Recent Technologies in Blown Film Extrusion

Sunil Jain
Rajoo Engineers Limited
Outline

- Agri films – an overview
- Why co-extrusion?
- Advances in multilayer blown film technology
Agri Films

- Mulch
- Greenhouse
- Silage
- Geomembrane
Agri Films

- Mulch
- Greenhouse
- Silage
- Geomembrane
What is mulch?
What is mulch?

Applied to the soil surface around plants to:

• Conserve moisture
• Control weeds
• Moderate soil temperature
• Beautify landscape
Agri Films

- Mulch
- Greenhouse
- Silage
- Geomembrane
Greenhouse Films
Agri Films

- Mulch
- Greenhouse
- Silage
- Geomembrane
Why Silage Film

- Maintain nutrition value
- Exclude air
- Increase life of feed
- Save for rainy days
Agri Films

• Mulch
• Greenhouse
• Silage
• Geomembrane
What is a geomembrane?
Outline

• Agri films – an overview
• Why co-extrusion?
• Advances in multilayer blown film technology
• Q & A
Why co-extrusion?

- Achieve specific performance properties
- Reduce costs
- Reduce waste
- Synergistically improve film properties
- Process non compatible polymers
Achieve specific performance properties

- Barrier properties - moisture, oxygen, nitrogen
- High strength
- Sealability
- Antistatic surface
Reduce Costs

- Reduce amount of expensive polymers
- Downgaging
- Regrind in middle layer
Outline

- Agri films – an overview
- Why co-extrusion?
- Advances in multilayer blown film technology
- Q & A
Advances in Multilayer blown film technology

- Stack Die
- Internal Bubble Cooling
- Oscillating Take-Off
- Thickness Profile Control
- Gravimetric Blending and Dosing
Advances in Multilayer blown film technology

- Stack Die
- Internal Bubble Cooling
- Oscillating Take-Off
- Thickness Profile Control
- Gravimetric Blending and Dosing
INCOSS

INverted CONical Spiral Stack Die
Includes advantages of both vertical spiral dies and flat dies. Most accepted for wide width stretch/shrink film, geomembrane films and lot more products with excellent profile.
Universal Co-ex Die – UCD®

- Most versatile die system
- Low wet surface area
- Same wet surface area for different layers
- Isolation of temperatures between layers
- Easy to dismantle for cleaning a particular layer
- Upgradeability in terms of number of layers and IBC retrofit
INCOSS

Variety of Stack dies to suit specific applications
INCOSS

Variety of Stack dies to suit specific applications
<table>
<thead>
<tr>
<th></th>
<th>Conv.</th>
<th>UCD®</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy consumption</td>
<td>High</td>
<td>Low</td>
</tr>
<tr>
<td>IBC retrofitting</td>
<td>Not possible</td>
<td>Possible</td>
</tr>
<tr>
<td>Layer up-gradation</td>
<td>Impossible</td>
<td>Anytime</td>
</tr>
<tr>
<td></td>
<td>Conv.</td>
<td>UCD®</td>
</tr>
<tr>
<td>--------------------------</td>
<td>------------------------</td>
<td>-----------------------</td>
</tr>
<tr>
<td>Wet surface area</td>
<td>More</td>
<td>Less</td>
</tr>
<tr>
<td>Polymer degradation</td>
<td>More</td>
<td>Less</td>
</tr>
<tr>
<td>IBC for die</td>
<td>More than 200 mm</td>
<td>Possible for any die</td>
</tr>
<tr>
<td></td>
<td>die dia</td>
<td></td>
</tr>
</tbody>
</table>
Advances in Multilayer blown film technology

- Stack Die
- Internal Bubble Cooling
- Oscillating Take-Off
- Thickness Profile Control
- Gravimetric Blending and Dosing
Why IBC?

- Reduced start-up wastage
- Improve throughput rates
- Improve optical properties
- Improve mechanical properties due to relatively lower frost line height
- Improve film width consistency
Internal Bubble Cooling—What it does?

- Exchanges air inside the bubble
- Cools inner bubble surface
- Removes hot air
- Senses and maintains bubble diameter

Sensor: non-contact or mechanical arm
Internal Bubble Cooling

Ultrasonic Sensor System

Operator Interface and Main Control Panel

Patented Bladder Valve and Flow Pneumatics
Internal Bubble Cooling

Internal bubble cooling and centerline controlled calibration baskets
Advances in Multilayer blown film technology

- Stack Die
- Internal Bubble Cooling
- Oscillating Take-Off
- Thickness Profile Control
- Gravimetric Blending and Dosing
Gauge Randomization

Why required?

• High speed converting machines intolerant
• Flatness necessary for coating applications for proper interply strengths
Why gage variation takes place?

• Melt flow variation - cross head sections
• Melt distributed uneven
• Melt temperature variation
• Die lips and other flow surfaces – limitation on machine tolerances
Why gage variation takes place?

- Film cooling not even
- Ambient current drafts
- Bubble cage rollers not evenly placed
- Elongation of film at nipping
Gage randomization techniques

- Oscillating/rotating die
- Oscillating/rotating platform
- Oscillating haul-off
Oscillating Die

- Not suitable for co-extrusion
Oscillating Platform

Not able to correct variations due to:

- Uneven cooling
- Ambient drafts
- Rollers on the bubble cage
- Flattening and nipping of the film
Oscillating Haul-off

Wide width Reversing Haul Offs with Motorized Gusseting

Uniform air cushioning, without heating and silent operation
Advances in Multilayer blown film technology

- Stack Die
- Internal Bubble Cooling
- Oscillating Take-Off
- Thickness Profile Control
- Gravimetric Blending and Dosing
Thickness Monitoring & Control System
Auto Air Ring
Advances in Multilayer blown film technology

- Stack Die
- Internal Bubble Cooling
- Oscillating Take-Off
- Thickness Profile Control
- Gravimetric blending and dosing
Gravimetric blending and dosing
Gravimetric blending and dosing
Recent milestones

MULTILAYER BLOWN FILM PLANTS
Boubyan Plastics, Kuwait – 2006

- 3 Layer
- 2 X 60, 1X 90 mm extruders
- 500 kg/hour
- LFW – 2100 mm
- Ultrasonic IBC
- Fully automatic surface/centre/gap winder
- 1+3 Gravimetric dosing, blending and conveying system
- Automatic thickness control with segmented air
- Integrated supervisory control panel with touch screen
Synthetic Packers, India – 2007 (15th repeat order)

- 3 Layer
- 3 X 120 mm extruders
- 1,200 kgs/hour
- LFW – 5.0 mm
- Max. film thickness – 1.2 mm
- Pneumatic IBC
- Fully automatic surface winder
- Motorised universal gusseting system
- Integrated supervisory control panel with touch screen
Ess Dee Aluminium, India – 2007

- 3 Layer
- 3 X 60 mm extruders
- 350 kg/hour
- LFW – 1700 mm
- Pneumatic IBC
- Fully automatic surface winder
- 1+3 Gravimetric dosing, blending and conveying system
- Automatic thickness control with segmented air
- Integrated supervisory control panel with touch screen
Reliance Industries – 2008

- Combo Sheet and Blown Film Line for Lab
- 5 Layer – ABCBD
- 2 X 40, 2 X 30 mm extruders
- 75 kg/hour
- Sheet Die width – 800 mm
- Blown Film Die Width – 150 and 200 mm
- Four Maag melt pumps
- Winders for sheet and film
- Integrated Supervisory Control Panel
Glory Polyfilms, India – 2008 (4\textsuperscript{th} repeat order)

- 3 Layer
- 1X 120, 2X 90 mm extruders
- 800 kg/hour
- LFW – 2100 mm
- 500 mm INCOSS die
- Pneumatic IBC
- Duo Air ring
- Fully automatic surface winder
- 1+3 Gravimetric dosing, blending and conveying system
- Automatic thickness control with segmented air
- Integrated supervisory control panel with touch screen
General Printers Ltd. Kenya – 2008 (4th repeat order)

- 5 Layer
- 2 X 60, 3 X 50 mm extruders
- 400 kg/hour
- LFW – 1600 mm
- Pneumatic IBC
- Fully automatic surface winder
- 1+3 Gravimetric dosing, blending and conveying system
- Automatic thickness control with segmented air
- Integrated supervisory control panel with touch screen
Vee Pee Industries, Nigeria – 2009 (10th repeat order)

- 3 Layer
- 1X 120, 2X 90 mm extruders
- 600 kg/hour
- LFW – 2100 mm
- 500 mm INCOSS die
- Pneumatic IBC
- Fully automatic surface winder
- 1+3 Gravimetric dosing, blending and conveying system
- Automatic thickness control with segmented air
- Integrated supervisory control panel with touch screen
Venkateshwara, Hyderabad – 2009 (3rd repeat order)

- 3 Layer
- 1X 90, 2X 70 mm extruders
- 500 kg/hour
- LFW – 1500 mm
- 500 mm INCOSS die
- Pneumatic IBC
- Dual station Fully automatic surface winder
- Integrated supervisory control panel
Thank you....