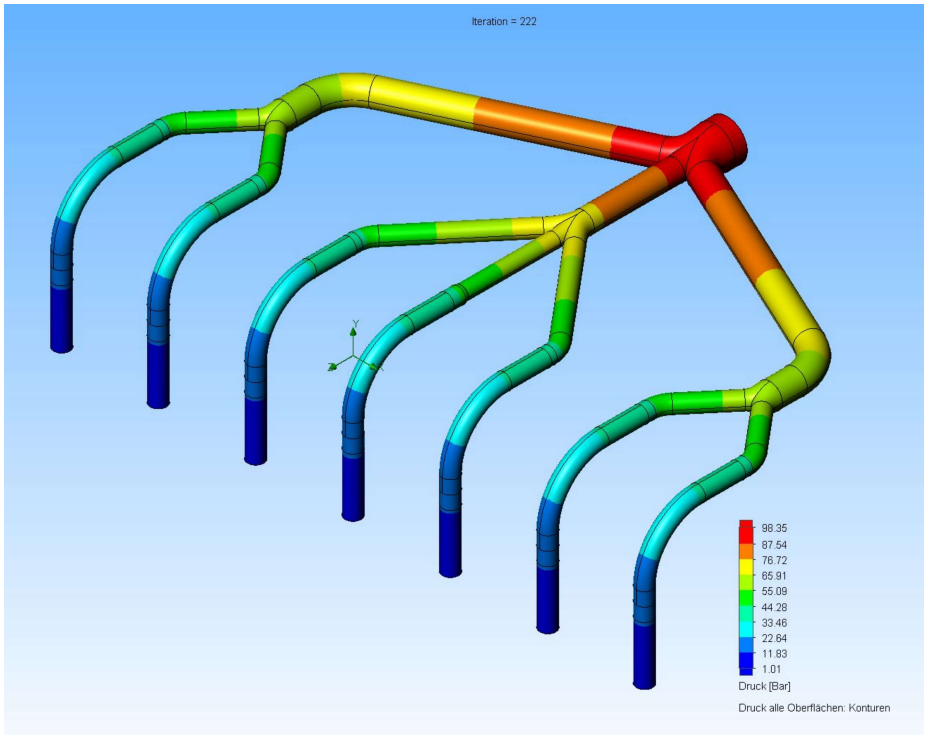
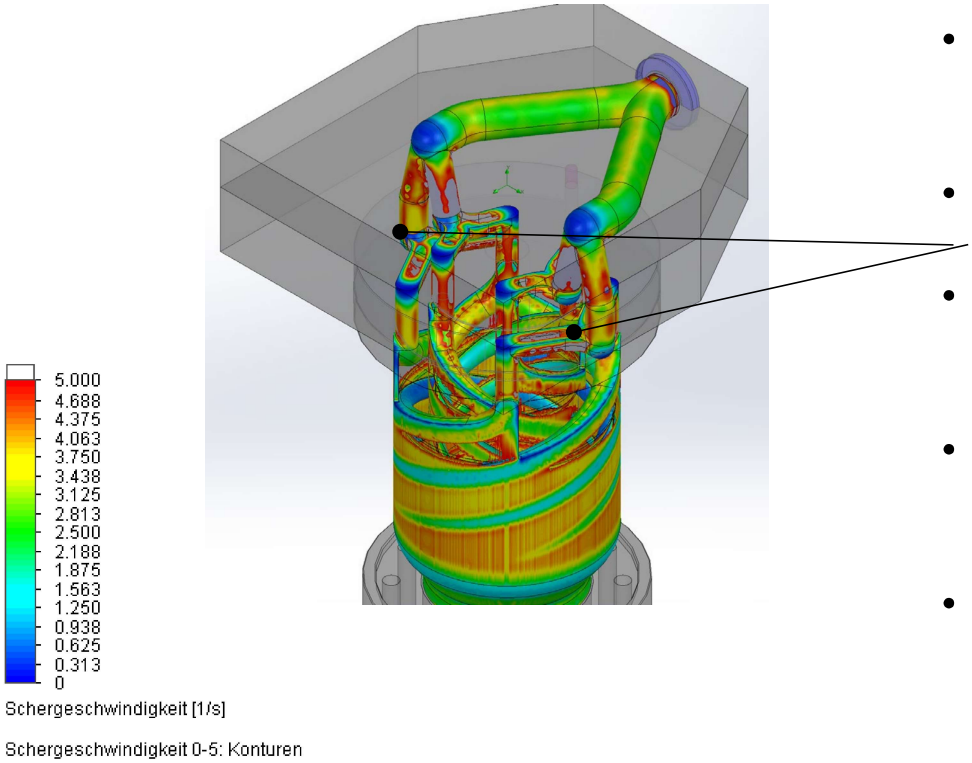
Multi-Layer Blow Molding – Melt Pressure Evaluation



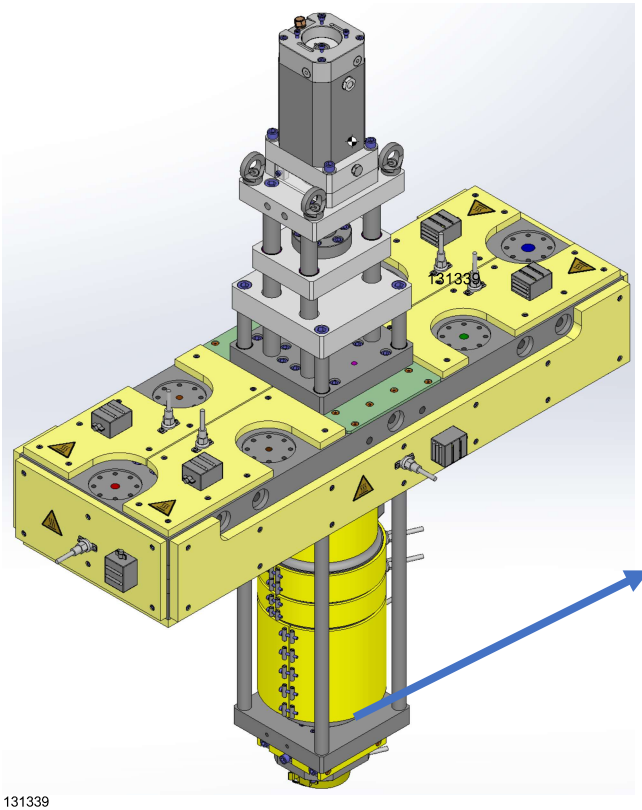
- Multi parison heads require equal melt preassures
- Any uneven number of parison required diffent flow channel designs to avoid using chokes to even parison lenght

Multi-Layer Blow Molding – Stagnation Zones



- Areas with low shear rates (blue) can be identified in Flow Simulation
- Material flow stagnates there
- By optimizing channel geometry, areas of stagnation can be reduced
- Thus, time for material and color change is reduced.
- Geometry optimization has to be done under consideration of manufacaturing processes

Multi-Layer Blow Molding – Parison Quality



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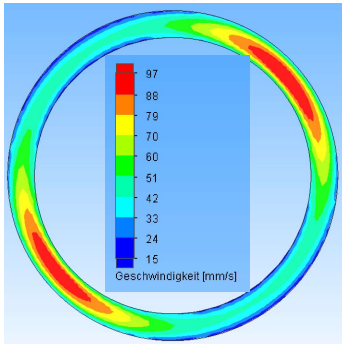

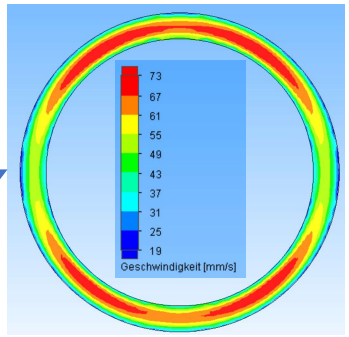

Initial Geometry
- Uneven distribution of outlet velocity
- Result: uneven wall thickness

Optimized Geometry
- Improved velocity distribution
- wall thickness more even

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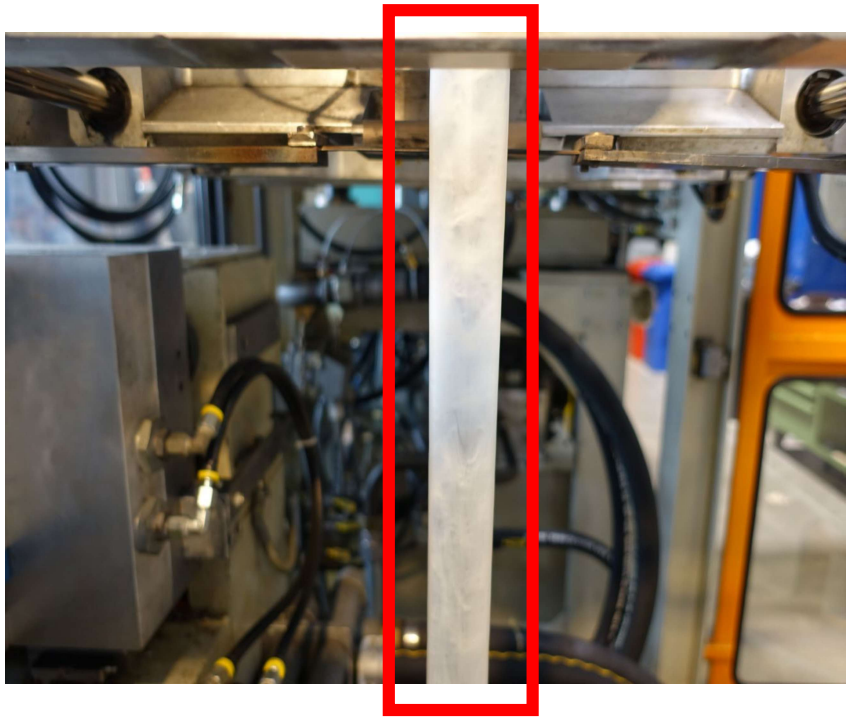
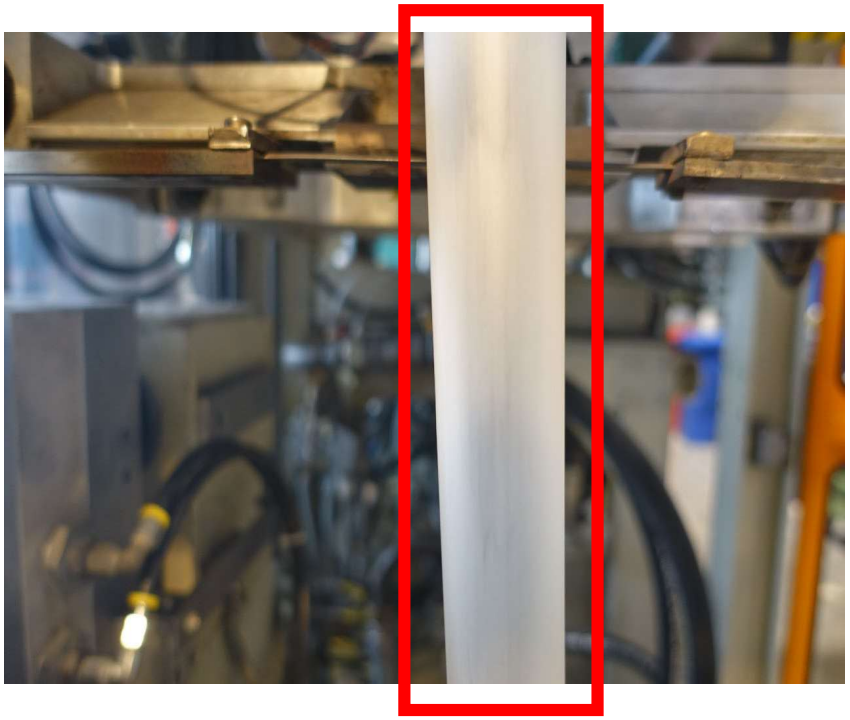
Multi-Layer Blow Molding – Parison Quality



Not Matching Layer Velocities



Matching Layer Velocities

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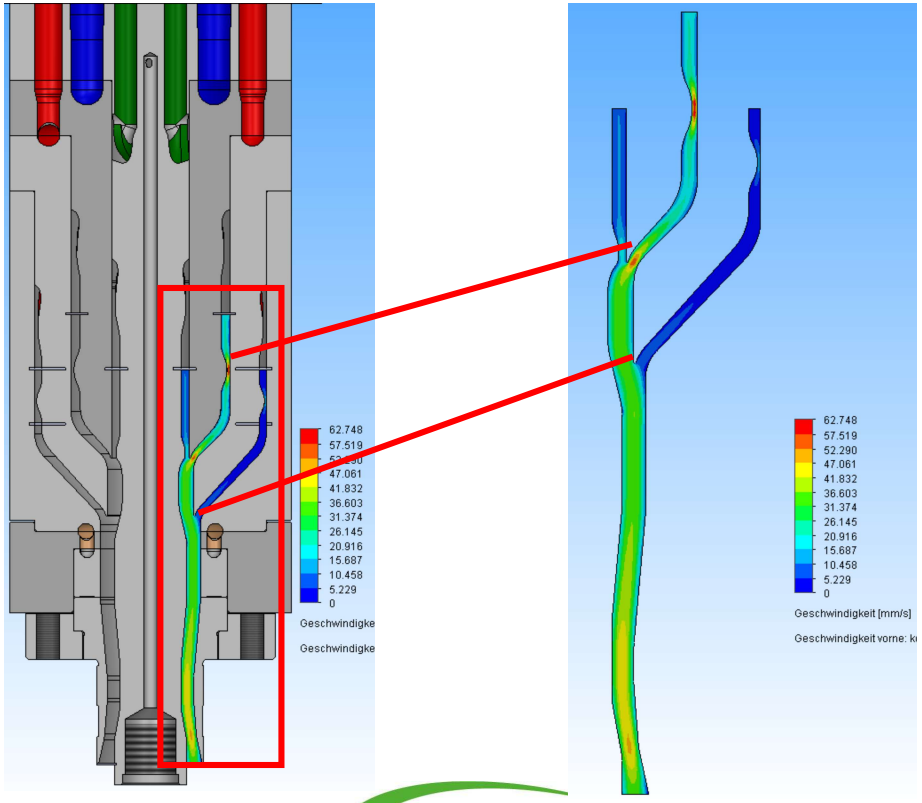
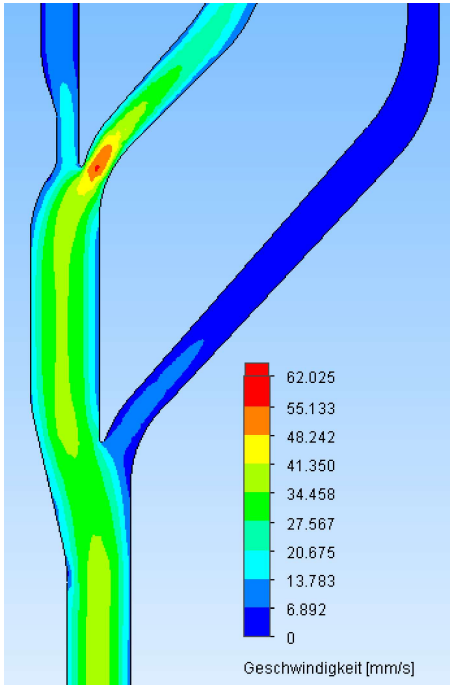
Multi-Layer Blow Molding – Layer Velocity

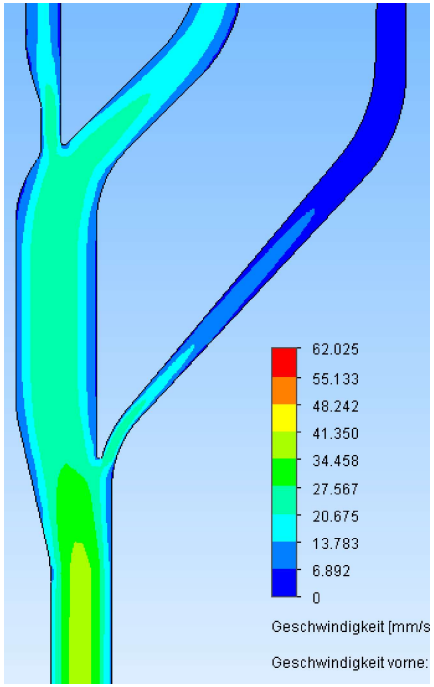
Cross-Section of 3-Layer Head



Multi-Layer Blow Molding – Parison Quality

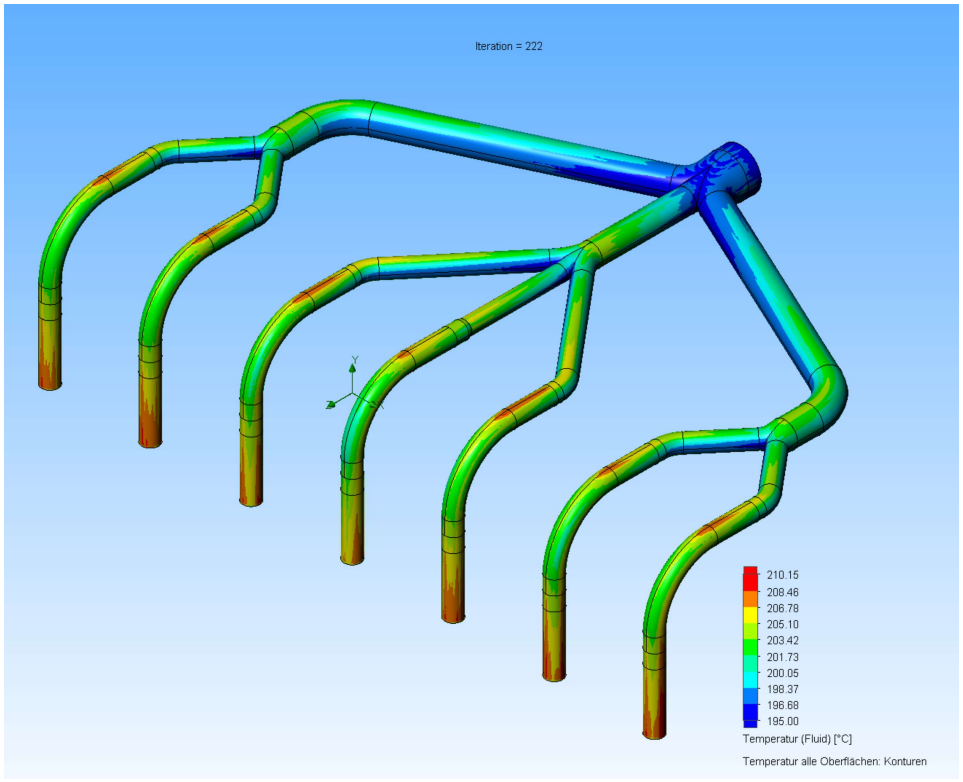


Initial Geometry



Optimized Geometry

Multi-Layer Blow Molding – Melt Temperature Evaluation



Multi parison heads require equal melt temperatures

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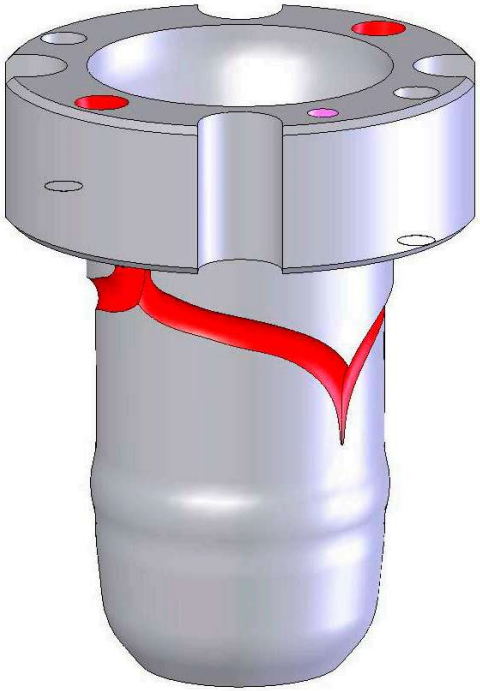
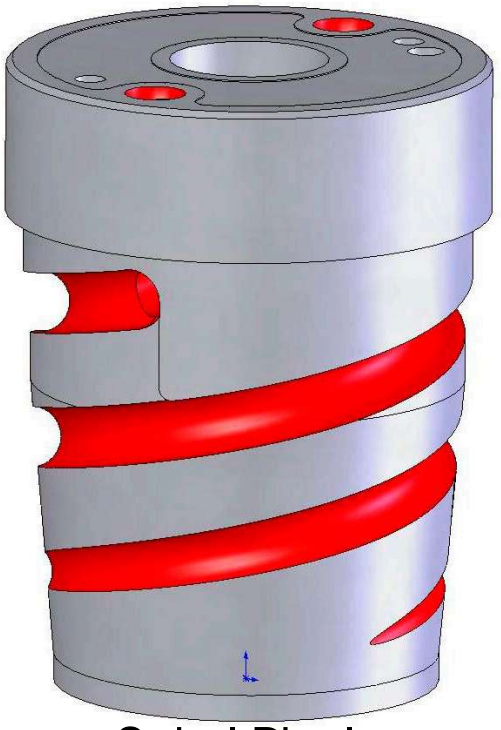
Multi-Layer Blow Molding – Insert Design



Dual Heart Pinola

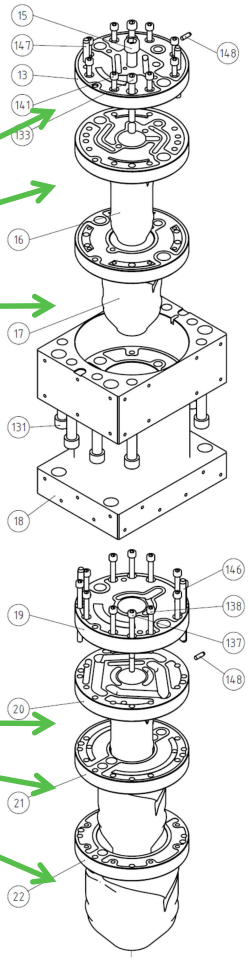


Spiral Pinola

Multi-Layer Blow Molding – Insert Design

Inside Layers

Outside Layers



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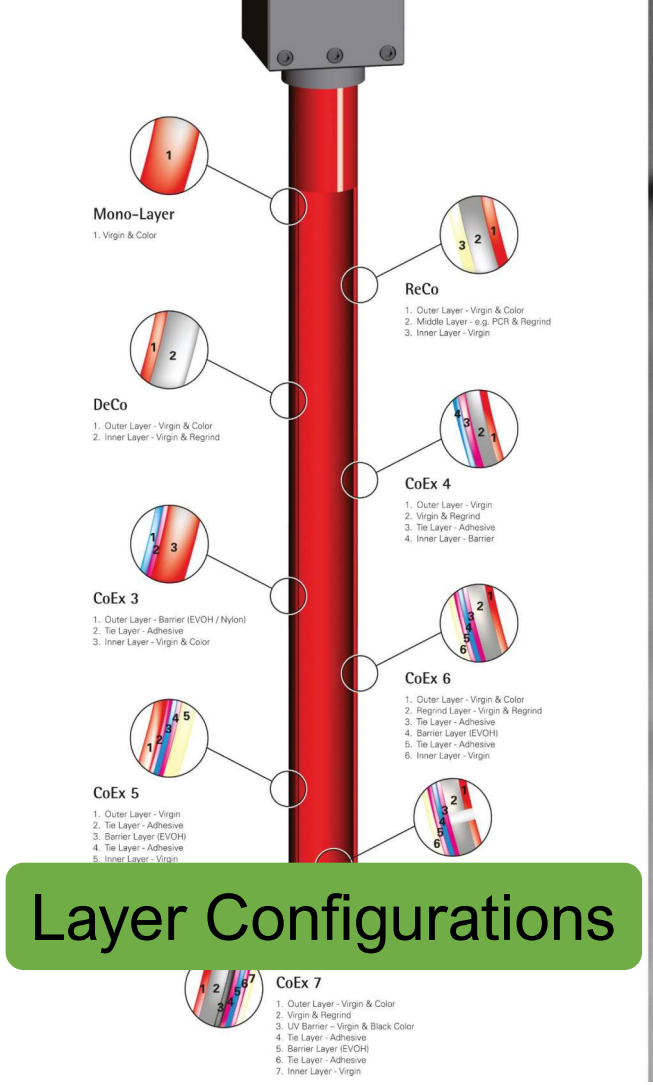
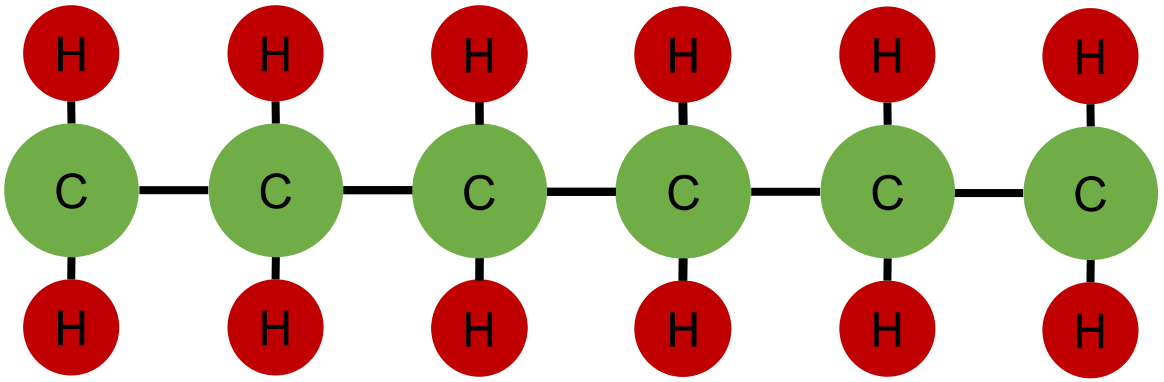


Layer Configurations

Multi-Layer Blow Molding Layer Configurations – Material Considerations



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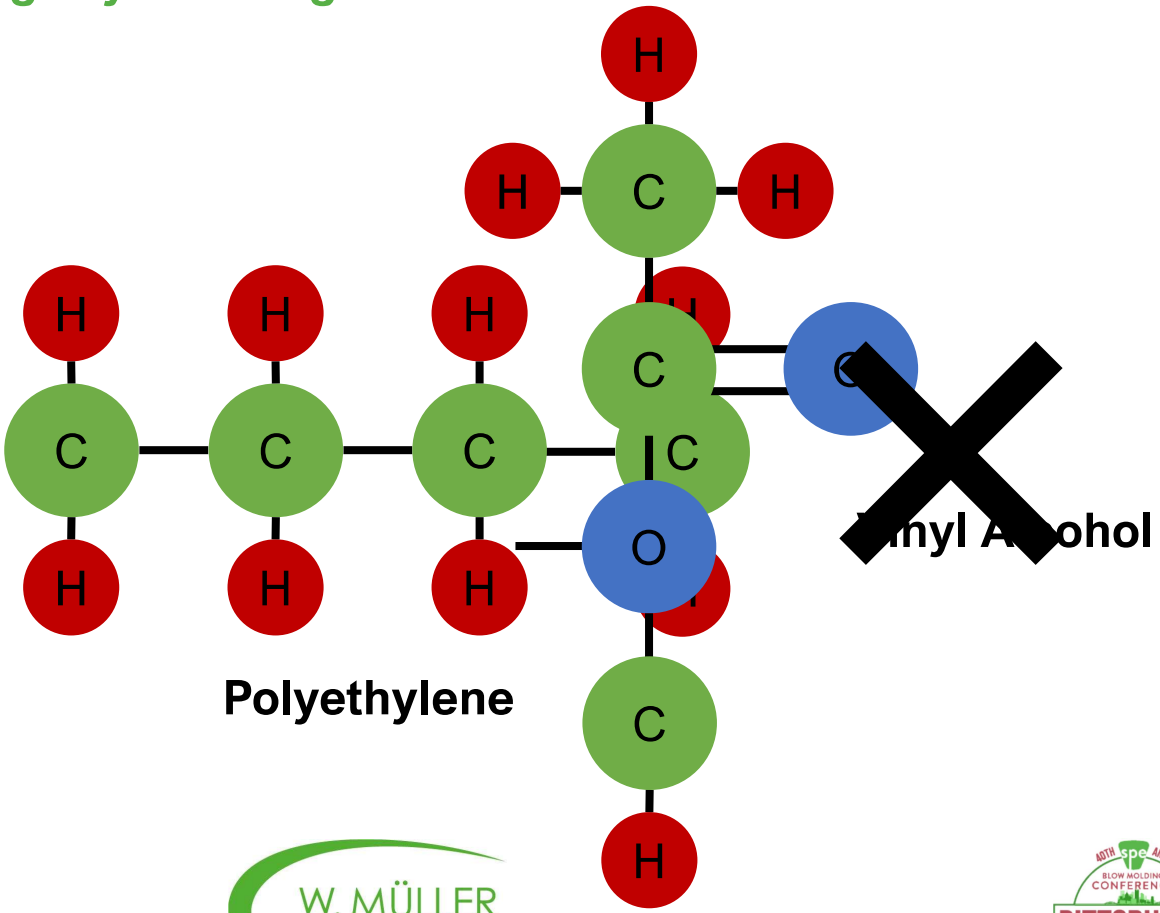
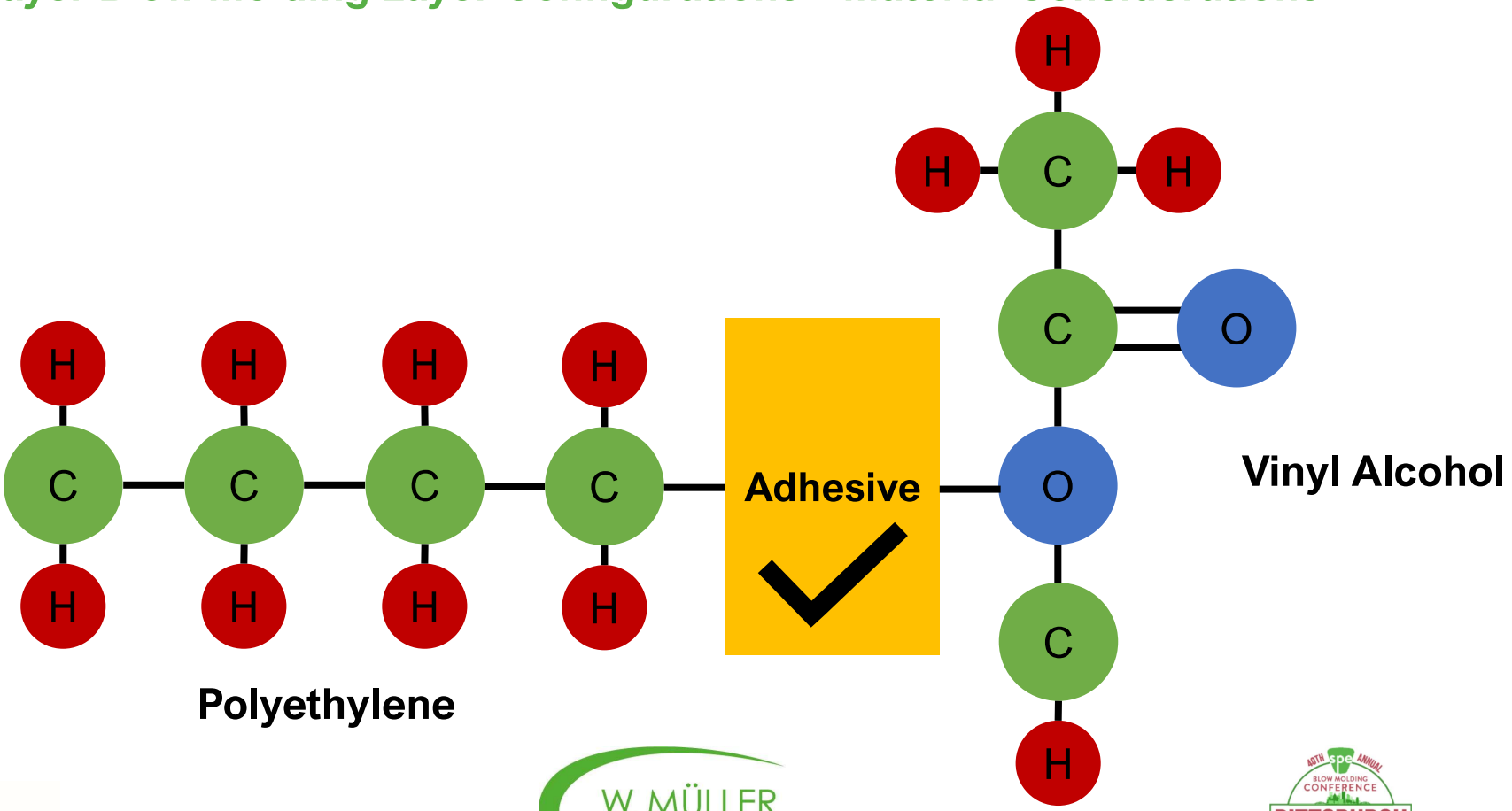
Multi-Layer Blow Molding Layer Configurations – Material Considerations



Polyethylene

Vinyl Alcohol

Multi-Layer Blow Molding Layer Configurations – Material Considerations



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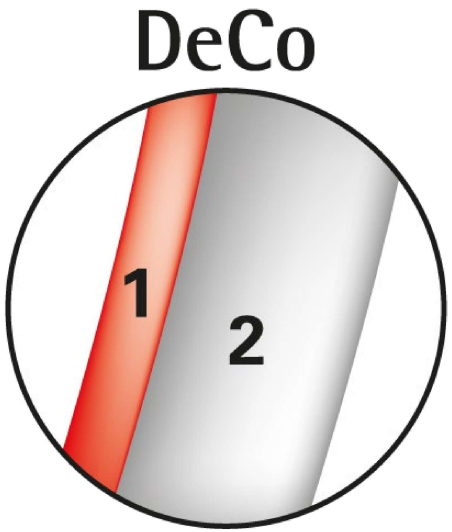
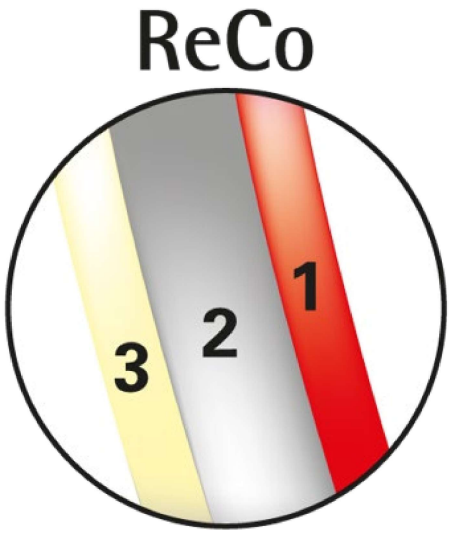
Multi-Layer Blow Molding Layer Configurations



1. Virgin Decoration Layer
2. Regrind/PCR

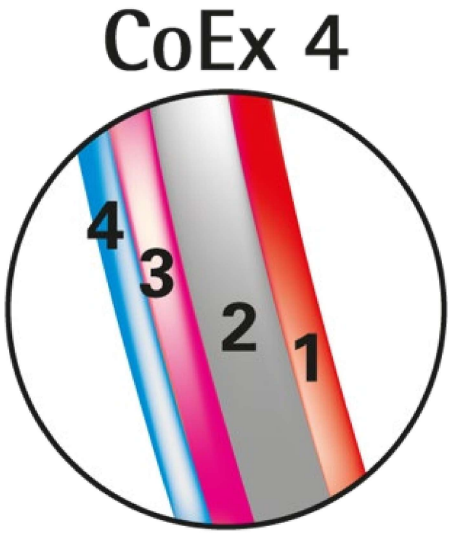
Multi-Layer Blow Molding Layer Configurations – Gradation Effect

Multi-Layer Blow Molding Layer Configurations



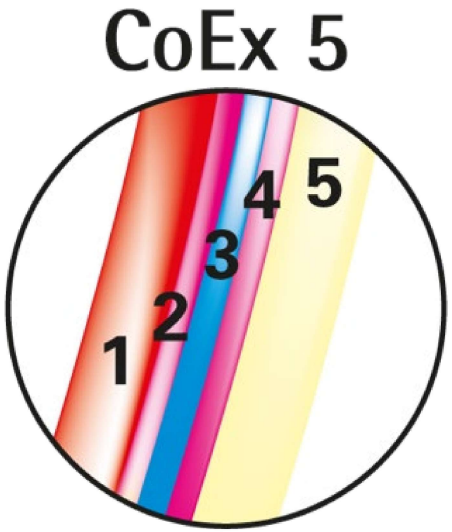
1. Virgin Decoration Layer
2. Regrind/PCR
3. Virgin Inner Layer

Multi-Layer Blow Molding Layer Configurations



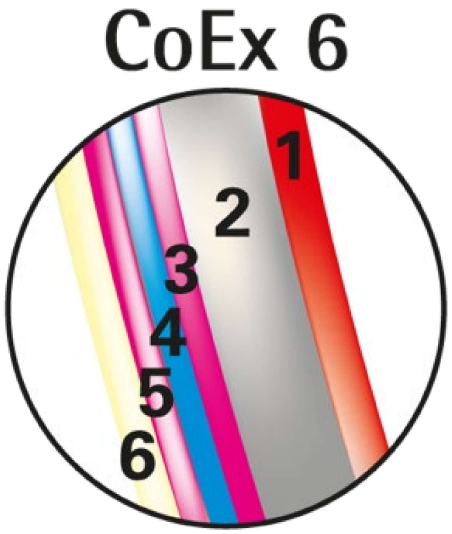
1. Virgin Decoration Layer
2. Regrind/PCR
3. Adhesive
4. Barrier Layer

Multi-Layer Blow Molding Layer Configurations



1. Virgin Decoration Layer
2. Adhesive
3. Barrier Layer
4. Adhesive
5. Virgin Inside Layer

Multi-Layer Blow Molding Layer Configurations



1. **Virgin Decoration Layer**
2. **Regrind/PCR***
3. **Adhesive**
4. **Barrier Layer**
5. **Adhesive**
6. **Virgin Inside Layer**

*PCR/Regrind layer can be on either side of the barrier & adhesive layers

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Multi-Layer Blow Molding Layer Configurations

1. **Virgin Decoration Layer**
2. **Adhesive**
3. **Oxygen/Moisture Barrier**
4. **Adhesive**
5. **UV Barrier (High-Carbon Black Color)***
6. **Regrind/PCR***
7. **Virgin Inside Layer**

*PCR/Regrind and barrier layers can be on either side of the barrier & adhesive layers

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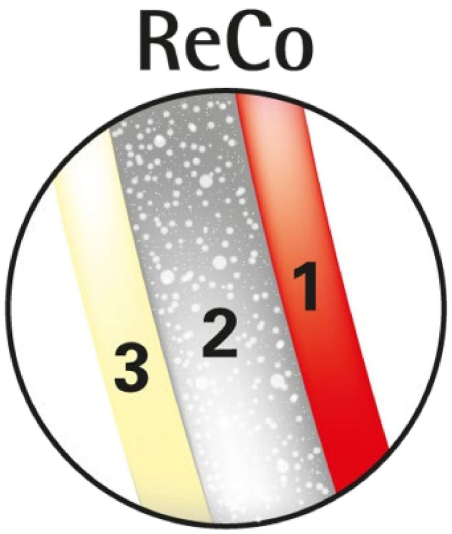
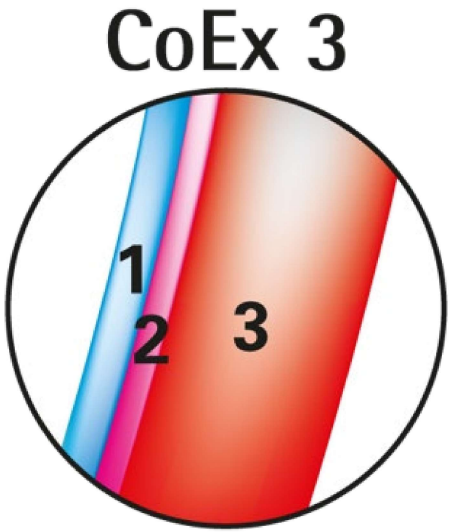
Multi-Layer Blow Molding Layer Configurations – Foamed Layer



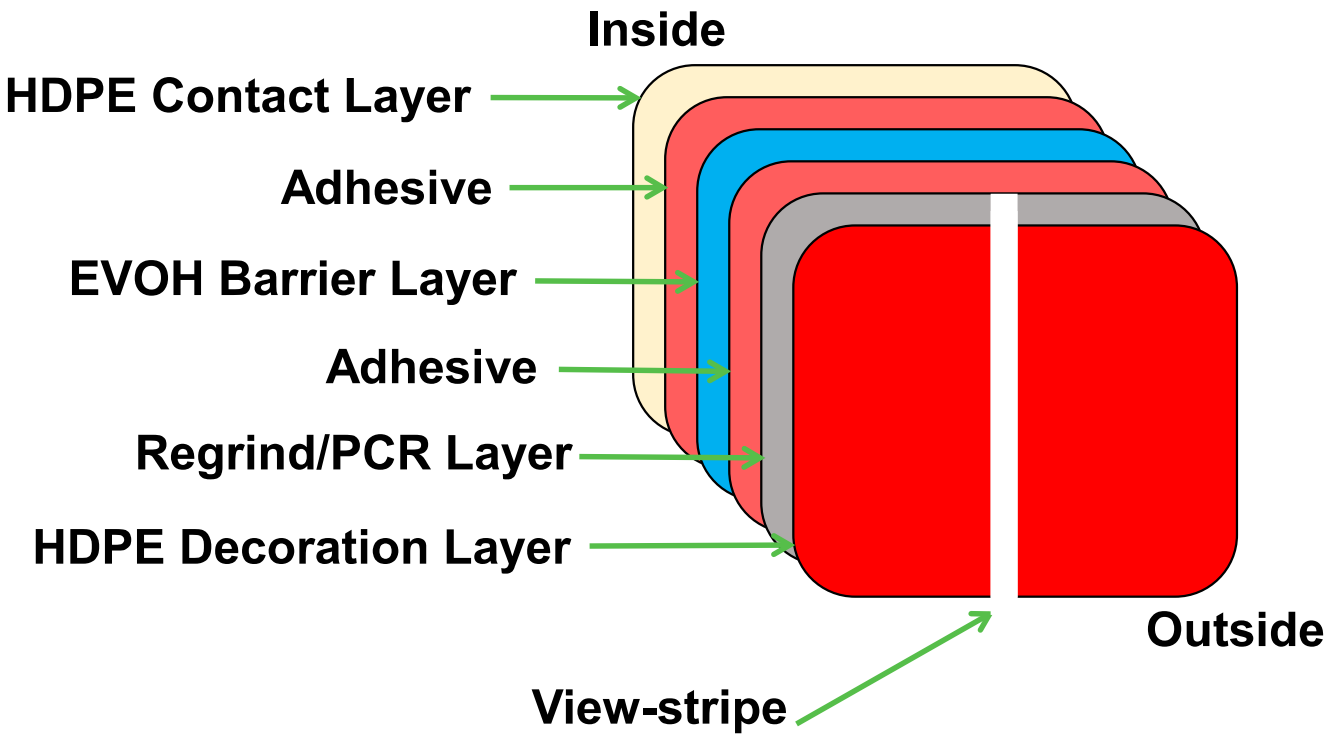
1. Virgin Decoration Layer
2. *Foamed* Regrind/PCR
3. Virgin Inner Layer

Multi-Layer Blow Molding Layer Configurations



1. Barrier *Outer* Layer
2. Adhesive Layer
3. Virgin Inner Layer

Multi-Layer Blow Molding Layer Configurations – View Stripe



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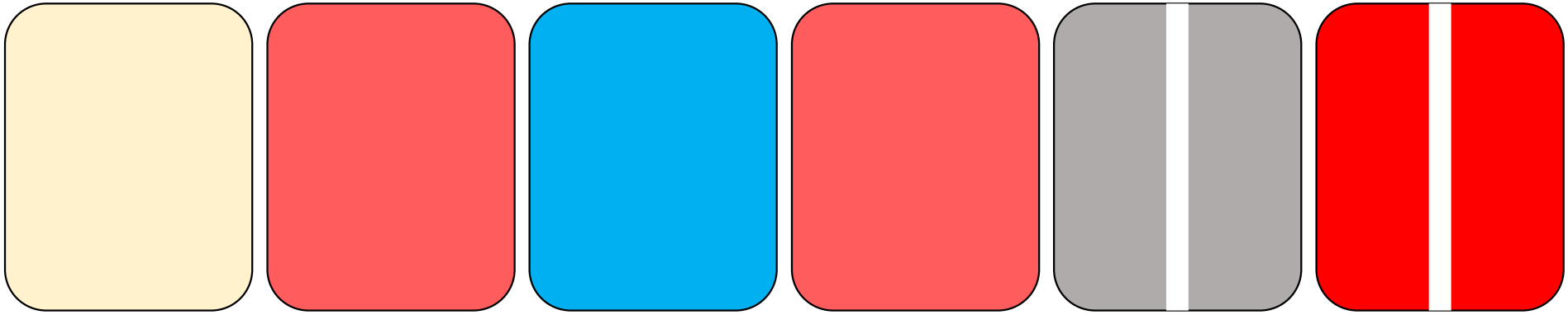
Multi-Layer Blow Molding Layer Configurations – View Stripe

Inside

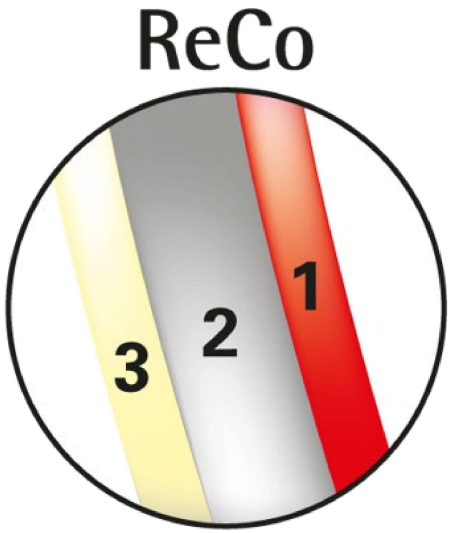


Outside

Add shelf value
Keep Protective Qualities Intact

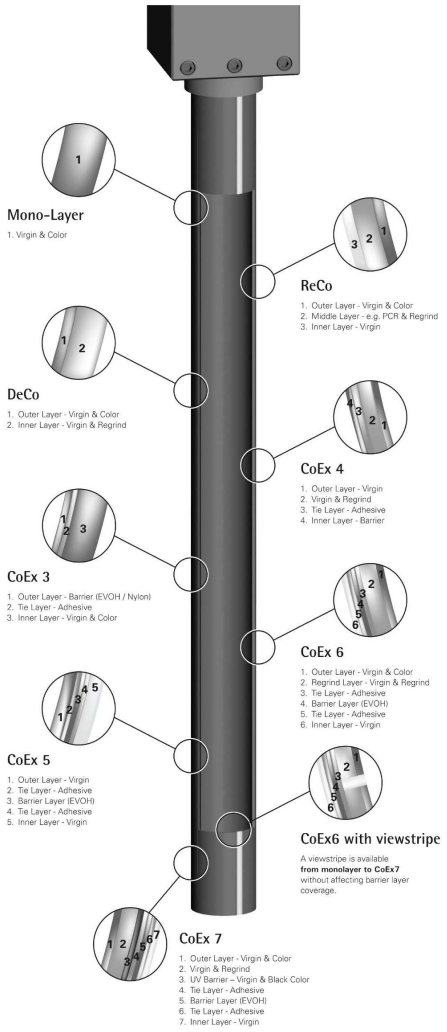
Multi-Layer Blow Molding – Sustainability

Multi-Layer Blow Molding – Sustainability



Replace 60% of the mass of the container with PCR

1.7 Million kgs less virgin material usage every year



Mono-Layer
1. Virgin & Color

ReCo
1. Outer Layer - Virgin & Color
2. Middle Layer - e.g. PCR & Regrind
3. Inner Layer - Virgin

DeCo
1. Outer Layer - Virgin & Color
2. Inner Layer - Virgin & Regrind

CoEx 4
1. Outer Layer - Virgin
2. Virgin & Regrind
3. Tie Layer - Adhesive
4. Inner Layer - Barrier

CoEx 3
1. Outer Layer - Barrier (EVOH / Nylon)
2. Tie Layer - Adhesive
3. Inner Layer - Virgin & Color

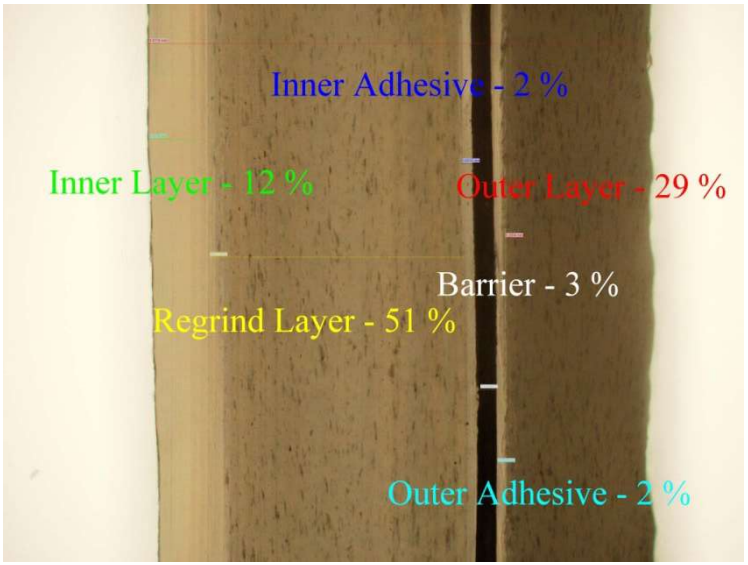
CoEx 6
1. Outer Layer - Virgin & Color
2. Regrind Layer - Virgin & Regrind
3. Tie Layer - Adhesive
4. Barrier Layer (EVOH)
5. Tie Layer - Adhesive
6. Inner Layer - Virgin

CoEx 5
1. Outer Layer - Virgin
2. Tie Layer - Adhesive
3. Barrier Layer (EVOH)
4. Tie Layer - Adhesive
5. Inner Layer - Virgin

CoEx6 with viewstripe
A viewstripe is available **from monolayer to CoEx7** without affecting barrier layer coverage.

CoEx 7
1. Outer Layer - Virgin & Color
2. Virgin & Regrind
3. UV Barrier – Virgin & Black Color
4. Tie Layer - Adhesive
5. Barrier Layer (EVOH)
6. Tie Layer - Adhesive
7. Inner Layer - Virgin

Multi-Layer Blow Molding Applications – Food & Beverage



*Barrier stained black using iodine for better visual representation

CoEx 6 to preserve flavor

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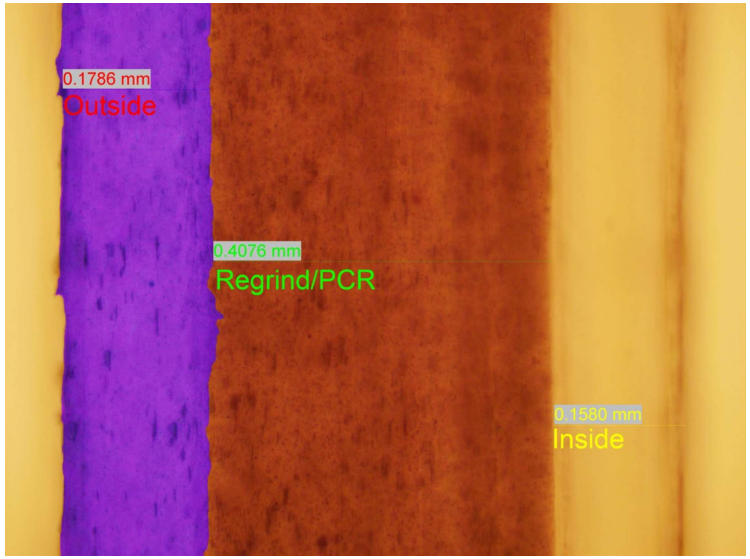
Multi-Layer Blow Molding Applications – Personal Care



DeCo 2/ReCo 3 to save color costs

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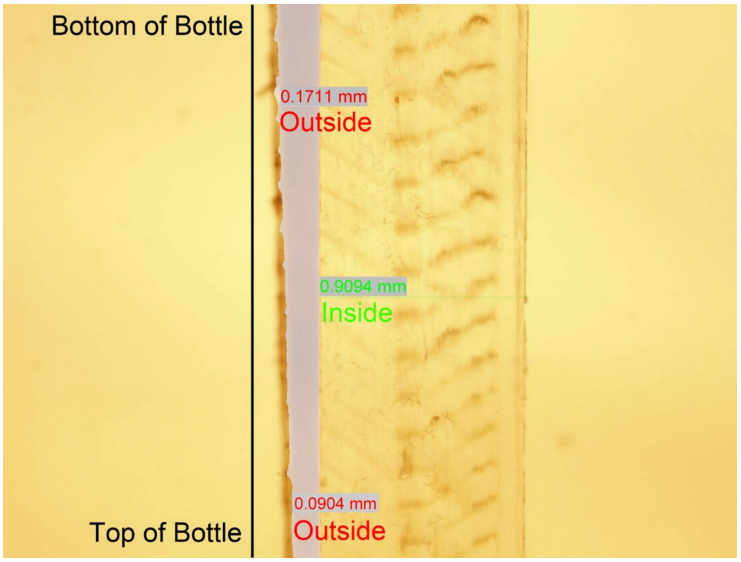
Multi-Layer Blow Molding Applications – Personal Care



DeCo 2 for a gradated design

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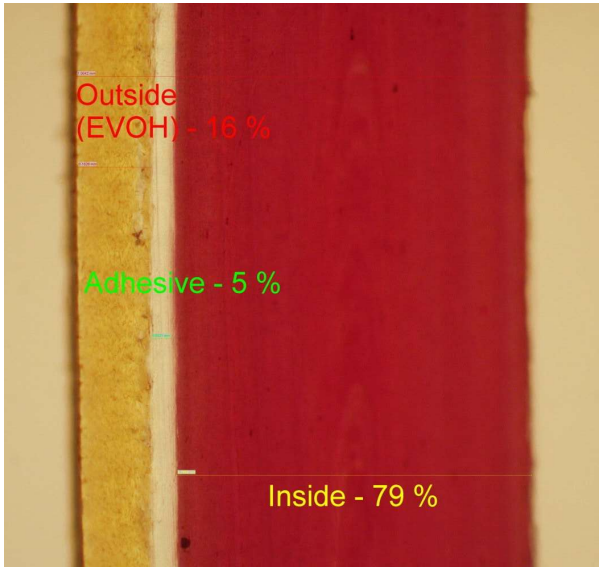
Multi-Layer Blow Molding Applications – Cosmetics



CoEx 3 to highlight color

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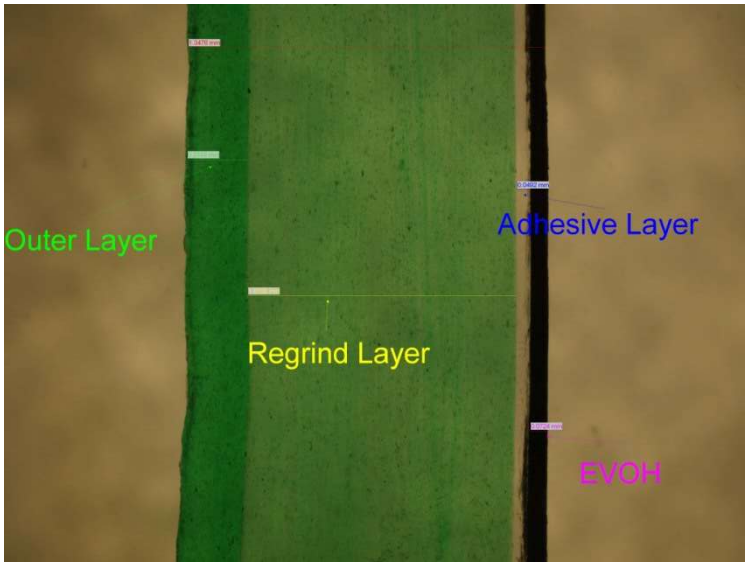
Multi-Layer Blow Molding Applications – Agro-Chemical



*Barrier stained black using iodine for better visual representation

CoEx 4 to isolate contents

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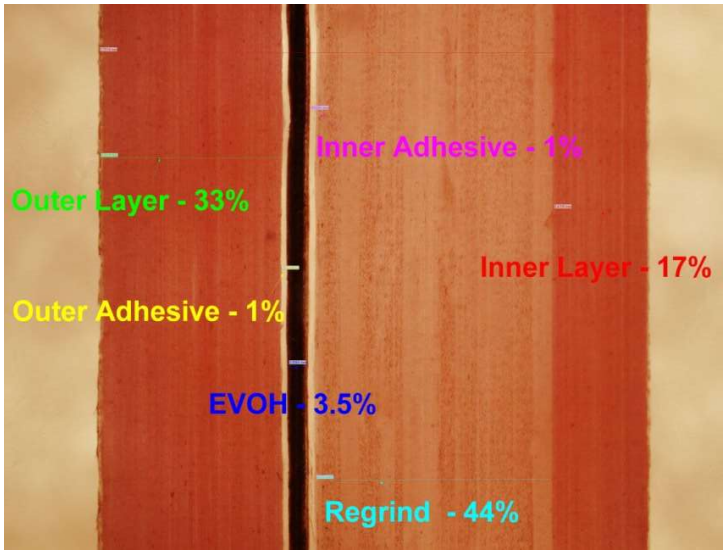
Multi-Layer Blow Molding Applications – Petroleum



*Barrier stained black using iodine for better visual representation

CoEx 6 to protect consumers

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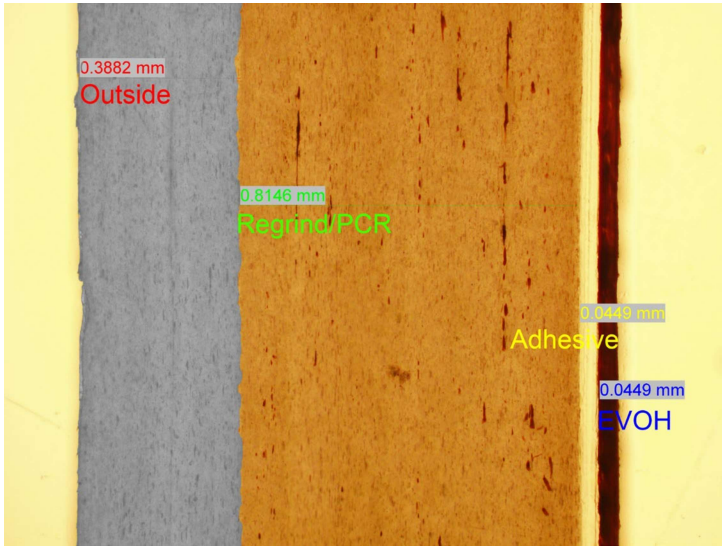
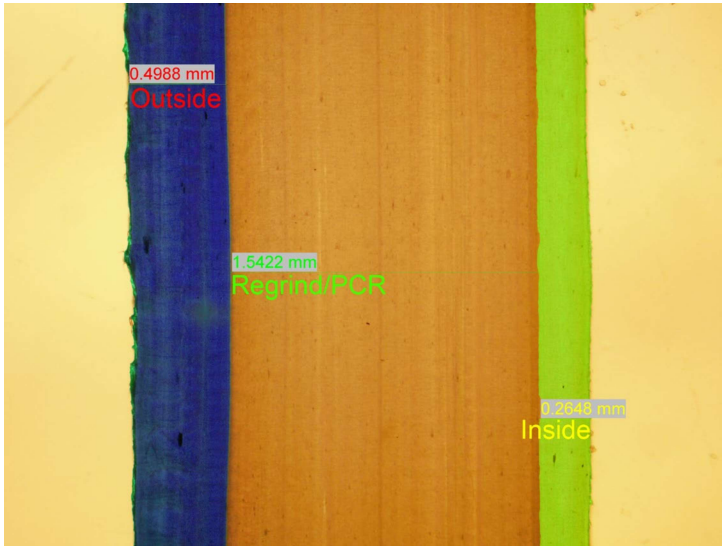
Multi-Layer Blow Molding Applications – Lubricants & Additives



*Barrier stained black using iodine for better visual representation

CoEx4 to use more recyclables

Multi-Layer Blow Molding Applications – Industrial Packaging



ReCo3 to save virgen material

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