Polyethylene Basics

How is Polyethylene Made

Basic Types of Polyethylene

Who are these Resin Companies and why are they so darn powerful
Polyethylene Resin Manufacturing

Natural Gas 70 → Ethane Propane Butane

Cracking process

Crude Oil 30 → Naphtha Gas Oils

Polymerization Process

Ethylene

Polyethylene Resin
## Polyethylene Basic Types

<table>
<thead>
<tr>
<th><strong>LOPE</strong></th>
<th>![LOPE Image]</th>
</tr>
</thead>
</table>
| Low density polyethylene  
High density polyethylene  
Branched polyethylene | |

<table>
<thead>
<tr>
<th><strong>LLDPE</strong></th>
<th>![LLDPE Image]</th>
</tr>
</thead>
</table>
| (main component of stretch film)  
Linear low density polyethylene  
Low pressure low density polyethylene  
Linear polyethylene | |

<table>
<thead>
<tr>
<th><strong>mLLDPE</strong></th>
<th>![mLLDPE Image]</th>
</tr>
</thead>
</table>
| Linear low density polyethylene copolymer  
Linear polyethylene produced using a hexene copolymer | |

<table>
<thead>
<tr>
<th><strong>HDPE</strong></th>
<th>![HDPE Image]</th>
</tr>
</thead>
</table>
| High density polyethylene  
Linear polyethylene | |
Major Resin
Companies

**Exxon Mobil**
40% + market share on Stretch Resin

**Dow Chemical**
40% + market share on Stretch Resin

Remaining 20% split between several companies

- Nova Chemcials
- Eastman
- Hunstman
- Formosa
- Equistar
- Chevron Phillips
Manufacturing Methods

Extrusion Process and methods

Inherent qualities to each process/
What makes them different?

The Industry in Review
Blown films are produced by pumping melted resin through a heated circular slotted rotating die to form a tube. The tube is filled with air which assisted in determining the gauge. The flow of air cools the film before it reaches the nip rollers. The collapsed tube is then slit into various widths and roll lengths.
Web oath

Upper Nip

Upper Nip A-frame (wood or air booring type)

IBC Exhaust Airflow

IBC Cooling Airflow

Air Ring Airflow

Internal Bubble Cooling

Input

Exhaust

Manual Damper

Air Activated

Automatic Damper

Servo Driven

Bubble caos

Frotaline

Sonar Head

4-6 inch Typ Positioning

Air Ring
The cast coextrusion manufacturing method consists of melted resin pumped through several extruders through a straight slotted die creating a layered sheet of film. The film is then quickly cooled by a water filled chill roller and slit to size.

The cast process usually produces superior quality stretch film with more uniform gauge, and more consistent cling. Cast films traditionally offer better tear strength which results in the prevention of tear propagation.
Extruder in operation

Vaccum Box
Dia
Air knife
Casting Roll
Pine out Roll
Chill Roll
To Winder
Differences Blown & Cast Films

**CAST**
- Superior optics
- High Gloss
- Lower modulus (stretches easier)
- Tear resistance
- Good puncture
- Quiet unwind
- Non-migratory
- Excellent gauge control

**BLOWN**
- Hazy
- Dull
- Tough
- Noisy unwind
- Tear resistance
- Migratory cling
- Poor gauge control
- Excellent puncture

[Images of Cast and Blown films]
• 2009 Stretch Film Sales were approximately 1.7-1.9 Billion Pounds

• 2009 Capacity was roughly 2.6 Billion lbs

• 2008 Capacity was over 2.1 billion lbs

• 2008-10 Major reshaping of players due to the mergers and consolidation that the industry has gone through. RECESSION has hurt many small and big players

• The top 5 companies have nearly 1.6 Billion pounds of capacity
Stretch Film Performance

Measuring Hand Film Performance
Measuring Machine Film Performance
Load Types

Hand Film Performance

Stiffness
Puncture Resistance
NECK Down
Yield
Clarity
Holding Force
Machine Film

Performance

- **Pre-Stretch**
  The amount of stretch achieved between the rollers.

- **F2 Stretch**
  The amount of stretch achieved by the load against the unwinding film.

- **Total Stretch**
  The combination of the pre-stretch and the F2 stretch.

- **of F2**
  The F2 stretch %/ pre-stretch gear % (Normal is about 10%).

Measuring Film

Performance

- **Total Stretch**
  Is measured with a 10” star wheel.

- **Load Retention**
  The amount of force exerted inward by the film. It is measured in lab conditions on a load cell.

- **Cut & Weigh**
  The amount of film cut off the load & measured on a scale.

- **Force to Load**
  Is measured with a flat plat and a pull scale.
Load Types

“A”
Up To 3” Protrusion

“B”
3”- 6” Protrusion

“C”
Greater than 6” protrusion
Film Failures

**Gel Holes**
A gel is a V shaped break in the film caused by resin imperfection or some other manufacturing problem.

**Edge Damage**
An edge tear starts at the top or bottom of a roll and tears in a diagonal direction. A nick in the film edge usually causes it.

**Application Failure**
An Application failure is when the wrong film is being used for an application. Load type and excessive down gauging are possible causes.

**Ultimate Breaks**
An ultimate break is a straight-line break with pointed edges. The break occurs when the film has been pre-stretched beyond its limits.
How to sell Stretch film

Current Market Conditions & Pricing

Questions to Ask

Let’s do the Numbers

What’s in the Box

Who’s my Competition?
Current Market

Conditions & Pricing

Pricing Factors:

- Oil and Natural Gas
- Supply and Demand from Overseas Markets
- Overcapacity from Fabricators both in North America and international Markets

Stretch Film Market still remains very volatile with increases and decreases due to capacity from the mill to excess capacity from the Stretch Film Manufacturers.
Questions to ask:

- Know your NEEDS
- What are they using NOW
- What is the EQUIPMENT?
- What do they ENJOY about it
- Who is the DECISION MAKER
- How SOON?
- NEEDS
- NOW – gauge, width, length, competition, blown or cast

Let’s do the numbers

How to figure out the weight of a roll (NET POLY)

Width x Length x Mill Thickness/2500 = poly wt.
Gauge to Micron
Gauge x 0.254 = Micron
Micron to Gauge
Micron x 3.937 = Gauge
MIN FTL on a pallet
Weight of pallet/100
## Stretch Film Performance Formulas

**Find Approximate Net Poly Weight**  
Purpose: To determine the amount of poly on a roll of film  
Formula: \( \text{Film Width (inches)} \times \text{Film length (inches)} \times \text{Thickness (mil)} = \text{Poly lbs.} \)  
Example: \( \text{ATT1-2080 20”X(6000’X12”)X8mil/30,000=38.4 lbs} \)

**Find Net Cost Per Pound**  
Formula:  
\[ \frac{\text{Price Per Roll}}{\text{Net Pound Per Roll}} = \text{Net Cost Per Pound} \]  
Example: \( \text{ATT1-2080@$31.68 per roll} \)  
\( \frac{31.68}{38.4} = 83 \text{ cents/lb} \)

**Find Net Cost Per Thousand Linear Feet**  
Formula:  
\[ \frac{\text{Price Per Roll}}{\text{Thousand Ft Per Roll}} = \text{Net Cost Per Thousand Linear Feet} \]  
Example: \( \text{ATT1-2080@$31.68 per roll} \)  
\( \frac{31.68}{38.4} = 83 \text{ cents/lb} \)

**Find Geared Stretch Level of a Machine**  
Given: Both rollers on the machine are the same diameter, count the teeth in the two gears driving the rollers (Number of teeth on the Input Roller = RS1, Number of teeth on the Output Roller = RS2)  
Formula: \( \frac{\text{RS1}}{\text{RS2}-1} \times 100 = \text{Pre-Stretch%} \)  
Example: \( \frac{54}{18-1} \times 100 = 200\% \)
## Conversion Chart

<table>
<thead>
<tr>
<th>Microns</th>
<th>Gauge</th>
<th>Microns</th>
<th>Gauge</th>
</tr>
</thead>
<tbody>
<tr>
<td>8.5</td>
<td>0.33</td>
<td>19</td>
<td>0.75</td>
</tr>
<tr>
<td>9</td>
<td>0.35</td>
<td>19.5</td>
<td>0.77</td>
</tr>
<tr>
<td>9.5</td>
<td>0.37</td>
<td>20</td>
<td>0.79</td>
</tr>
<tr>
<td>10</td>
<td>0.39</td>
<td>20.32</td>
<td>0.80</td>
</tr>
<tr>
<td>10.5</td>
<td>0.41</td>
<td>20.5</td>
<td>0.81</td>
</tr>
<tr>
<td>11</td>
<td>0.43</td>
<td>21</td>
<td>0.83</td>
</tr>
<tr>
<td>11.5</td>
<td>0.45</td>
<td>21.5</td>
<td>0.85</td>
</tr>
<tr>
<td>12</td>
<td>0.47</td>
<td>22</td>
<td>0.87</td>
</tr>
<tr>
<td>12.5</td>
<td>0.49</td>
<td>22.5</td>
<td>0.89</td>
</tr>
<tr>
<td>13</td>
<td>0.51</td>
<td>22.86</td>
<td>0.90</td>
</tr>
<tr>
<td>13.5</td>
<td>0.53</td>
<td>23.0</td>
<td>0.91</td>
</tr>
<tr>
<td>14</td>
<td>0.55</td>
<td>25.4</td>
<td>1.00</td>
</tr>
<tr>
<td>14.5</td>
<td>0.57</td>
<td>27.9</td>
<td>1.10</td>
</tr>
<tr>
<td>15</td>
<td>0.59</td>
<td>30.5</td>
<td>1.20</td>
</tr>
<tr>
<td>15.5</td>
<td>0.61</td>
<td>33.00</td>
<td>1.30</td>
</tr>
<tr>
<td>16</td>
<td>0.63</td>
<td>35.6</td>
<td>1.40</td>
</tr>
<tr>
<td>16.5</td>
<td>0.65</td>
<td>38.1</td>
<td>1.50</td>
</tr>
<tr>
<td>17</td>
<td>0.67</td>
<td>40.6</td>
<td>1.60</td>
</tr>
<tr>
<td>17.5</td>
<td>0.69</td>
<td>43.2</td>
<td>1.70</td>
</tr>
<tr>
<td>17.75</td>
<td>0.70</td>
<td>45.7</td>
<td>1.80</td>
</tr>
<tr>
<td>18</td>
<td>0.71</td>
<td>48.3</td>
<td>1.90</td>
</tr>
<tr>
<td>18.5</td>
<td>0.73</td>
<td>50.8</td>
<td>2.00</td>
</tr>
<tr>
<td></td>
<td></td>
<td>63.5</td>
<td>2.50</td>
</tr>
<tr>
<td></td>
<td></td>
<td>76.2</td>
<td>3.00</td>
</tr>
</tbody>
</table>
What is in this box, Really?
Customer say’s it’s 80 Gauge,
But what is it really? Why are
WE priced so much higher?

We weigh a case and it weighs
30.1 lbs and we know a 80 GA
Box should weigh net poly 34.56 lbs
+Cores + Box

SOMETHING IS WRONG!

Where can they cheat?
Width, Length and Gauge
How does this effect you?

• Customer states he’s buying a 18” x 80 Gauge x 1500’ roll

• You do your math from the formula you just learned: 18” x 1500 x .80/2500 = 8.64 lbs/roll

• The cores weigh 1 lb each and there are 4 lbs box weighs 1 lb so the total weight for a 18” x 80 x 1500 box

• At 4 rolls per case = Net poly weight + Cores + Box

• 34.56 lbs net poly weight + 4 lbs cores + 1 lb box = 39.56 lbs

• We weighed the box and it comes out to 30.1 lbs and we subtract core and box = Net poly weight is 25.1 lbs

• We know he’s getting cheated!

• Their cost is 25.1 @ 1.00 per pound = $25.10 a case vs Your cost of 34.56 x .85 a lb = 29.37 a case

• You are at a 17% disadvantage.
Hand Film

Selling Techniques

- Ask them what they prefer, cast or blown (Noisy or not noisy)

- Observe how they stretch wrap, if they are pulling hard and the film is soft – you can show them a stiff blown or cast film to save their back and money

- Show them the quick tightness of a stiff cast film vs the film they are using

- Show them the puncture resistance of the film vs what they are using

- Show neckdown, more film coverage vs what they are using

- Weight difference and strain on shoulder, wrist and back

- Walking forward vs backward – safety

- Fatigue factor

- Stronger but thinner = Environmental Source Reduction

- Better load retention means less damage
Common Situations

- **What’s your roll price?** If you don’t know the application and what the operating parameters are, how can you begin to quote a roll price? Explain how Our Films are different and convert to cost/load.

- **Don’t change any machine settings.** The customer wants you to compare apples to apples when you may be offering an opportunity for the customer to improve their current package if they will allow some minor or sometimes major changes. Explain how performance can be measured and how our films are high performance films and achieve the greatest advantage at the higher performance levels.

- **Drop off a sample & we’ll tell you how it does.** Our films are not the same as other films and before a sample can be tested, someone with the knowledge of how to measure performance needs to be present. Show the customer how performance is measured and how it not as simple as changing rolls out. Sell like a film expert.

- **You don’t need to see the machine I’ll tell what you need.** Start talking about the different variables effecting performance and these are critical in choosing the correct film. Don’t guess at the film needed, new business is too important not to do correctly.
The Right Solution

Alliance Plastics
Your Link to the Supply Chain!

Why Alliance Plastics

- Professional
- Customer service
- Solutions provides

- Locations
- Three Ship Points

- Expectations
- Cutting Edge Technology
- Service quality

- Distributors
- JIT Inventory
- Improve Cash Flow
- Cut Inventory Expense

- End Users
- Quality Care
- Wide product line
- World class speed
- Effective Pricing

- Products
- Tape, Cornerboard, Stretch Film cores, Converted stretch film, tubes, Strapping, Packaging equipment

- Solutions
- Promote your brand
- Define your market

- Xpress program
- 48 hours or less

Why Alliance Plastics

Alliance Plastics
Your Link to the Supply Chain!