MDO: Stretching the Limits for Performance

By: Steve DeSpain, Reifenhauser
Four Global Trends

- Environmental Protection/ Climate Change
  - Increased regulations, changing industry and consumer demands

- Declining Resources
  - Raw material and energy price increases, need for increased efficiency, sustainability

  - Globalization
    - Competition from imports, outsourcing, need for innovation

  - Demographic Changes
    - Lack of qualified technical personnel, education problems, aging workforce, migration (language problems)
Global Megatrends from a perspective of a machinery supplier

- New Consumer Behavior
- Gender Shift
- Increasing Health Awareness
- Digitalization
- Utilization of Resources
- Increasing Individualism & Silver Society
- Demographic Change
How are Megatrends impacting Plastic Manufacturers today?

Utilization of Resources
- Need of flexible extrusion systems
- Adapt / change existing successful structures
- Come up with easy to recycle “mono structures”
- Use of Recycled polymers and Biopolymers
- Monitor energy consumption and take actions

Increasing Individualism & Silver Society
- Dedicated products e.g. easy opening + re-closeable
- Utilizing knowledge of aged persons and integrate them in the society + companies
- Hygienic products

Demographic Change
- Difficult to find skilled employees in less populated areas
- The “Big are getting Bigger”

New Consumer Behavior
- Smaller Container Sizes + re-closeable packaging
- Smaller Order Runs
- Just in time delivery
- More Job Changes

Increasing Health Awareness
- Employees in saturated markets aim for an improved "Work live Balance"
- Awareness for sustainable behavior / products

Digitalization
- Implementation of new Data Systems
- Traceability of production batches
- Data Collection & Data Assessment
- Turning Data into Information
Metal (steel) is currently the most recycled material however plastic is forecast to show the highest levels of growth to 2023, with 19-24% of plastic being collected and reused. Other materials such as paper and glass have relatively high collection rates but show signs of little growth.
• Manufacturers, brand owners and retailers are now looking to shift toward a circular economy in which no material is wasted, but is used multiple times.

• **The circular economy and climate change**
  – Before recycling became popular, packaging waste was traditionally buried in landfill sites or incinerated
  – A shift is beginning from a linear ‘take, make, waste’ economy – where materials are used just once before disposal – to a circular one, which minimizes the use of raw materials, energy and water and reprocesses materials into new products rather than simply throwing them away.

• **Legislation and recycling targets**

• **Voluntary agreements**

• **Environmental campaigning**
### Circular economy - Consequences for Film

**Mono-Material Packaging**
- Pouches: Pure PE or Pure PP
- Barrier: No PA, EVOH in small amounts

**Recipes**
- Five instead of three-layers in order to incorporate recycled resin

**Machine Technology**
- Stretching will become more important for mechanical properties
**Market trends - Sustainable film production**

**Recycling**
- fully recyclable products

**Bio-Material**
- mechanical behavior
Market-driven trend - Recyclable products

- **Nestlé**: “100% of our packaging recyclable or re-usable by 2025”
- **Unilever**: “100% of our plastic packaging will be reusable, recyclable or compostable by 2025”
- **Pepsico**: “design 100% of our packaging to be recyclable, compostable or biodegradable.”
- **Danone**: “Our goal for 2025 is for every piece of packaging—from bottle caps to yogurt cups—to be reusable, recyclable, or compostable.”

**Friendly reminder:**
2025 is in 5 ½ years

**Brand owners are the driving force**
Today many PE packaging applications consist of laminates of different materials that are difficult to recycle together.

**Today’s Typical Pouch Structure**

- OPP
- BOPP
- BOPA
- PE
- AIOx
- SiOx
- BOPET
- PET
- OPA
Reducing the material choice is key to sustainable packaging solutions.
Future target for recyclable barrier film materials

- OPP
- BOPP
- BOPA
- EVOH
- PE
- PET
- BOPET
- SiOx
- AlOx
- OPA
OPE allows replacing PP and PET, enabling PE only laminates

Blue goes Green
Enabling Recyclability
Example: Stand-up pouch - Current material mix

Different structures for manifold applications (3, 5, n-layers)

<table>
<thead>
<tr>
<th>Layer</th>
<th>Purpose</th>
<th>Properties</th>
<th>Material</th>
<th>Processing</th>
</tr>
</thead>
<tbody>
<tr>
<td>1)</td>
<td>(Outer) surface layer; „high quality impression“</td>
<td>Strength, tear and puncture resistance, stiffness</td>
<td>PET, PP</td>
<td>reverse printed</td>
</tr>
<tr>
<td>2)</td>
<td>Adhesive</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3)</td>
<td>(Inner) surface layer; „product contact“</td>
<td>Water vapour protection, hot sealing surface</td>
<td>LLDPE, mLLPE, LDPE</td>
<td>sealing</td>
</tr>
</tbody>
</table>

Low recyclability due to material mix
Example: Stand-up pouch - Pure PE fully recyclable structure

Properties of stretched PE film:
- Perfect **optics**, no scratches
- High **stiffness** (mainly in MD)
- Good **flatness** and good **printability**
- Seal ability with conventional equipment
- Temperature resistant against sealing bar
- **Thin film** to compete against 12 µm BOPP or BOPET pricewise

Basic PE pouch film (3 or 5-layer) with special sealing layer, sealing at low temperatures
Pure PE application produced using MDO

The EVO Ultra Stretch advantage:
• Superior shrink properties
• No sealing issues
• No adaptation on FFS machine required
• Maintaining full efficiency of converting process

Proven by an international brand owner
Comparison of 20 µm stretched PE with 12 µm BOPET

Reifenhäuser Pure PE film
- Sufficient stiffness for BOPET replacement
- Good mechanics
- Low shrinkage for easy sealing capability
- Excellent film optics with low haze and high clarity
The Golden Rules of Stretching

The warmer the film before stretching, the less energy required to stretch!

The less crystalline the film, the easier it stretches!

The longer the annealing time, the better the sealing performance!
MDO Placement

New Position

Ordinary Position

EVO Ultra Stretch advantages:

- Energy saving
- More stable process
- Improved film properties (e.g. welding)
EVO Ultra Stretch vs. MDO on 1st tower level - Energy saving

- Heating-up only approx. 60 °C
- Heating-up approx. 80 °C
- Cooling only approx. 50 °C
- Cooling approx. 75 °C

3 = 1st MDO roll
4 = last MDO roll

+ Energy saving
EVO Ultra Stretch vs. MDO on 1st tower level – More stable process

- **EVO Ultra Stretch**
- **MDO on 1st tower level**

Diagram showing:
- **Ultra Stretch** pathway
- **MDO** pathway

Key points:
- **3 = 1st MDO roll**
- **4 = last MDO roll**

Graph indicates:
- More stable process
- Temperature [°C] vs. Web path [m]
- 26 sec* at 35 m/min primary web speed

Legend:
- Blue line: EVO Ultra Stretch
- Red line: MDO on 1st tower level

Note:
- * at 35 m/min primary web speed
Lower crystallinity increases process stability

Every moment that you stretch the film earlier, you will improve the process.

Every second counts.

1 = Ultra Stretch 2 = MDO (1st tower level)
Ultra Stretch vs. MDO on 1st tower level
Improved film properties

Post annealing = 3.1 sec
Post annealing = 11.7 sec

③ = 1st MDO roll
④ = last MDO roll

+ Improved film
Pure PE pouch for easy recycling

100% PE

Film stretched 110 µm -> 20 µm
Pure PE Sample Application - Quad Seal Bag without wrinkles or film shrinkage

Multi seal areas without wrinkles or film shrinkage

Converted on a Wolf packaging machine
Details of EVO Ultra Stretch
Ultra Stretch The 3rd generation of stretching unit by Reifenhäuser

Type S

Type M

Type L

Available Layflat
1.800 mm
2.600 mm
3.000 mm

= steel take-off roll
○ = rubber take-off roll
● = heating roll
■ = stretching roll
□ = annealing roll
□ = cooling roll
□ = slitting unit

Reifenhäuser reserves the right to change design
EVO Ultra Stretch –L
Enabling recyclable packaging applications

- Full scale MDO
- Stretch ratio up to 1:10
- 12 rolls
- Individual tempering device per roller (up to 120°C)
- Easy access to rollers
- Can be used as Ultra Flat
Film width optimization
Get more net out of your gross

Neck-in

Thick edges to be removed according to the desired thickness profile

Primary profile measurement to control thickness before Ultra Stretch

Secondary profile measurement after Ultra Stretch to adjust edge trim
Typical Blown Film Line with EVO Ultra Stretch for production of Pure PE Film

**Typical machine configuration**

- EVO Universal Extruder 70-70-80-70-70
- EVO 5-layer die head 650
- EVO Ultra Stretch 2600
- EVO Winder WP 2600

**Main dimensions**

- Width: 8.0 m
- Length: 20.6 m
- Height: 20.5 m
Multibubble Blown Film Lines
Advantages

- Combination of multilayer co-extrusion with a stretching process
- Higher puncture resistance
- Higher stiffness
- Seal strength
- Adjustable shrink properties
- No curing times as with laminate structures
11-Layer Multi Bubble Technology
Typical products
MULTIBUBBLE Blown Film Extrusion
MULTIBUBBLE Blown Film Extrusion
Primary Tube Extrusion

Saving of special additives: Minimum Dosing of e.g. AB CaCo3
MULTIBUBBLE Blown Film Extrusion
Vacuum Water Quenching (1st Bubble)
MULTIBUBBLE Blown Film Extrusion
Vacuum Water Quenching (1st Bubble)

Dual Disc Cooling System

Water exchange system for fast cooling
MULTIBUBBLE PVDC Shrink Film Extrusion Lines
Conclusion

• Sustainability and Plastics Reduction Plastic containers will experience the fastest gains among major produce packaging types.
  – Consumers are increasingly avoiding plastics, perceiving them to be harmful to the planet. With reduced material and eco-friendly packaging material options, flexible packaging represents sustainability and less environmental impact than the packaging formats that used to dominate the shelves.

• Heightened demand is anticipated for pouches, which, in addition to being less expensive than rigid containers, are valued for being display-ready and offering good aesthetics and pure PE SUP’s will be required

• Orientation of film provides processors with the ability to supply sustainable solutions

• Machinery, materials, and people will need to keep pace and adapt to grow with these trends.

• Spread the word on the good things plastics are used for and don’t believe everything you hear!
THANK YOU FOR YOUR ATTENTION