Monomaterials in Multilayers

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Overview

- Introduction: Circular Economy for Flexible Packaging
- Design for Recycling: Full PE Laminate already demonstrated
- Case 1: Full PP laminate by Adhesive Lamination
- Case 2: Full PP laminate by Extrusion Coating
- Conclusions
CEFLEX will work to find solutions to make flexible packaging even more relevant to the circular economy

End of Life challenges
While highly resource efficient, flexible packaging is generally showing a lower recycling performance than other packaging.

Collection
Flexible plastic is not widely collected for recycling in all countries.

Technical
The possible combination of different layers/materials makes flexible packaging very resource efficient but can also make it more challenging to recycle.

Infrastructure
The light weight of flexible packaging means a lot more packs need to be collected to meet weight based recycling targets. It is easier and costs less to meet the targets with heavier packaging formats.
Polyolefins – a valuable resource in the circular economy

Polyolefins combine excellent properties, cost / performance ratio and recyclability

Grade and application development – addressing future major trends
Full PE Laminate – TAPPI PLACE 2017
Benefits of flexible and recyclable design combined!

Full PE laminates by extrusion coating and lamination
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Full PE Laminate by Extrusion Coating and Lamination
- MDO PE as substrate in extrusion coating and lamination
- Is PE based substrate heat resistant enough?
- Can we extrusion coat it?
- Shrinkage during extrusion coating?
- Introducing oxygen barrier?
- Sealability?

Full PP Laminate by Extrusion Lamination

Case 1: BOPP/PP Cast Film Adhesive Laminate
Case 2: BOPP/PP Blown Film Extrusion Laminate

Sealing challenge: low SIT
Challenge lamination: adhesive, extrusion lamination
Challenge core layer: stiffness/toughness

BOPP 20 my
Adhesive or extrusion lamination
PP cast of blown film 80 my

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Film structures and sealing performance

Plastomer modification of PP terpolymer sealing layer for lower SIT (seal initiation temperature)
Sealing curve for cast film (picture), SIT below 110°C.
BOPP/blown film extrusion laminate als, SIT below 115°C
SIT is temperature when seal strength 10 N/15 mm reached

PP Cast Film, 80 microns
3-layer coex (20/60/20 layer distribution)
• Lamination layer: PP homopolymer
• Core Layer: PP heterophasic copolymer + 10% plastomer
• Sealing layer: PP terpolymer + 10% plastomer

PP Blown Film, 80 microns
3-layer coex (20/60/20 layer distribution)
• Lamination layer: PP heterophasic copolymer
• Core Layer: PP heterophasic copolymer + 10% plastomer
• Sealing layer: PP terpolymer + 10% plastomer

Comparison of Lamination Films properties
PP cast vs. PP Blown

Observations:
Different film cooling rate is affecting the property profile.
Cast film is tougher as can be seen in tear and puncture strength
Blown film is stiffer as can be seen in modulus and tensile strength
**Adhesive Lamination of BOPP and PP Cast Film**

Relative change in properties Cast Film vs. Laminate

- Relative Elmdorf Tear MD (N/mm)
- Tensile Strength MD (MPa)
- Tensile Modulus MD (Mpa)
- Total Penetration Energy /mm
- Puncture Peak Force (N)

Solvent based adhesive, ca 3 gsm

Observations: laminate vs. film
- Reduced tear strength
- Reduced tensile strength
- Improved modulus
- Improved puncture force, but reduced energy

**Extrusion Lamination of BOPP and PP Blown Film**

Relative change in properties Blown Film vs. Laminate

- Relative Elmdorf Tear MD (N/mm)
- Tensile Strength MD (MPa)
- Tensile Modulus MD (Mpa)
- Total Penetration Energy /mm
- Puncture Peak Force (N)

Polypropylene copolymer, 10 g/m2 used for extrusion lamination

Observations: laminate vs. film
- Improved tear strength
- Reduced tensile strength
- Improved modulus
- Improved puncture force and energy
Comparison of Laminate properties
PP cast adhesive laminate vs. PP Blown extrusion laminate

Extrusion lamination has an overall positive effect on laminate properties

Full PP Laminate by Extrusion Lamination is Beneficial

Sealing challenge: low SIT
Challenge lamination: adhesive, extrusion lamination
Challenge core layer: stiffness/toughness

Full PP Laminate by Extrusion Lamination:
Great Opportunity to contribute to Circular Economy
“Thank You”
for your attention

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