Extrusion Blow Moulding

For Packaging Applications
This presentation will inform you about ...

- Processing Technology
- Material Properties of Grivory G 21
- Applications
- Typical Structures
- Material Recommendations by EMS-GRIVORY
Multilayer Extrusion Blow Moulding

- Combination of different Properties by Multilayer Technology
- Continuous Extrusion of a Multilayer Parison
- Container/Bottle Shape is defined by the Mould
Grivory G 21
Our Choice for Food Applications

• Co-polyamide (ISO designation PA 6I / 6T)
• Amorphous
• Partially aromatic
Grivory G 21
Displays the Best Oxygen Barrier at 100% R.H.

Oxygen Transmission Rate at 23°C [cm³/m² day bar]

- EVOH 32 mol%
- Grivory G21
- PA6
- PET

Measured on 50 µm cast films
Grivory G 21
Odour Neutral

The smell of a polyolefin can strongly affect the taste of a packaged fluid when in direct contact.

Polyolefin-Fluid Direct contact
Fluid has taken on a Polyolefin taste
Aroma and Taste Absorption
Some Polymers are like Sponges

"FLAVOUR SCALPING"
Grivory G 21
Minimises the Flavour Scalping

Absorbed Citrus Aroma after 7 days [mg/cc]

Aqueous solution containing 16.8 mg/cc Citrus Aroma (d-Limonene)
Polyamide UV-Barrier Characteristics

Wavelengths:
UV-Light: 200-380 nm
Fluorescent lighting: 256 nm

Graph showing light transmission (%) against wavelength (nm) for different materials:
- Grivory G21
- PE
- PP
- EVOH
Barrier Containers
General Requirements

• Gas Barrier (Oxygen, ....)
• Flavour Protection
  – Barrier
  – Minimal Absorption
• UV and/or Light Barrier
• No Influence of the Package on the Product
  (Organoleptics, ..)
• Food Approvals
• Transparency
Barrier Drink Containers
Improved Shelf Life for Milk and Fruit Juice

• Typical Structure:
  – Wall Thickness: 400 - 700 µm
  – Barrier Thickness: 20 - 50 µm
  – Container Size: 0.25 - 5 litre

• 4 Layer Structure
  – PE-HD or PP as outer layer
  – Regrind
  – Adhesive
  – Grivory G 21 as inner layer
Barrier Drink Containers with Grivory G 21, because ... 

- Direct Food Contact Approval (EEC, FDA)
- Excellent Oxygen Barrier at High Relative Humidities
  - Suitable for direct contact
  - 3 (4) Layer Construction possible (Cost reduction)
- Odour Neutral
  - Taste not effected by the polymer
- Minimal Aroma Absorption
  - Taste not effected by the polymer
Transparent Barrier Bottle
Glass Substitution at Reduced Costs

• Typical Structure:
  – Wall Thickness: 400 - 700 µm
  – Barrier Thickness: 20 - 50 µm
  – Container Size: 0.25 - 1 litre

• 3 Layer Structure
  – PP (Clarified) as outer layer
  – Adhesive
  – Grivory G 21 as inner layer
Comparison of the optical properties between the two EBM barrier concepts

<table>
<thead>
<tr>
<th></th>
<th>5-layer bottle, 31 g CPP / Adhesive / EVOH / Adhesive / CPP</th>
<th>3-layer bottle, 31 g CPP / Adhesive / Grivory G21</th>
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<tbody>
<tr>
<td>Haze (%)</td>
<td>24</td>
<td>14.8</td>
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<tr>
<td>Clarity (%)</td>
<td>80</td>
<td>91.8</td>
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<tr>
<td>Transmittance (%)</td>
<td>88.8</td>
<td>88.4</td>
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<td>Gloss 60° Outside</td>
<td>65</td>
<td>114.5</td>
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<td></td>
<td>surface</td>
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<tr>
<td></td>
<td>73</td>
<td>122.8</td>
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</tbody>
</table>
Transparent Barrier Bottle with Grivory G 21, because ...

- Superior High Transparency for a 3 Layer CPP / Grivory G 21 Bottle
- Exceptional High Gloss
- Clear Advantage regarding UV Barrier against EVOH based solution
- Minimal Flavour Scalping
Containers for Agrochemicals

• Typical Structure:
  – Wall Thickness: 1000 µm
  – Barrier Thickness: 60 - 100 µm
  – Container Size: 0.5 - 10 litre

• 3 or 4 (with regrind) Layer Structure
  – PE-HD as outer layer
  – Regrind (if allowed by the end user)
  – Adhesive
  – Grilon A 28 NZ as inner layer
Grilon A 28 NZ is perfectly suited as a Barrier Layer against Organic Solvents due to its ..

- Excellent Resistance to Chemicals,
- Superior Toughness especially at Low Temperatures,
  - Suitable for Containers > 1 Litre (Drop Test)
- Very Good Barrier Properties (Solvents, Oxygen, Carbon-dioxide, Aroma and Hydrocarbons)
- Excellent Processing in Co-Extrusion Blow Moulding
Grilon A 28 NZ has been approved as the inside layer at companies like ..

- BASF AG (DE)
- BAYER (DE)
- NOVARTIS (CH)
- AGREVO (DE)
- PACKARD (NL)
- AVENTIS (FR)
- SHELL AGRAR (DE)
Correction Pen

- Typical Wall Thickness
  - 500 - 800 µm

- Typical Container Size
  - 7 - 20 ml

- Material
  - Grilon XE 3781 (PA 6-HI)
Grilon XE 3781 is well suited for the use as a container for Correction Fluids due to its …

– Excellent Resistance to Chemicals
– Good Mechanical Properties (Resilience, Toughness)
– Good Barrier against Correction Fluid
– Flexibility
– High Melt Strength
Mono-Inliner for Spray Cans

- Typical Wall Thickness:
  - 200 - 300 µm

- 2 Element Construction
  - Metal Can
  - (Propellant Gas)
  - **Grilon F 50** as inner bag
Grilon F 50 is well suited for the use as a Mono-Inliner due to its ...

- Good Mechanical Properties
- Excellent Resistance to Chemicals
- Good Barrier against Propellant Gases (Propane, Butane)
- Aroma Barrier
- High Melt Strength
Product Assortment for EBM Multilayer Packaging Applications

**Grivory G 21 natural**
For direct Food Contact and/or for applications which require a good Aroma Barrier and zero taste influence.

**Grilon A 28 NZ natural**
For Multilayer Applications, where good barrier properties and good toughness at low temperatures are required (i.e. Chemical Containers).

**Grilon F 28 NZ natural 6014**
For Multilayer Applications, where good barrier properties and good toughness at low temperatures are required (i.e. Chemical Containers). Contains an optical brightener which glows under UV light.
Grilon F 50
For Mono Applications which, next to the high melt strength also requires the typical polyamide properties such as a high barrier, good mechanical properties etc. (i.e. Blow Moulded Pouches).

Grilon XE 3781
For Correction Pen Containers due to its combination of high melt strength, flexibility and chemical resistance.