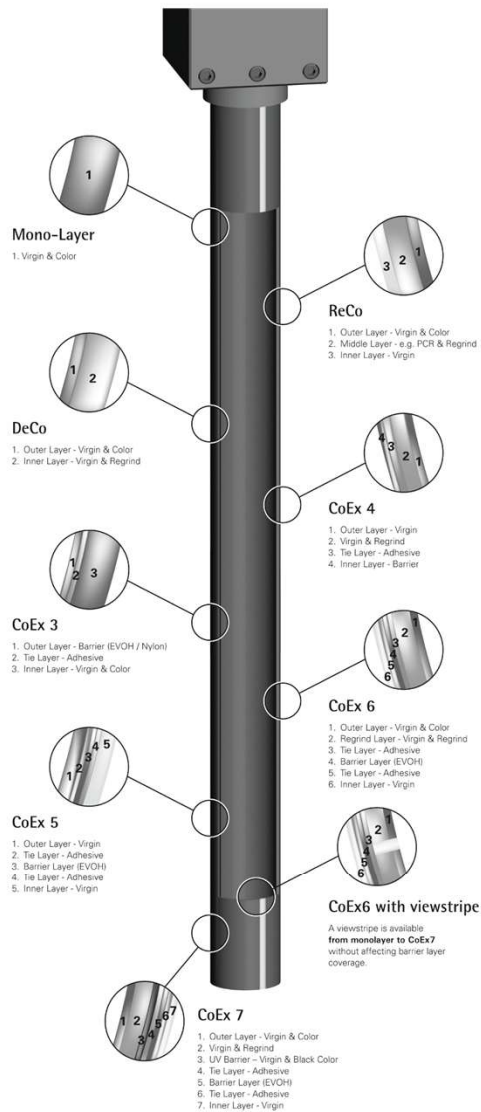


101 Multi-Layer Extrusion Blow Molding

Presented by Jens Schlueter





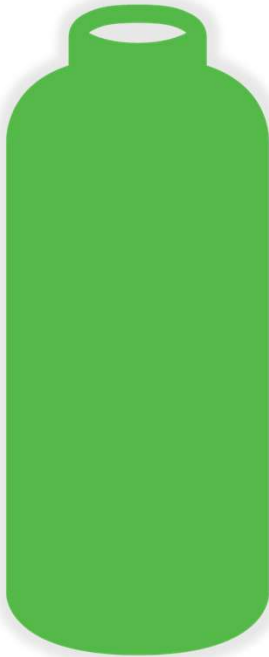
Multi-Layer Blow Molding – Basics



The perfect container must be:

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

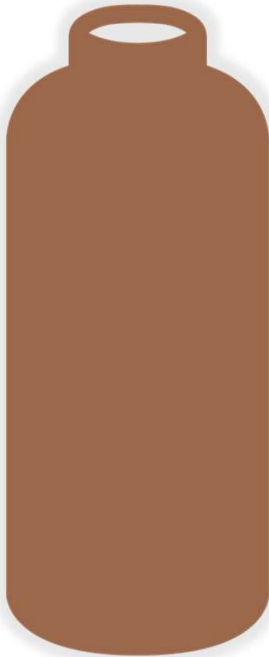
Multi-Layer Blow Molding – Basics



An all-virgin HDPE container is aesthetically pleasing, but also:

- Expensive
- Unsustainable
- No physical barrier function

Multi-Layer Blow Molding – Basics



An all-PCR container is sustainable, but also:

- Aesthetically Displeasing
- Subject to supply restrictions
- No physical barrier function
- Cannot directly contact food or medicine

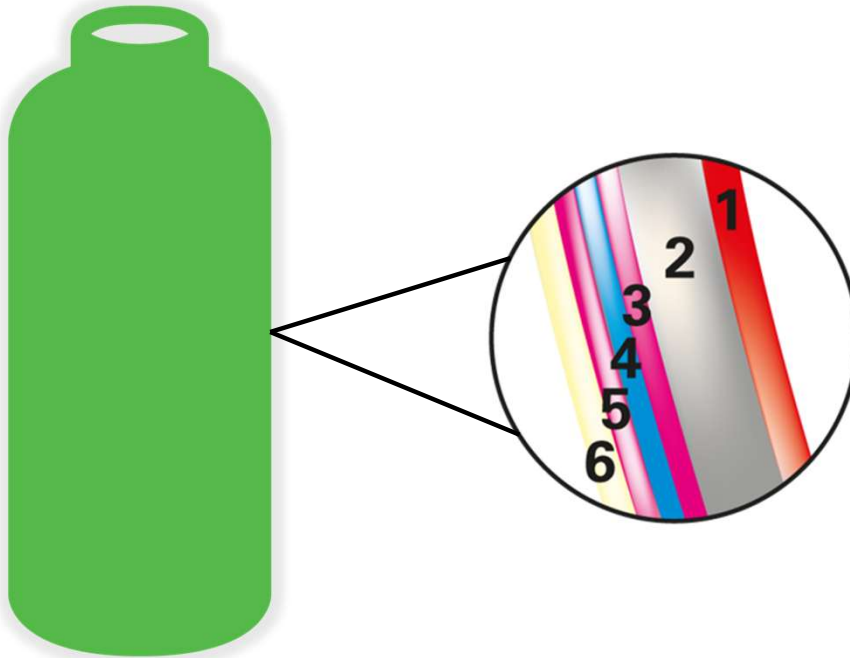
Multi-Layer Blow Molding – Basics



An all-barrier container is capable
Of isolating its contents, but also:

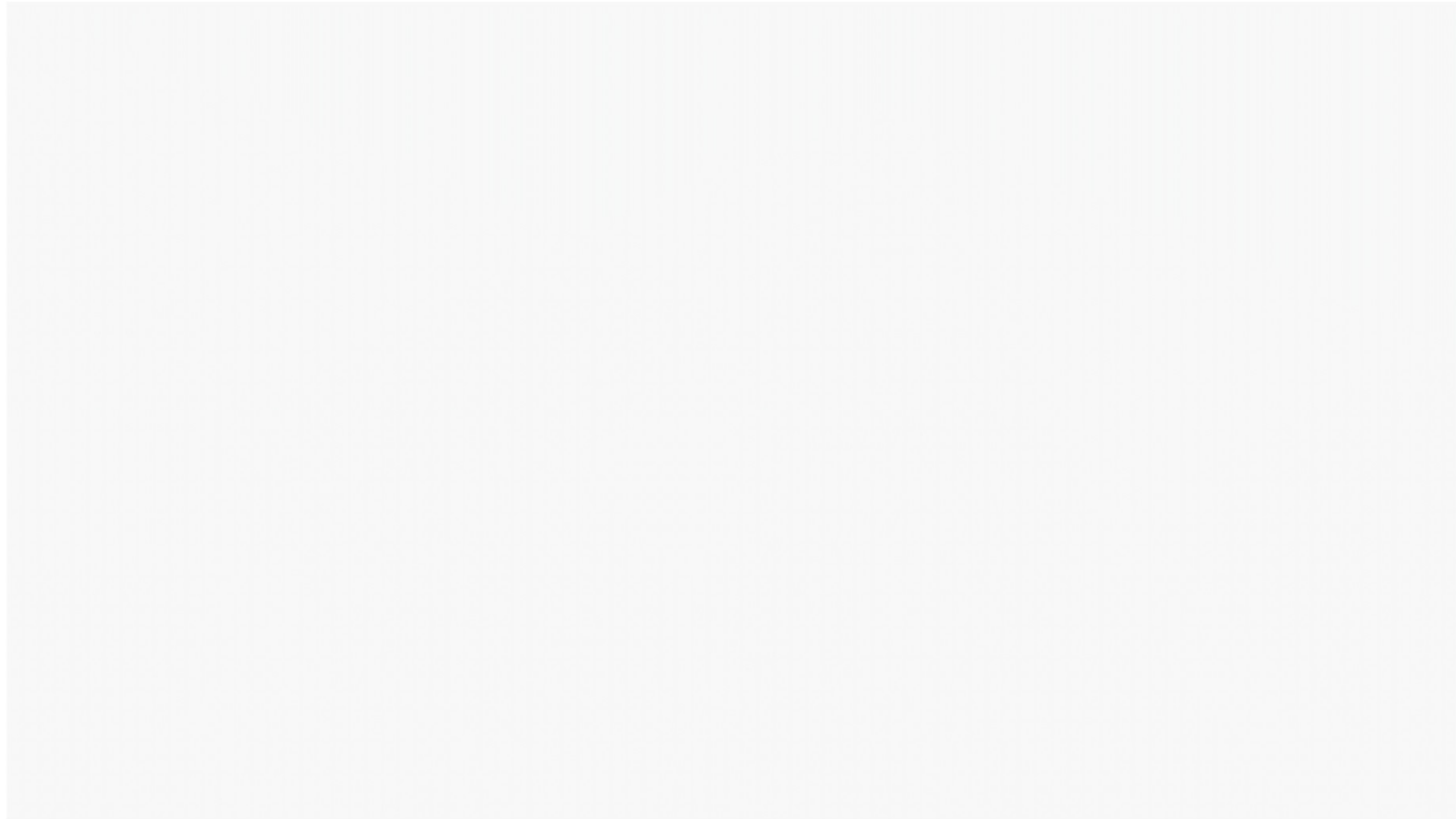
- Aesthetically Displeasing
- Massively Expensive
- Incredibly Unsustainable

Multi-Layer Blow Molding – Basics



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

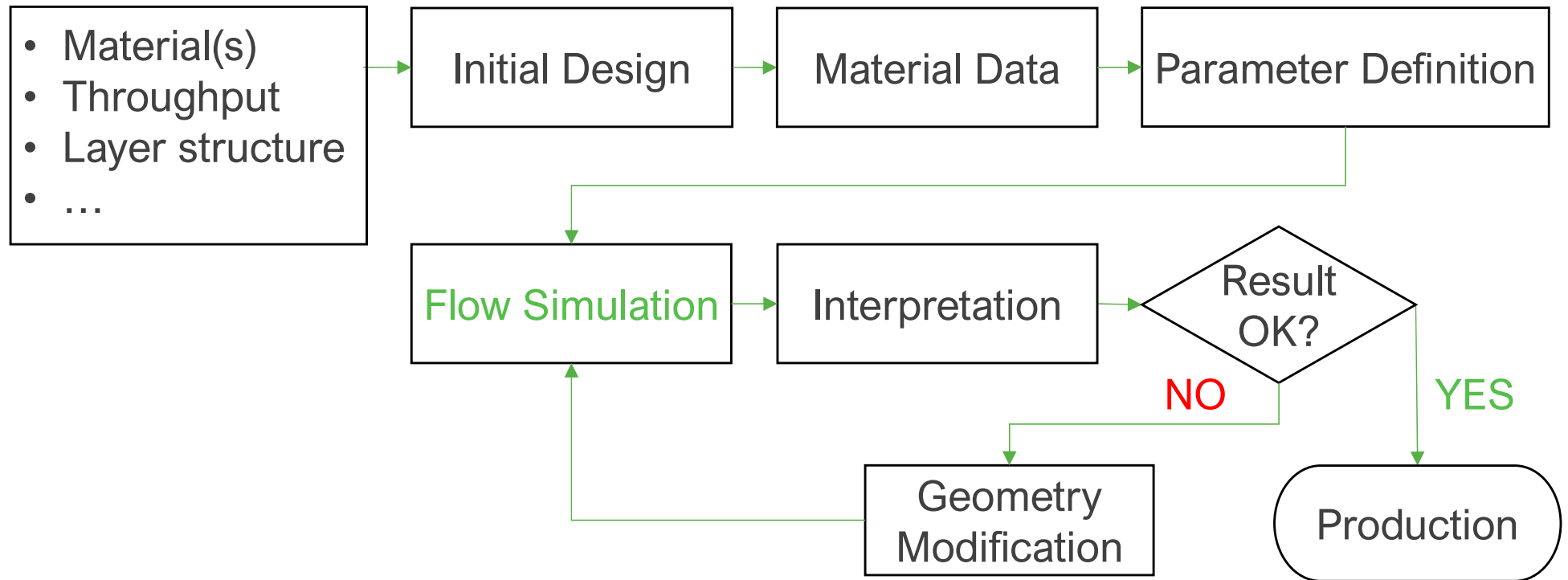
Multi-Layer Blow Molding – Melt Flow



Multi Layer Extrusion Head Design Process



Multi-Layer Blow Molding – Design Process



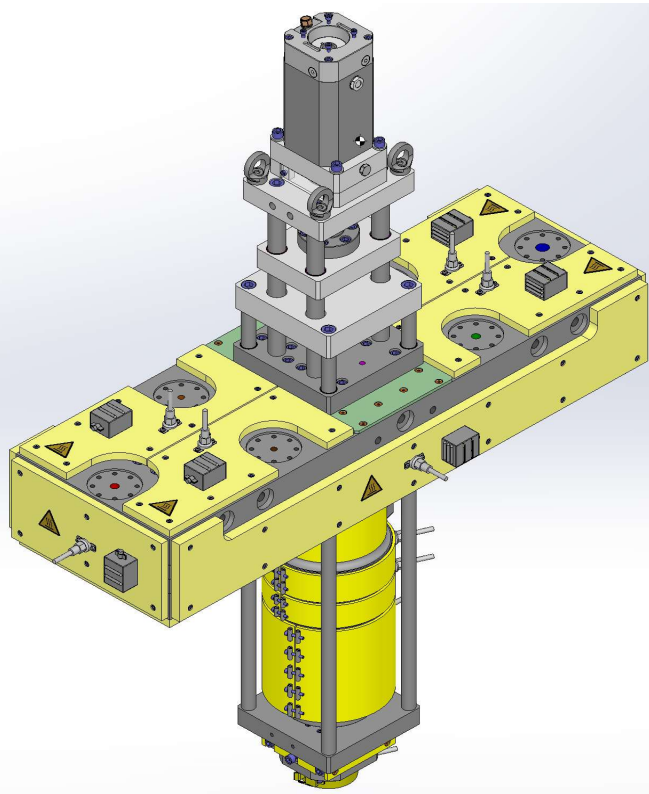
Multi-Layer Blow Molding – Evaluation of the Simulation Results

- Melt Pressure
- Melt Temperature
- Stagnation Zones
- Layer Velocity

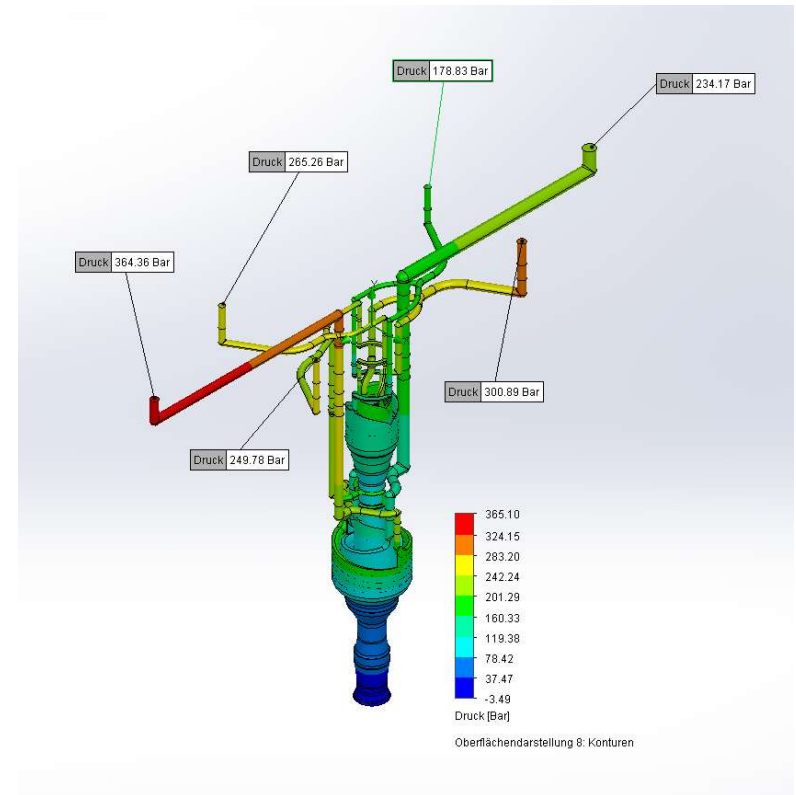


Multi-Layer Blow Molding – Melt Pressure Evaluation

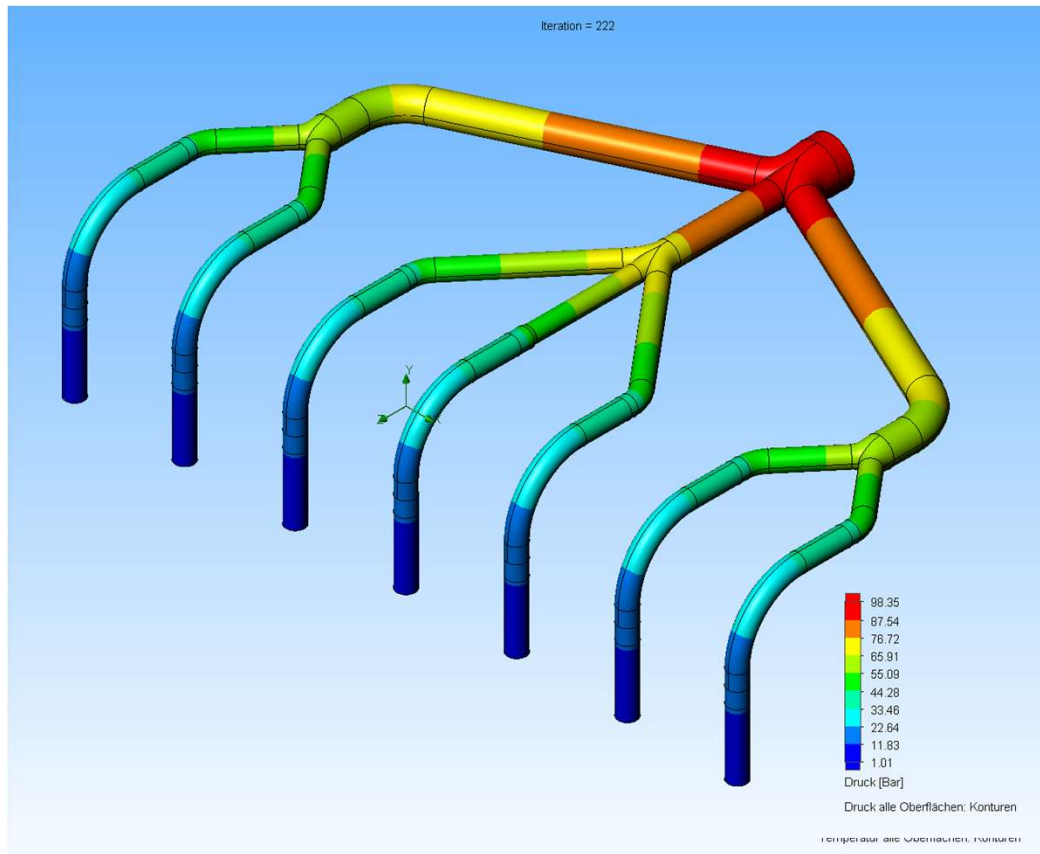
CoEx 6-Layer Head – One Parison



Simulation

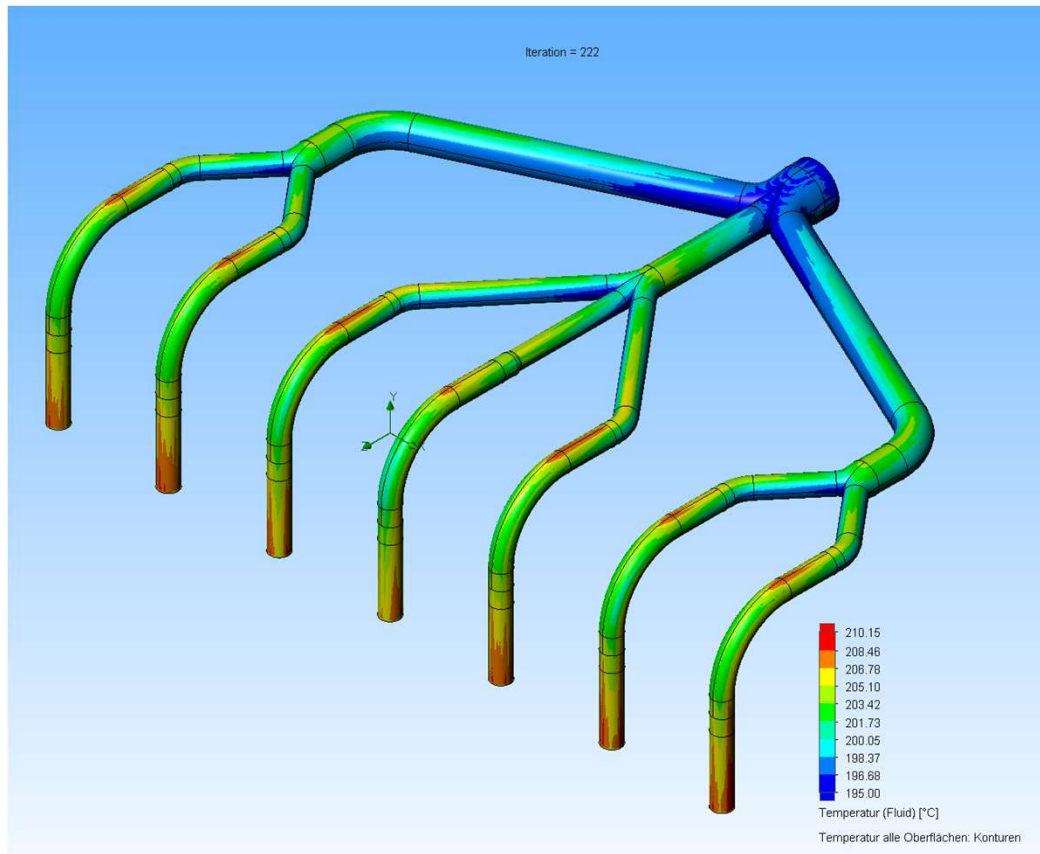


Multi-Layer Blow Molding – Melt Pressure Evaluation



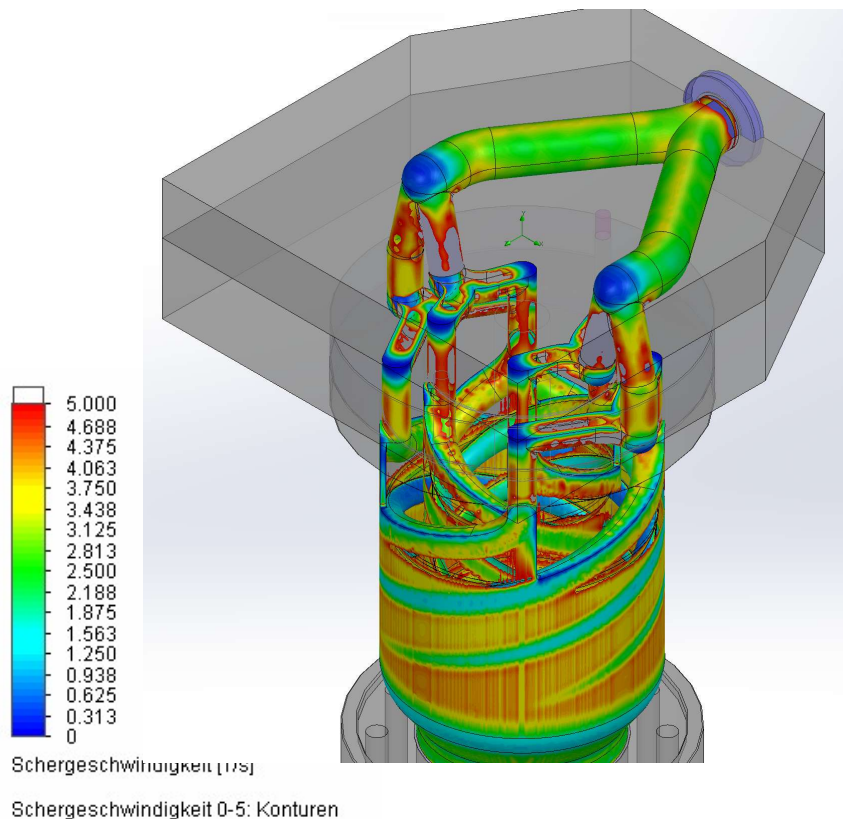
- Multi parison heads require equal melt pressures
- Any uneven number of parison required different flow channel designs to avoid using chokes to even parison length

Multi-Layer Blow Molding – Melt Temperature Evaluation



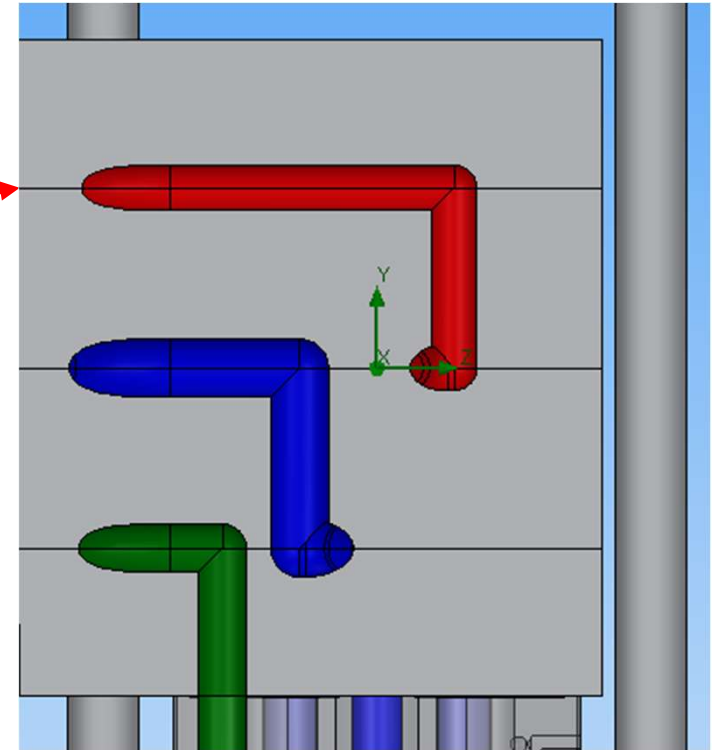
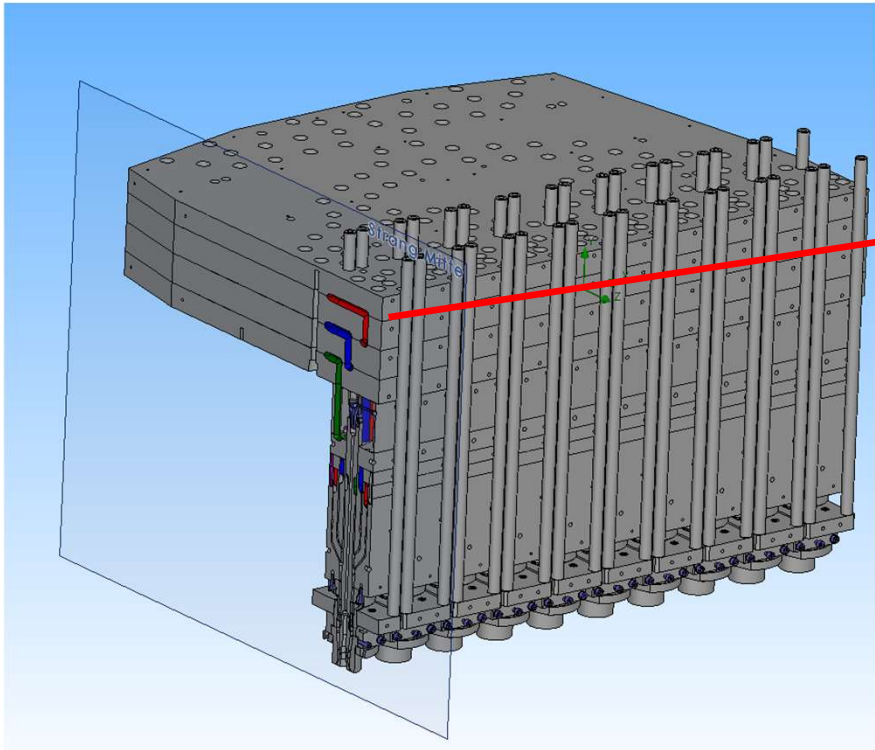
- Multi parison heads require equal melt temperatures

Multi-Layer Blow Molding – Stagnation Zones

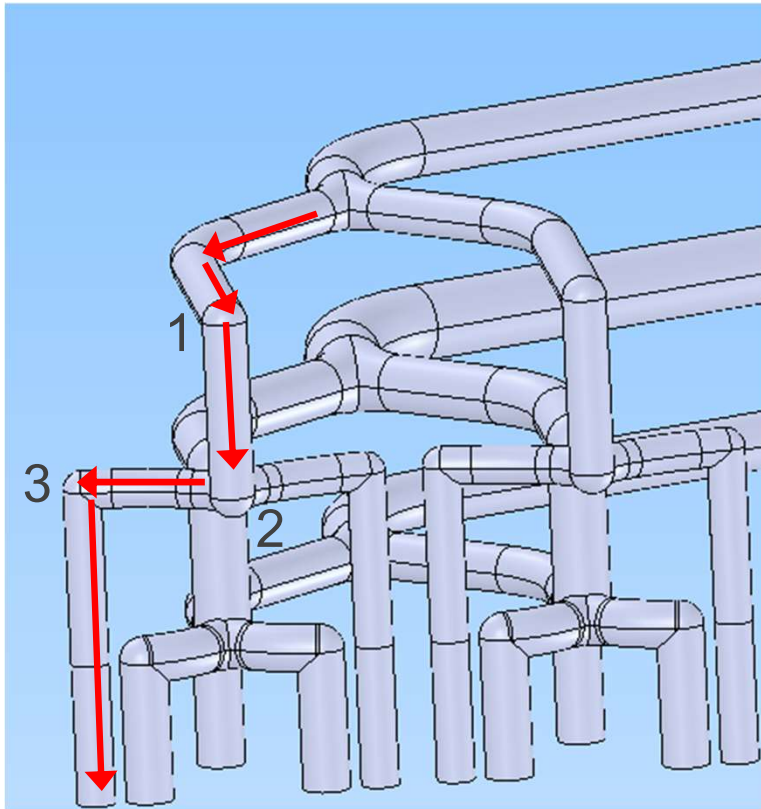


- Areas with low shear rates (blue) can be identified in Flow Simulation
- Material flow stagnates there
- By optimizing channel geometry, areas of stagnation can be reduced
- Thus, time for material and color change will be reduced.
- Geometry optimization has to be done under consideration of manufacturing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

Multi-Layer Blow Molding – Stagnation Zones



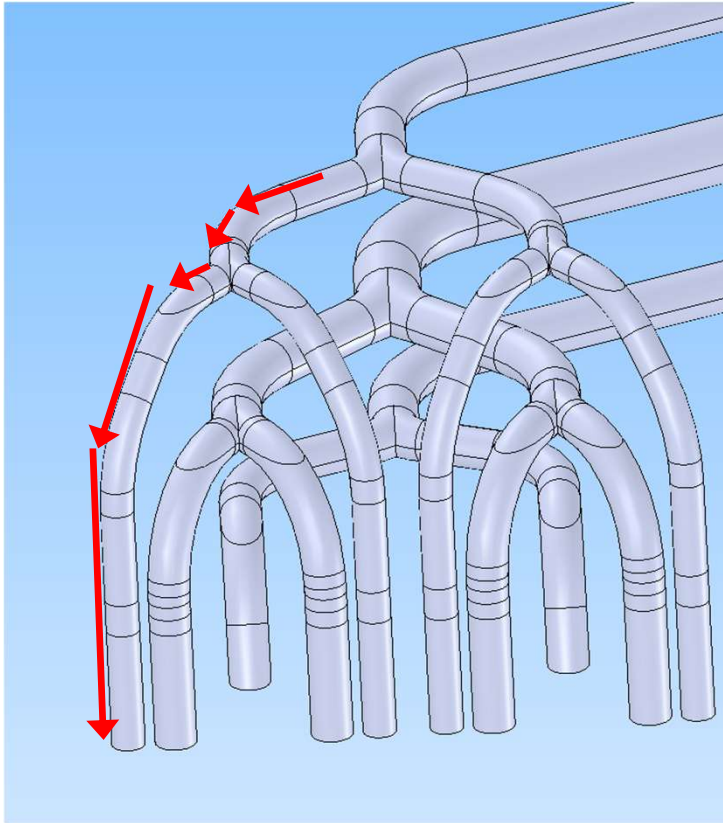
Multi-Layer Blow Molding – Stagnation Zones



Initial Geometry:

Material agglomerates in 3 areas

Multi-Layer Blow Molding – Stagnation Zones



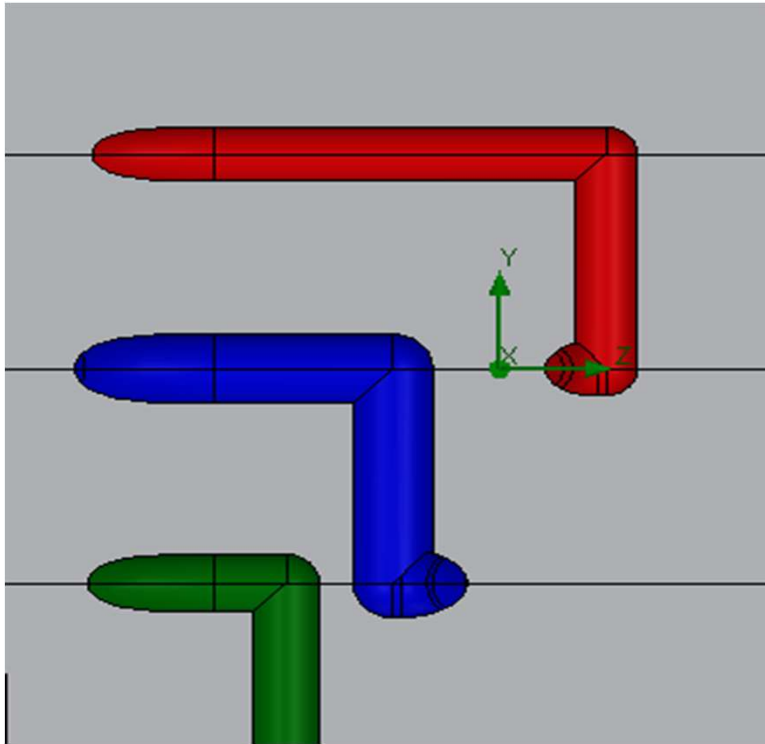
Optimized Geometry:

Smoother design of flow channels

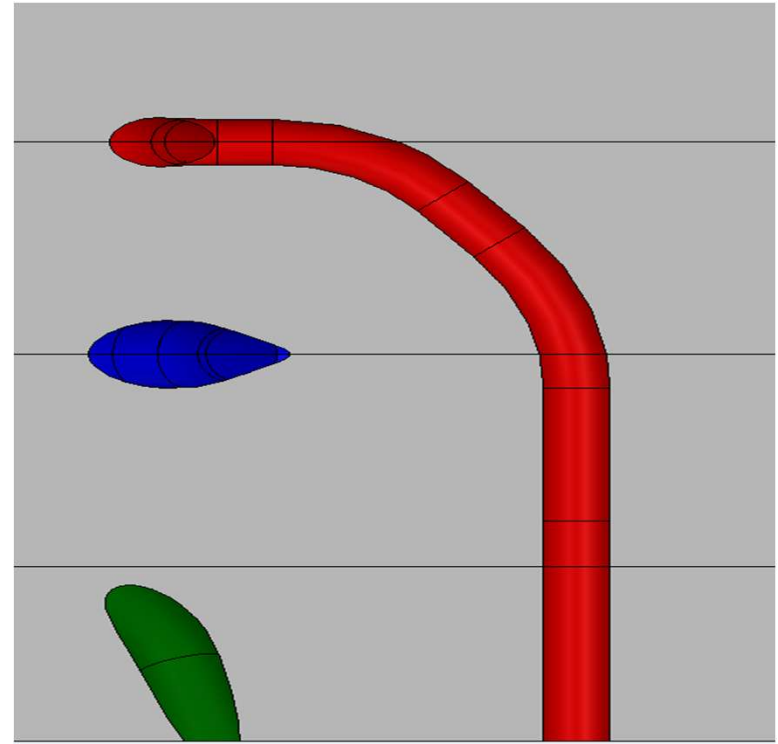
Result: Reduced color change times

Adequate manufacturing capabilities required

Multi-Layer Blow Molding – Stagnation Zones



Initial Geometry

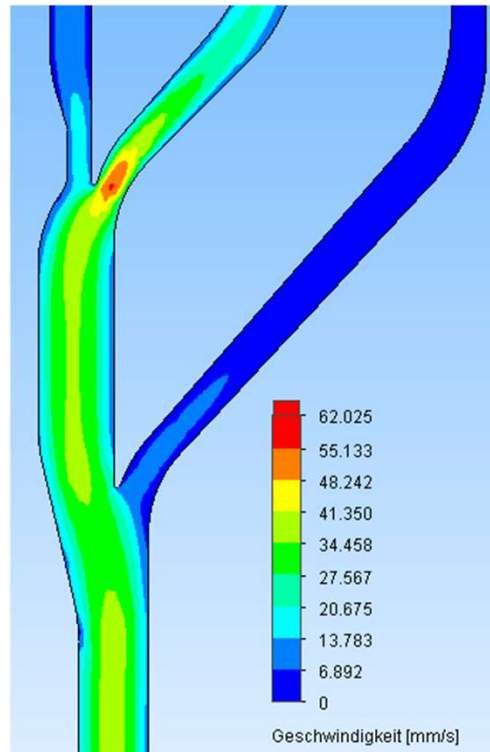


Optimized Geometry

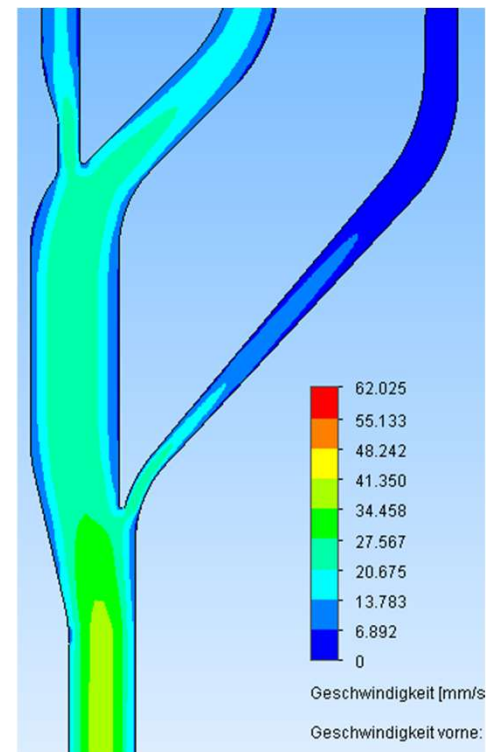
Cross-Section of 3-Layer Head



Multi-Layer Blow Molding – Layer Velocity

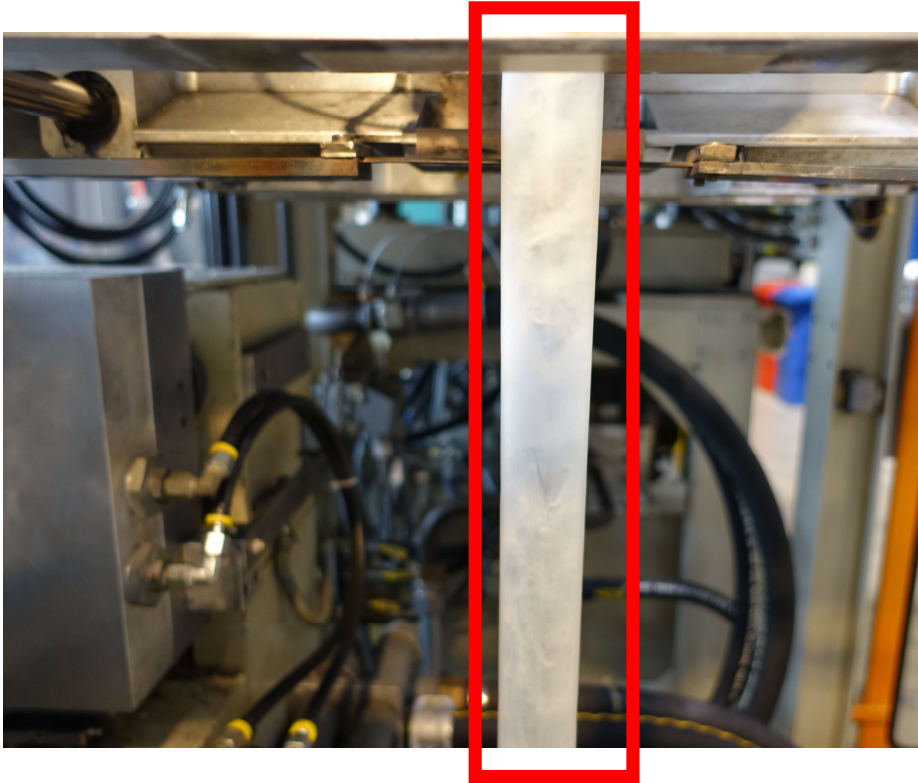


Initial Geometry

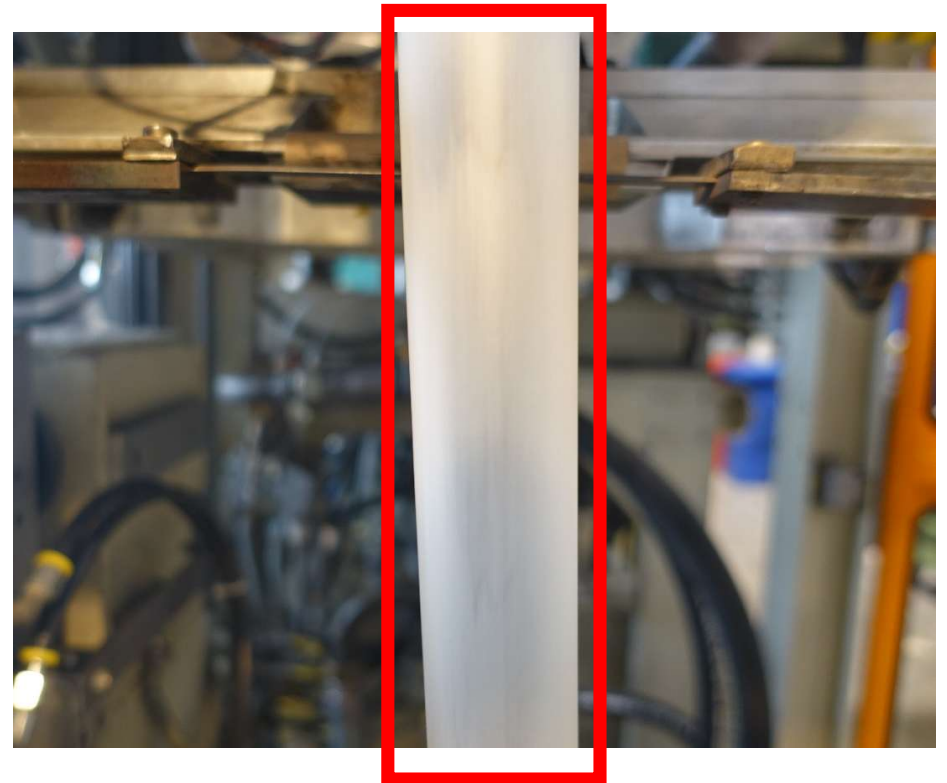


Optimized Geometry

Multi-Layer Blow Molding – Layer Velocity

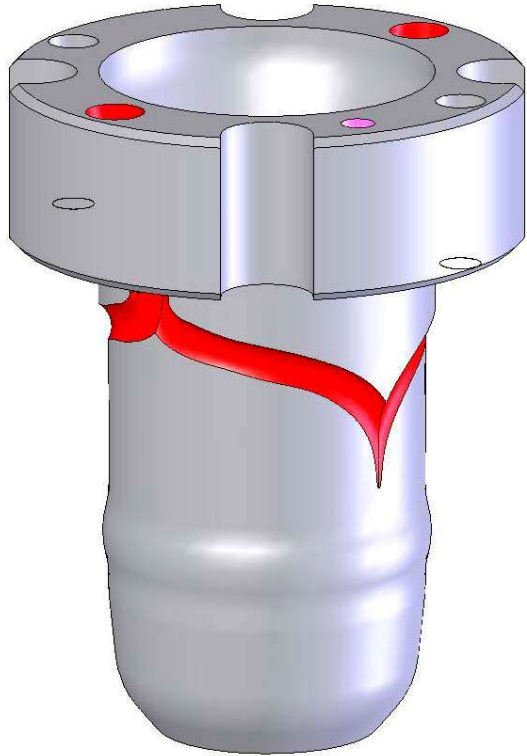


Not Matching Layer Velocities

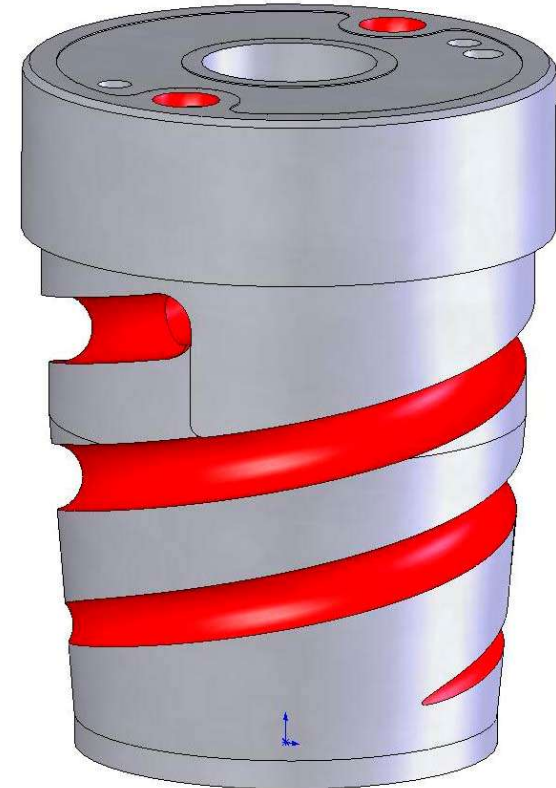


Matching Layer Velocities

Multi-Layer Blow Molding – Insert Design



Dual Heart Pinola

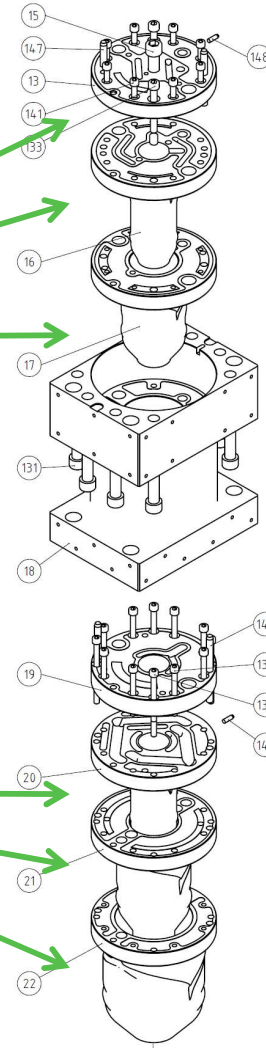


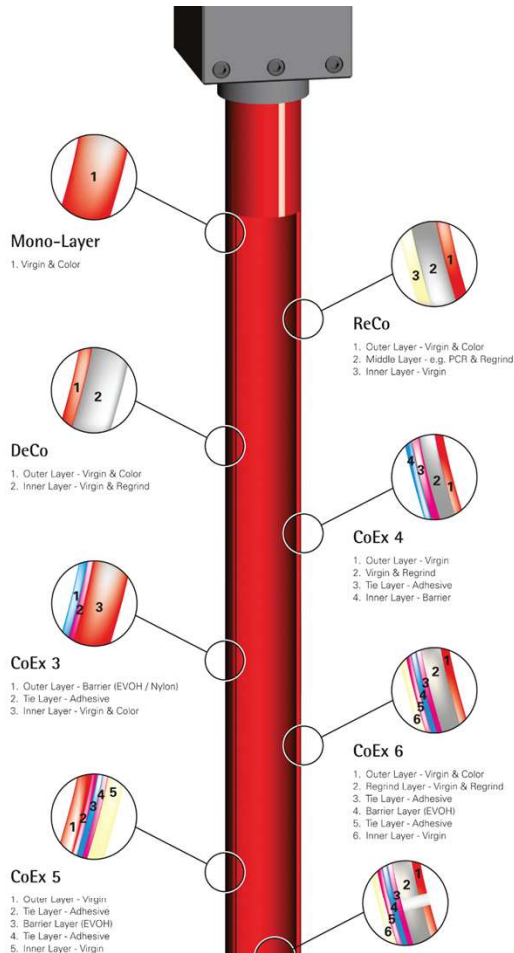
Spiral Pinola

Multi-Layer Blow Molding – Insert Design

Inside Layers

Outside Layers

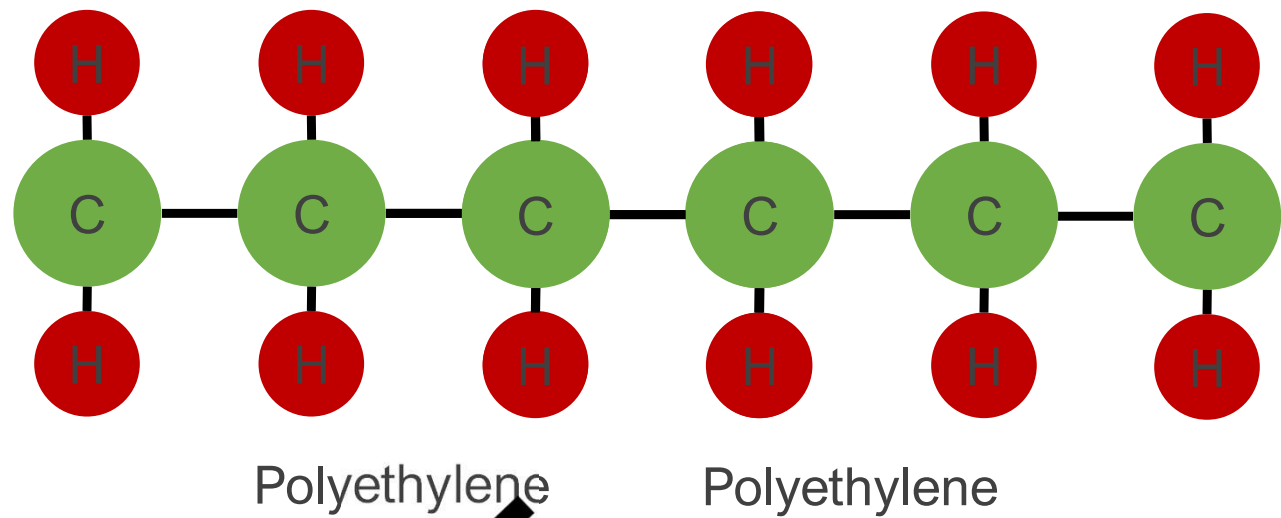




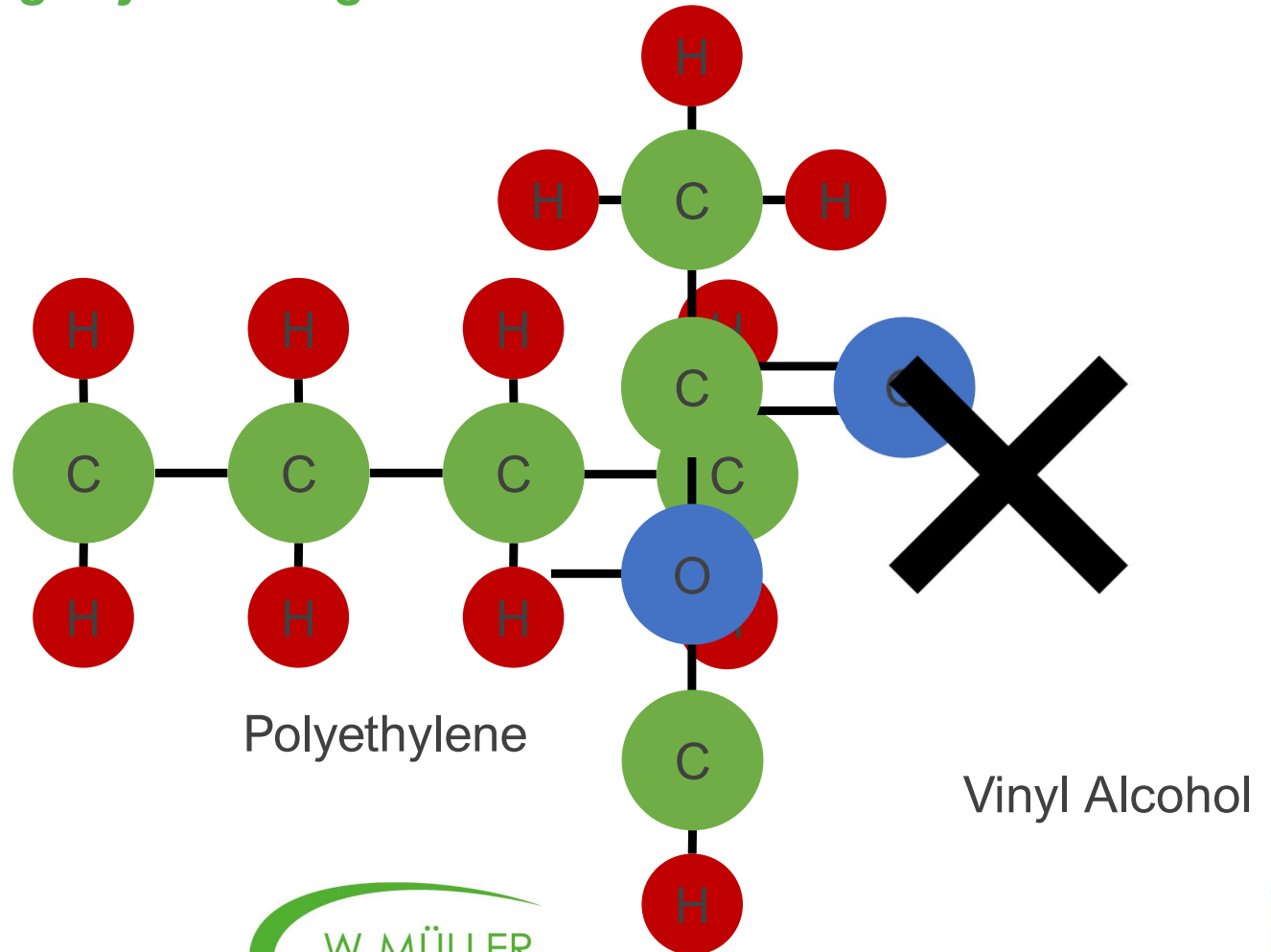
Layer Configurations



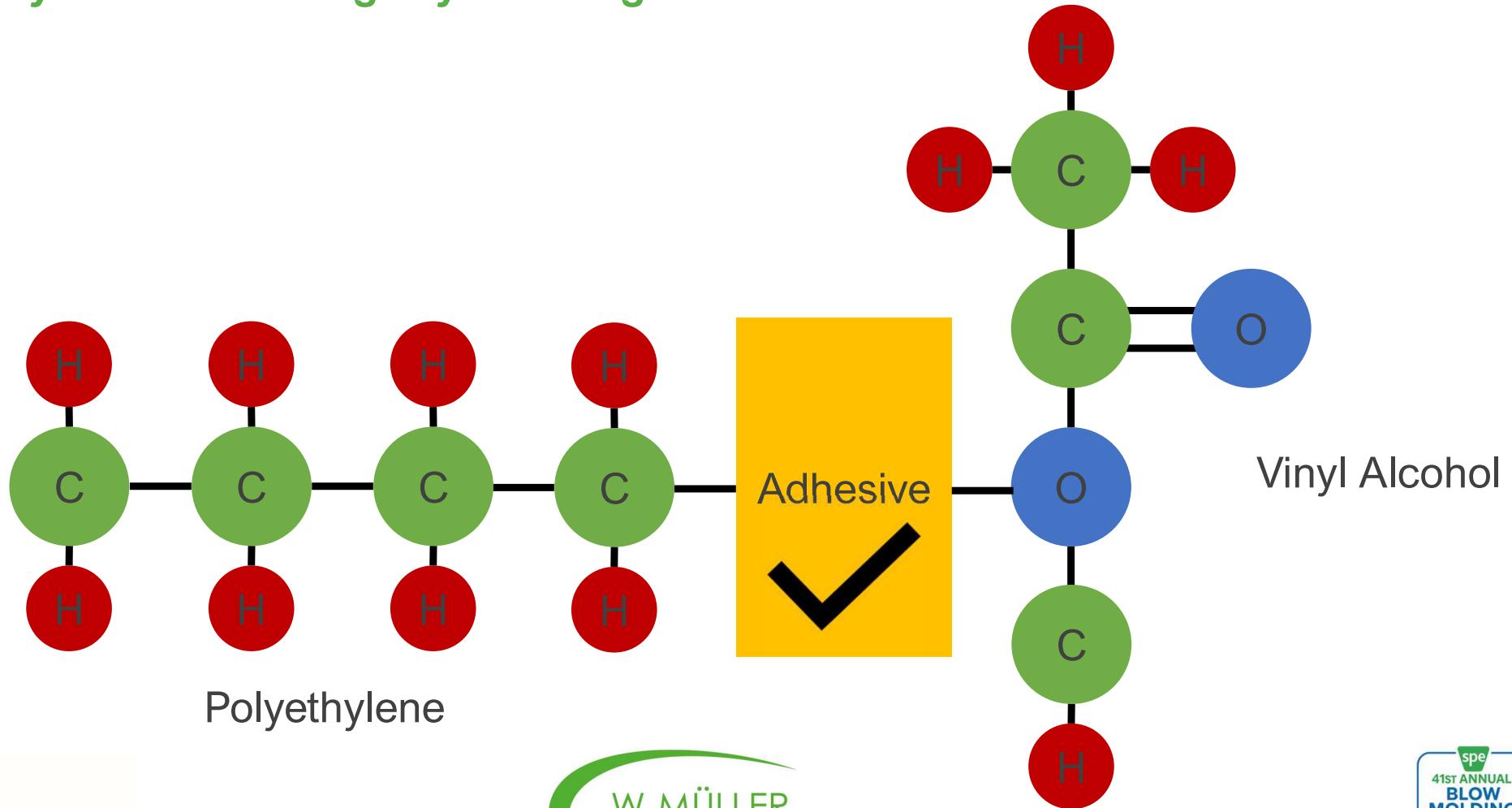
Multi-Layer Blow Molding Layer Configurations – Material Considerations



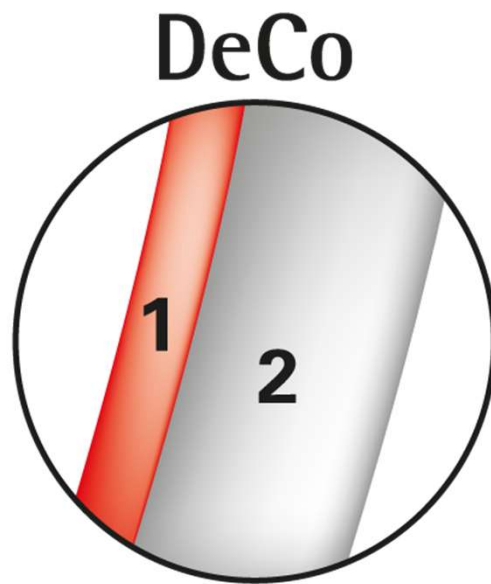
Multi-Layer Blow Molding Layer Configurations – Material Considerations



Multi-Layer Blow Molding Layer Configurations – Material Considerations

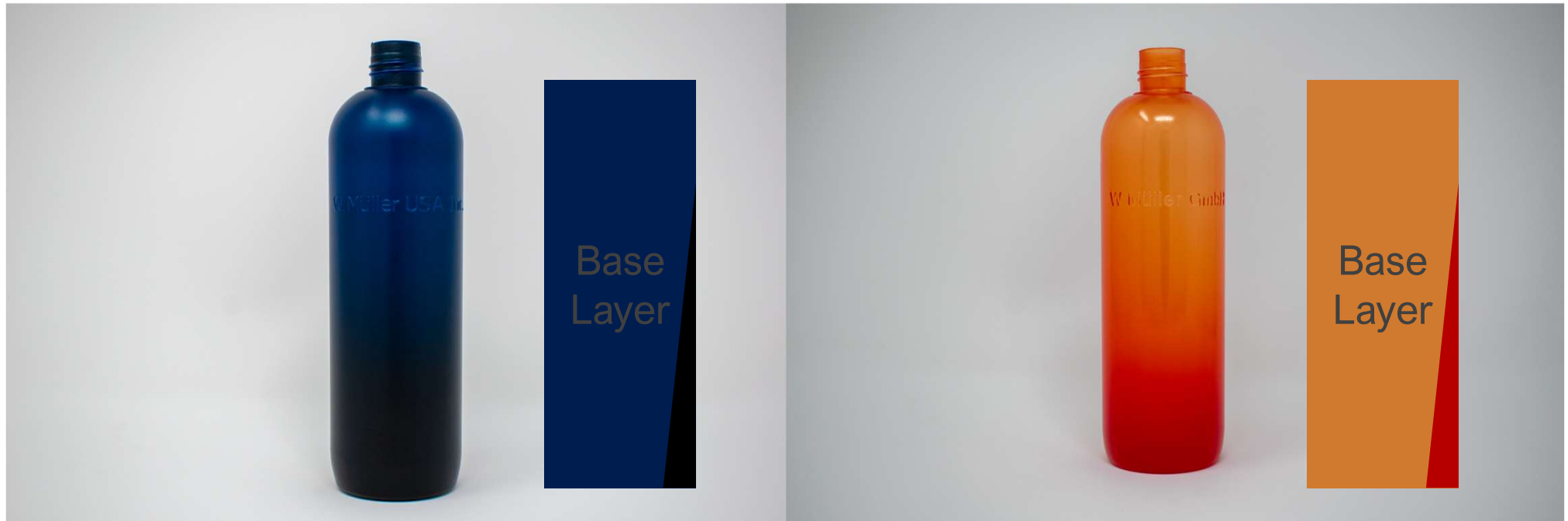


Multi-Layer Blow Molding Layer Configurations

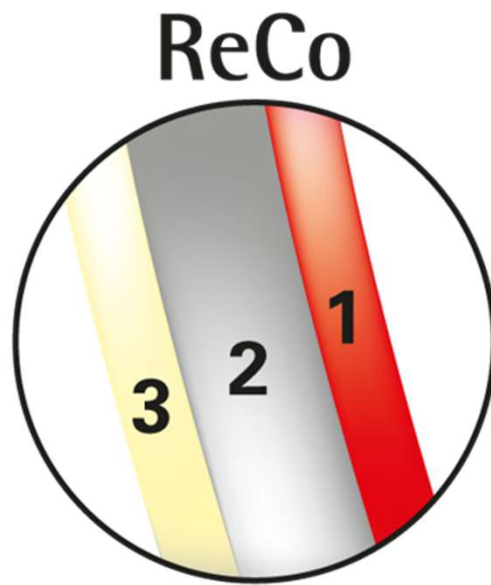


1. Virgin Decoration Layer
2. Regrind/PCR

Multi-Layer Blow Molding Layer Configurations – Gradation Effect



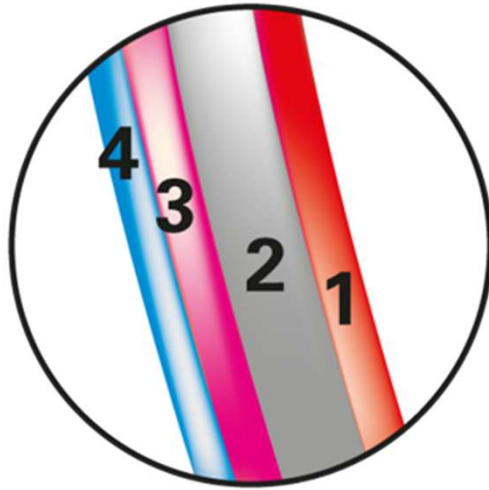
Multi-Layer Blow Molding Layer Configurations



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

Multi-Layer Blow Molding Layer Configurations

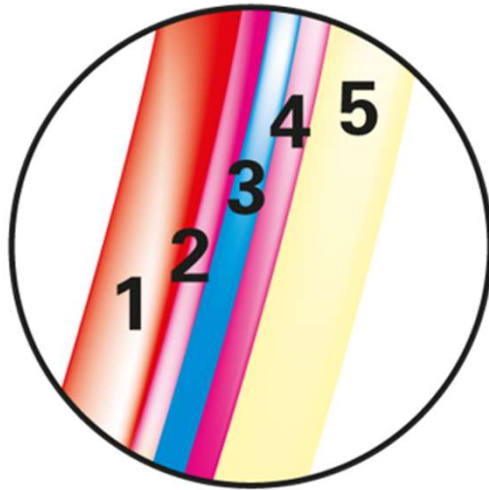
CoEx 4



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

Multi-Layer Blow Molding Layer Configurations

CoEx 5



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

Multi-Layer Blow Molding Layer Configurations

CoEx 6



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

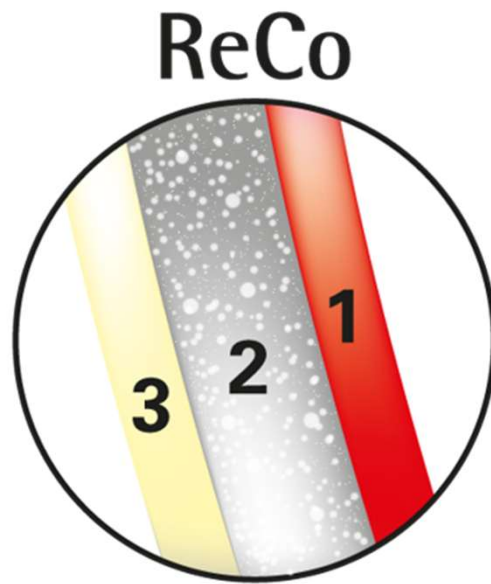
Multi-Layer Blow Molding Layer Configurations



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

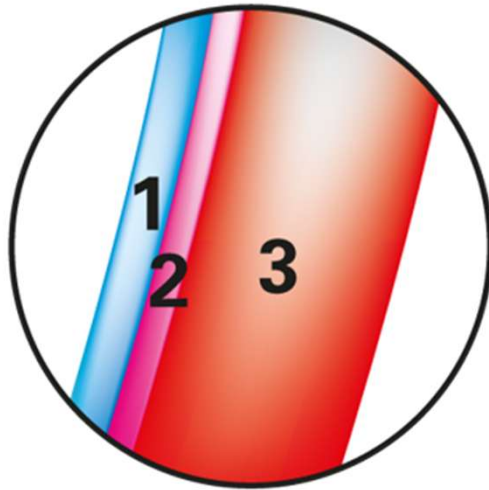
Multi-Layer Blow Molding Layer Configurations – Foamed Layer



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

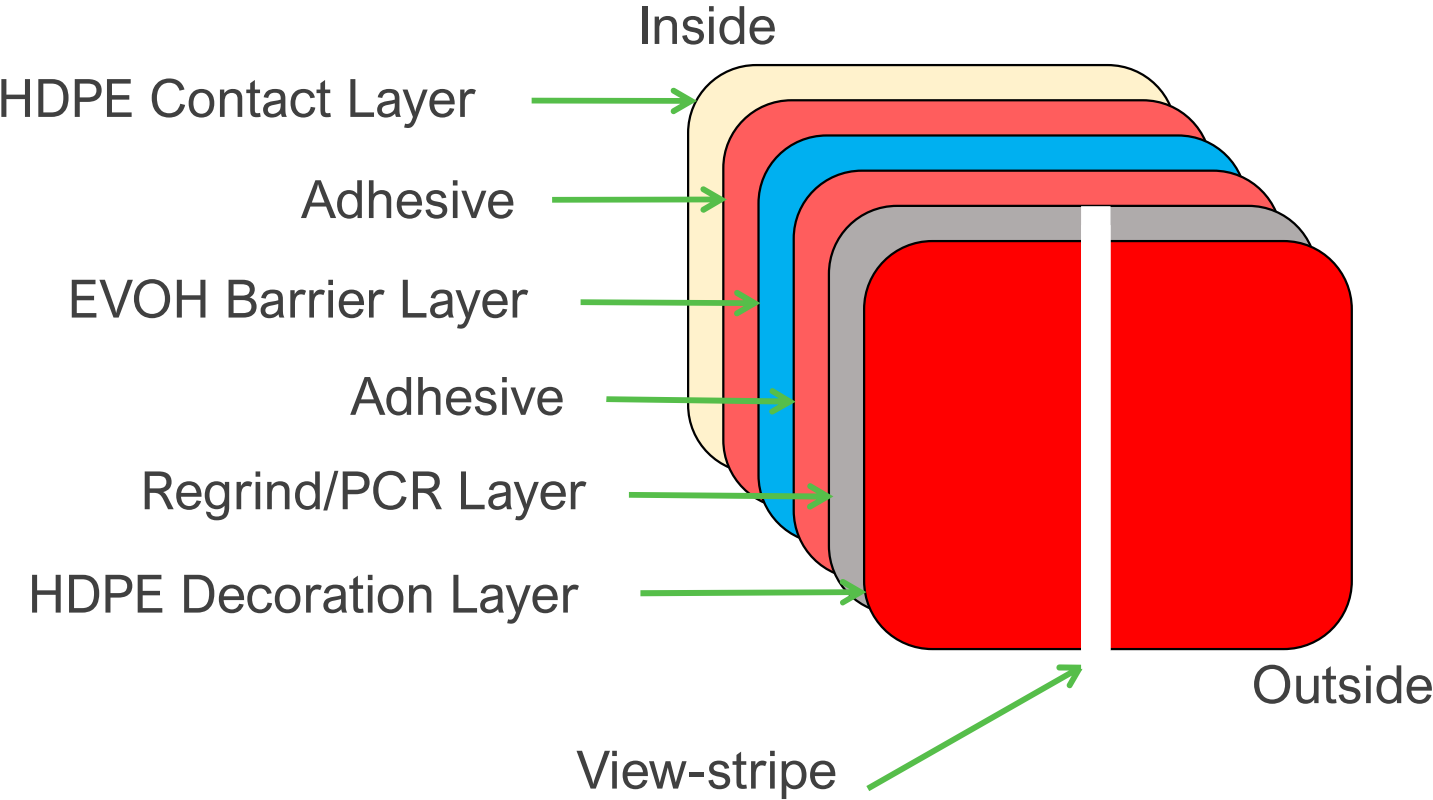
Multi-Layer Blow Molding Layer Configurations

CoEx 3



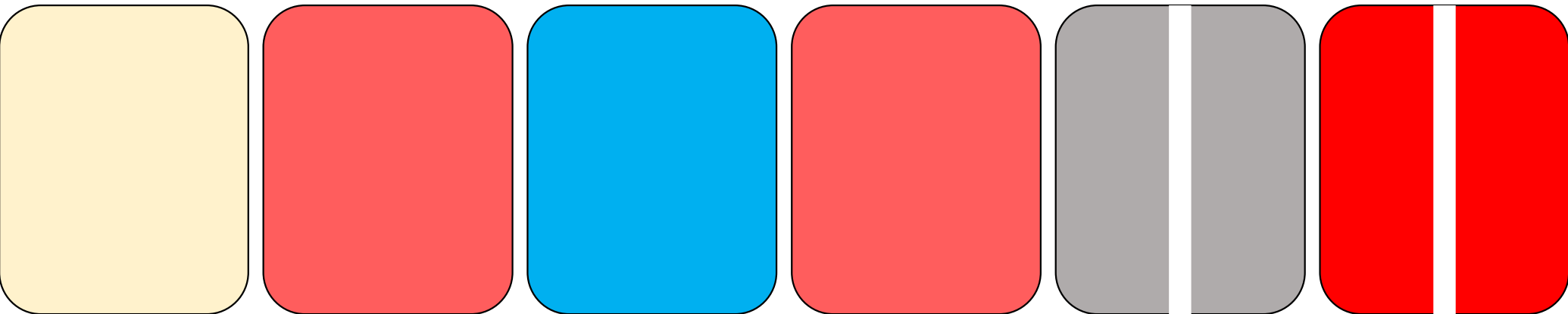
1. Barrier *Outer* Layer
2. Adhesive Layer
3. Virgin Inner Layer

Multi-Layer Blow Molding Layer Configurations – View Stripe



Multi-Layer Blow Molding Layer Configurations – View Stripe

Inside



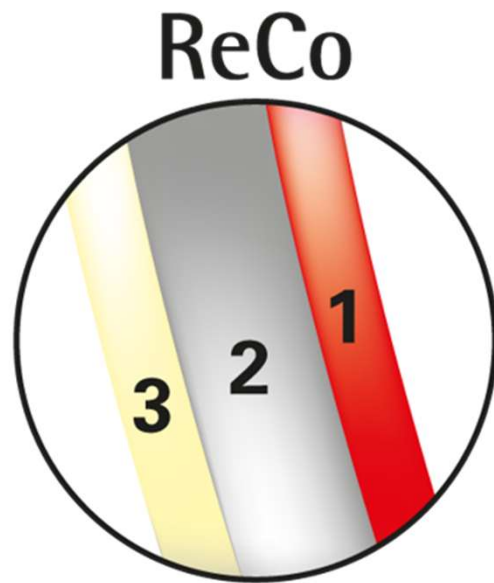
Outside



Add shelf value
Keep Protective Qualities Intact



Multi-Layer Blow Molding – Sustainability

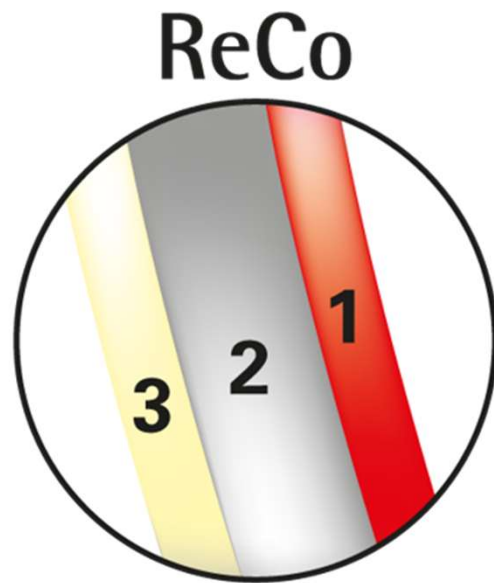


Example:

A 6-parison head with 60kg/hr
per parison has 360 kg/hr throughput

At 7885 hrs/yr this is 2,858,600 kg/yr

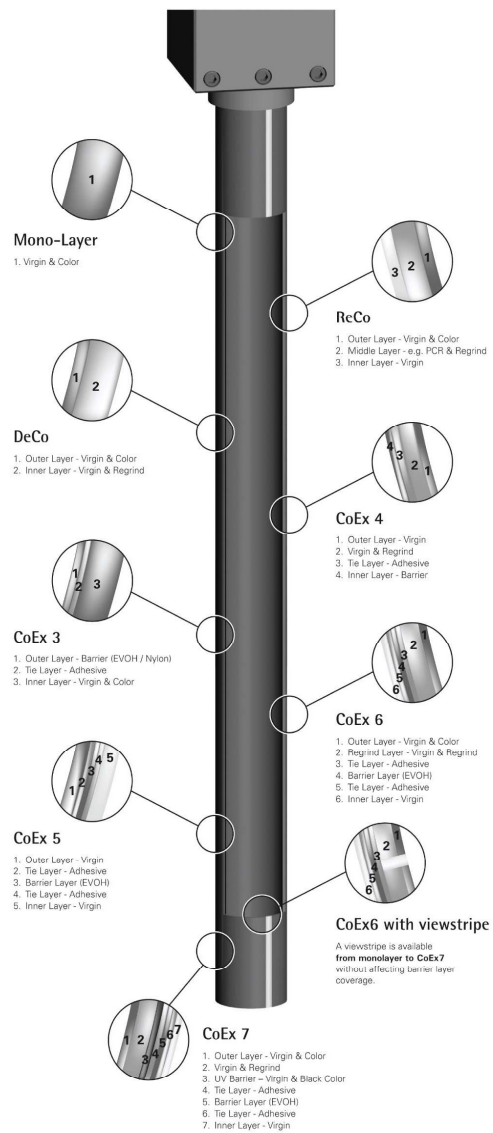
Multi-Layer Blow Molding – Sustainability



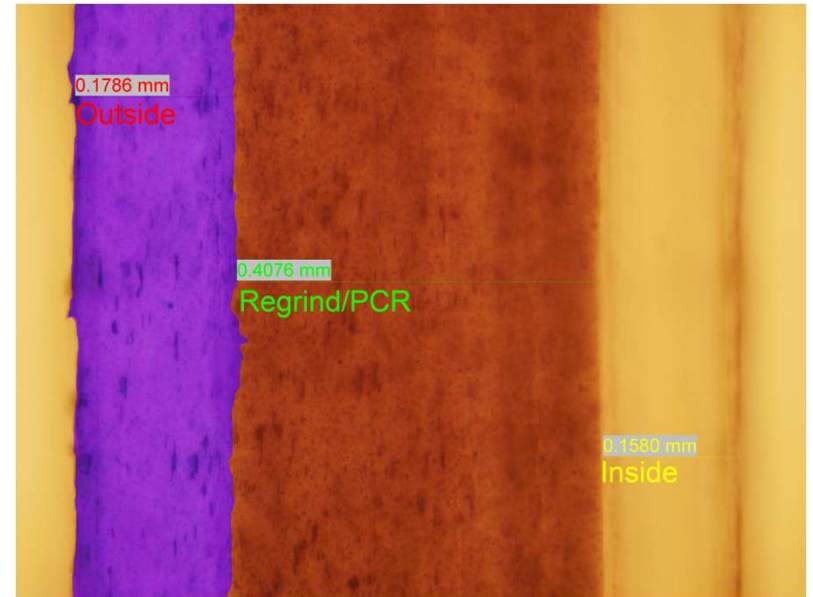
Result:

Replace 60% of the weight of the container with PCR

1.7 Million kgs less virgin material usage every year

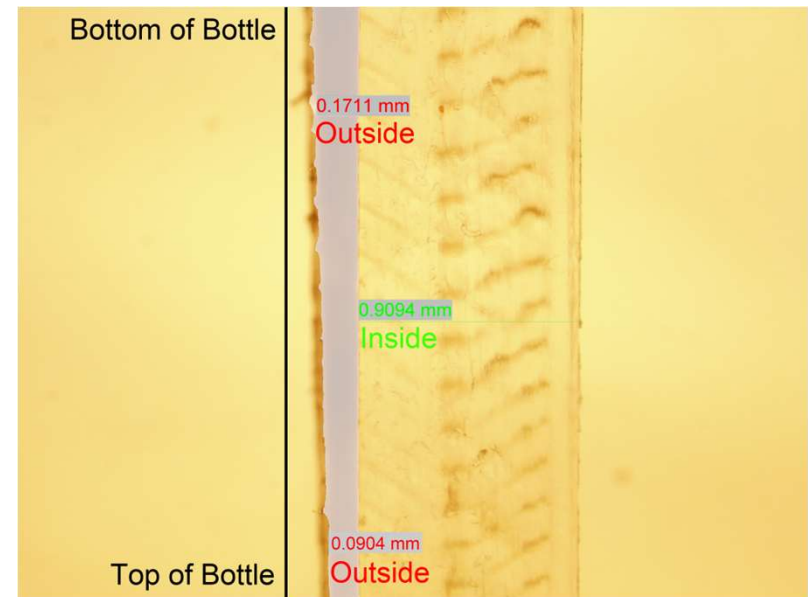


Multi-Layer Blow Molding Applications – Personal Care



DeCo 2/ReCo 3 to save color costs

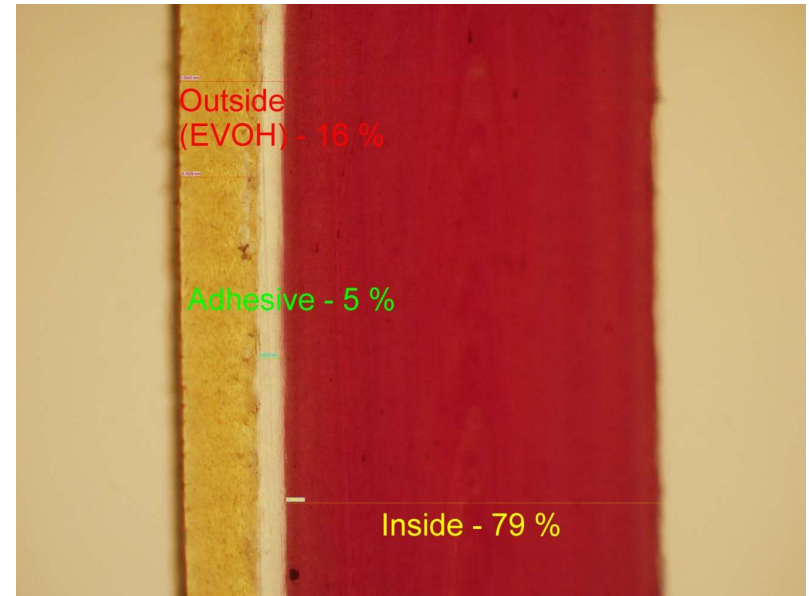
Multi-Layer Blow Molding Applications – Personal Care



DeCo 2 for a gradated design

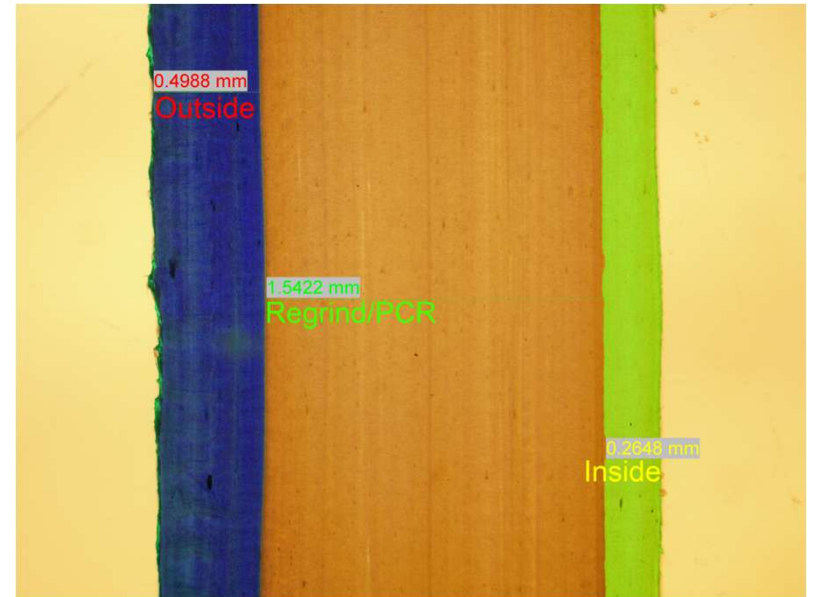


Multi-Layer Blow Molding Applications – Cosmetics



CoEx 3 to highlight color

Multi-Layer Blow Molding Applications – Industrial Packaging



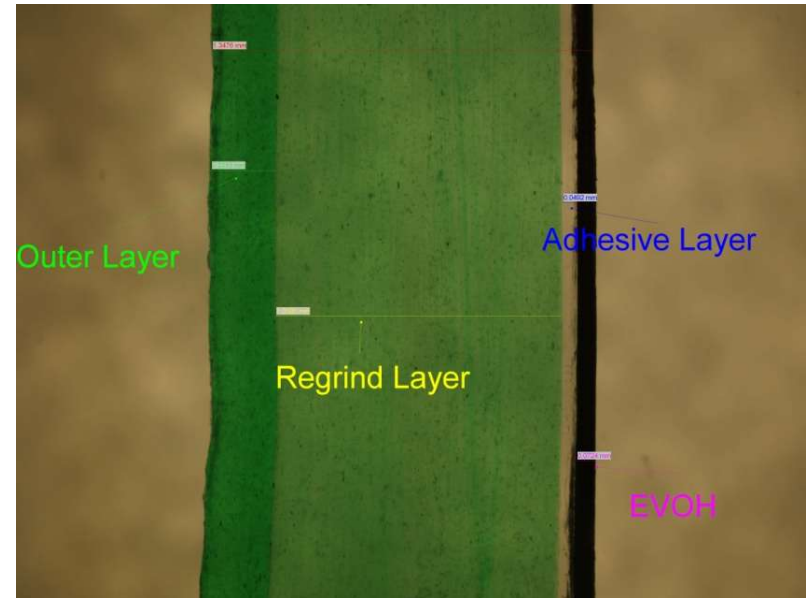
ReCo3 to save virgin material



Multi-Layer Blow Molding Applications – Agro-Chemical



CoEx 4 to isolate contents

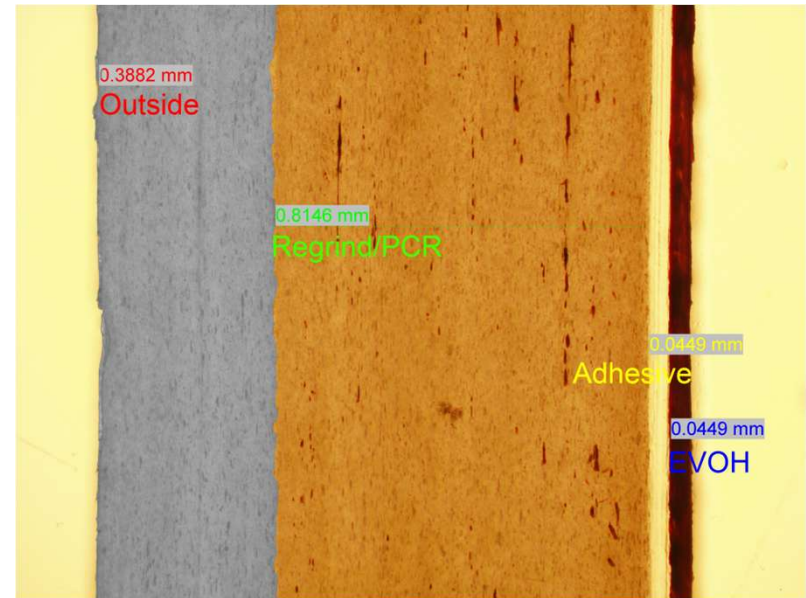


*Barrier stained black using iodine for better visual representation

Multi-Layer Blow Molding Applications – Lubricants & Additives



CoEx4 with view stripe

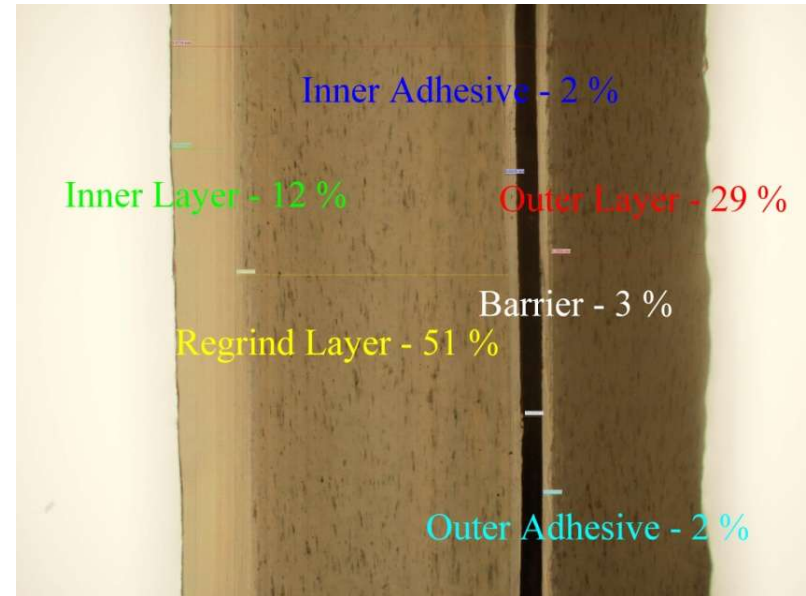


*Barrier stained black using iodine for better visual representation

Multi-Layer Blow Molding Applications – Food & Beverage



CoEx 6 to preserve flavor



*Barrier stained black using iodine for better visual representation

Multi-Layer Blow Molding Applications – Petroleum



CoEx 6 to protect consumers



*Barrier stained black using iodine for better visual representation

Expertise Courtesy of:



- Family Owned & Operated in 2nd generation
- Legendary Quality & Reliability
- 24/7 Global Support, Service, & Spare Parts
- Hand-Made in Troisdorf, Germany for Over 50 years

