AMI: Multilayer Films 2021

ENABLING RECOVERY OF PE/PET FILMS

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Ingenia Polymers Corp.

Ingenia at a Glance

- Founded in 1986 as WedTech and renamed Ingenia Polymers Corp. in 1998
- Five manufacturing sites: Brantford (Canada), Calgary (Canada), Houston & La Porte (USA), and Al-Jubail (KSA)
- Specialized in Additive and Pigment Masterbatches, Superlink® and Rototuff® rotomoulding compounds, and additive Ingenia Superblends®

Challenges of PE/PET Laminates

- PE/PET laminations traditionally non-recoverable due to incompatible materials
- Multi-material structure provides critical performance properties
- Drive for reduced waste, increased mass recovery

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Challenges of PE/PET Laminates

	Polyethlyene	Polyethylene Terephthalate
Melting Point (°C)	100-130	250-270
Polarity	Non-polar	Polar
Other conderations	Degrades at high temperature	Degrades with moisture

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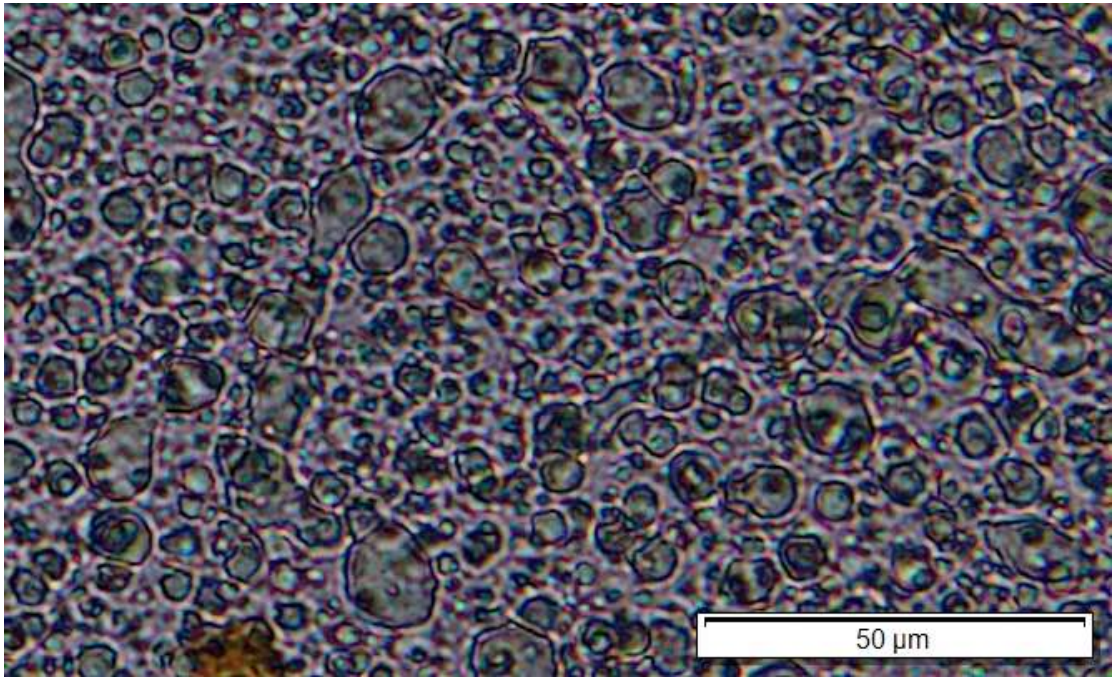
Challenges of PE/PET Laminates



Not two resins that really play nice!

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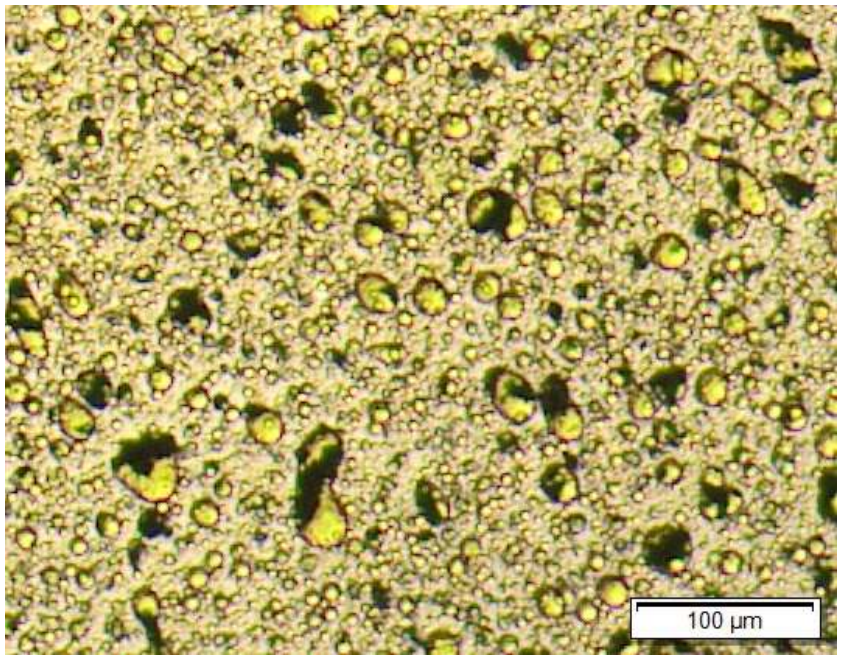
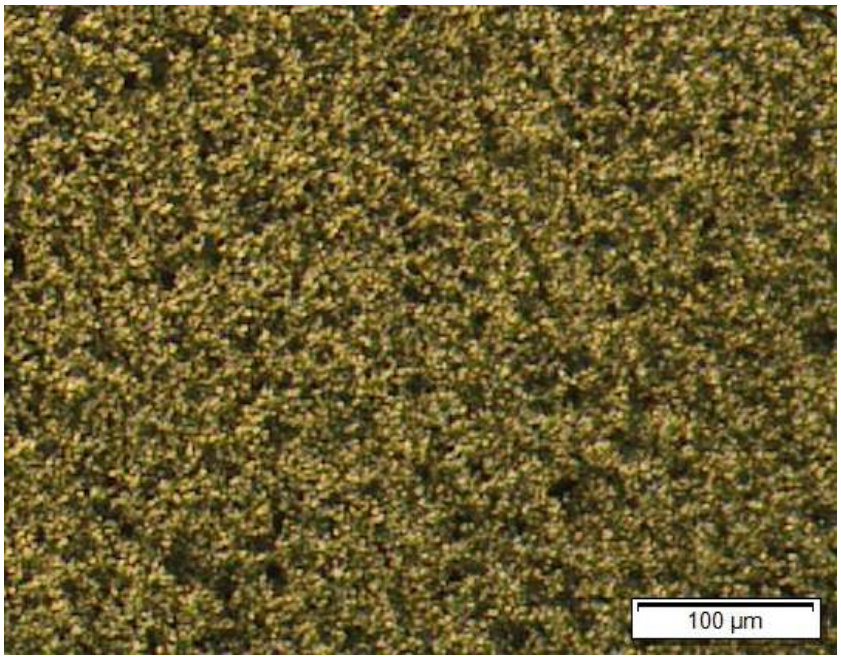


But could go from this…



…to this?

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Ingenia's ITZ-453 – PE/PET Compatibilizer

- Enables reprocessing of PE/PET laminate films
  - Creates a composite suitable for use in PE layers
- Increased value from 'scrappable' stream
- Not 'just a compatibilizer'
  - Designed for existing processing technology
  - Additive package design to account for reprocessing

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Ingenia's ITZ-453 – Method of Use

Difference in melting points, rheology requires a two-stage process

1. Film scrap is reprocessed & pelletized at >265 °C along with ITZ-453
   - PET is melted, dispersed in PE
2. Reprocessed scrap is let down into film line, same as any other pellet
   - Film line uses PE temperatures
   - PET remains solid – behaves like any solid filler

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Case Study – Commercial Film

- PE/PET laminate film with reverse printing
  - 75 µm (3 mil) total thickness
  - ~30% PET by mass
  - Solventless PU adhesive
- Compatibilized with ITZ-453 at 270 °C
  - No pre-drying
- Blown on film line at 190 °C
  - LLDPE letdown resin
  - 2% IP1130 as process aid

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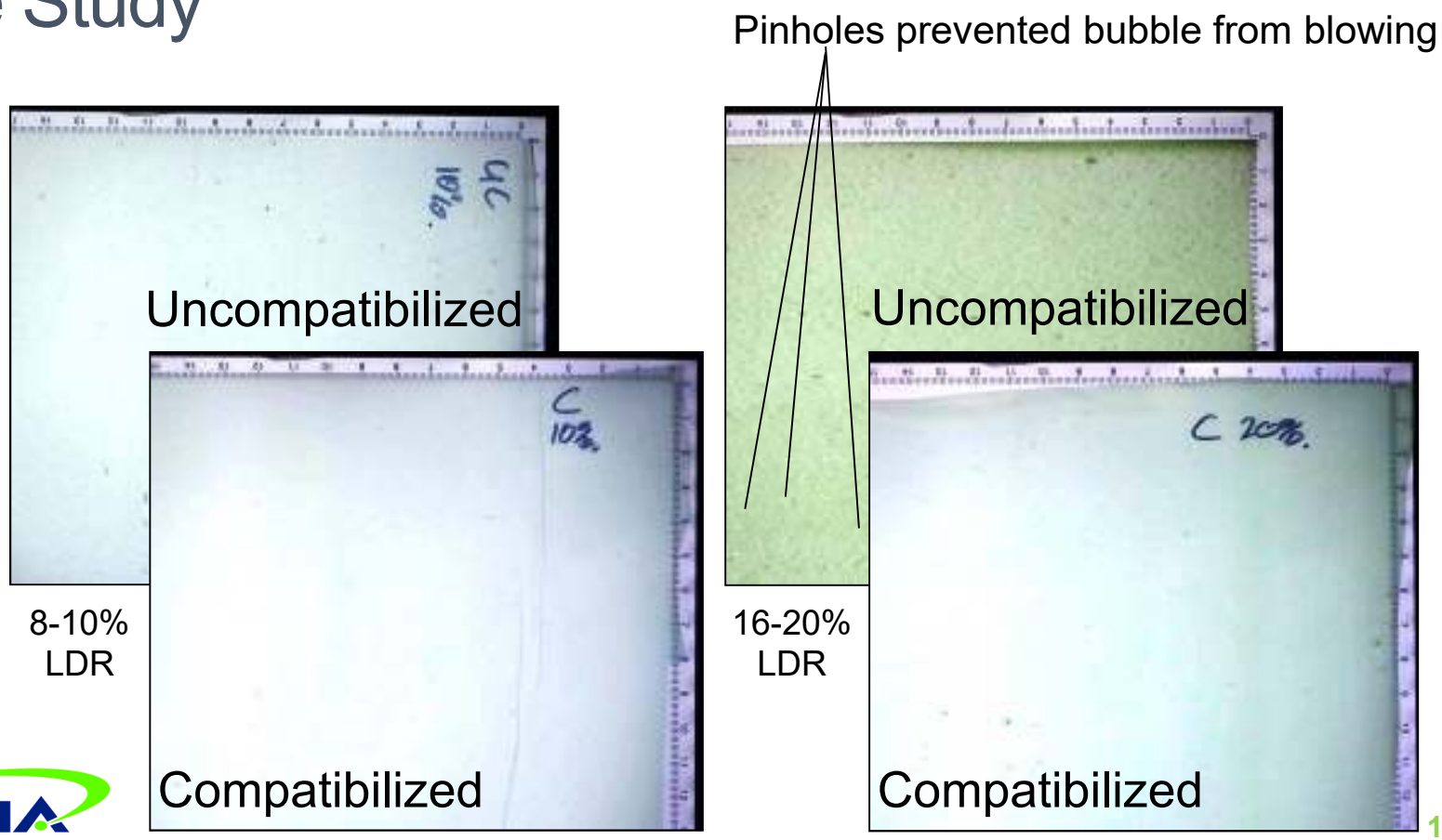
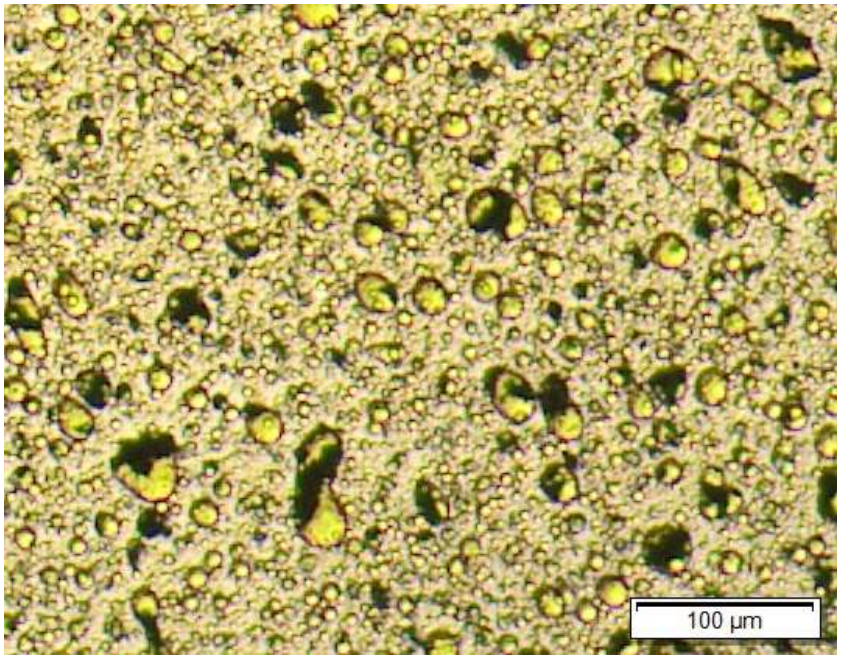
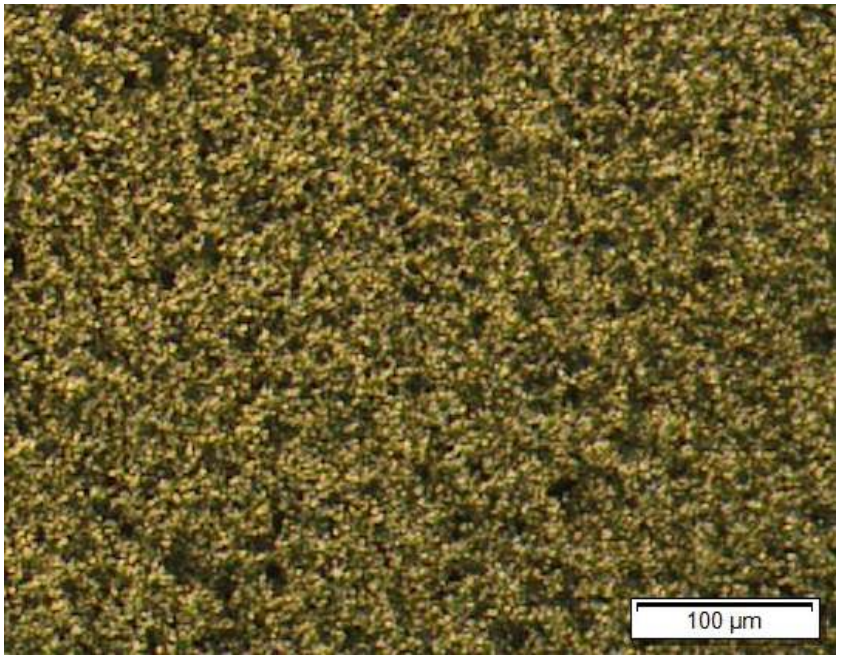
Case Study


Pinholes prevented bubble from blowing up
Uncompatibilized
Uncompatibilized
8-10%
LDR
16-20%
LDR
Compatibilized
Compatibilized

Case Study



Uncompatibilized



Compatibilized

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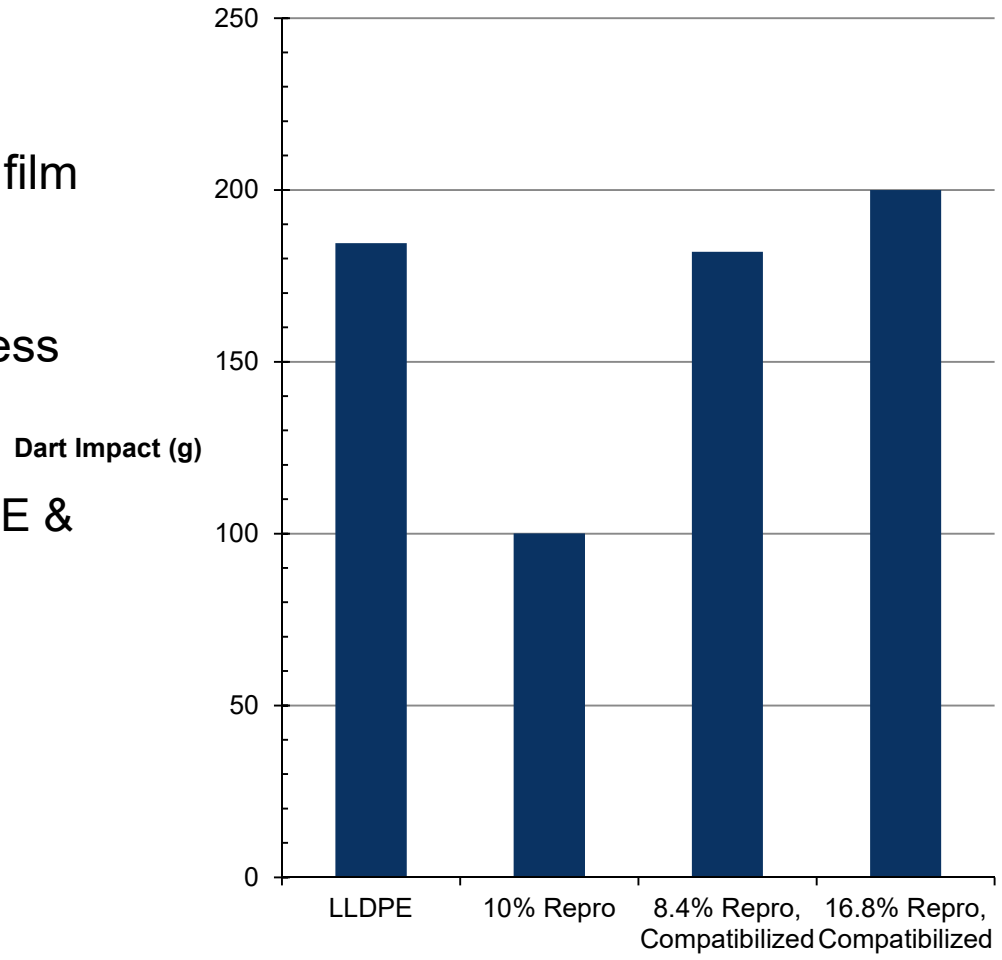
Case Study

- Impact strength of compatibilized film is same as the letdown resin
- Uncompatibilized film exhibits stress whitening.
  - Interfacial weakness between PE & PET clear mode of failure



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Case Study

- Other mechanical properties
  - Tensile, tear strength retained
  - Coefficient of friction & blocking force reduced
- Optical properties
  - Dispersed, high-RI gives the film a matte, hazy appearance
  - Pigment/inks in repro film will affect final film's tint/opacity

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Summary

- PE/PET films are technically critical, but cannot be recycled
  - PE & PET chemically incompatible, and process very differently
  - Uncompatibilized composites are weak
- ITZ-453 allow compatibilization and recovery of PE/PET films
  - Two-step process allows for processing on standard equipment
  - Additive package not only compatibilizes resins, but assists with reprocessing

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