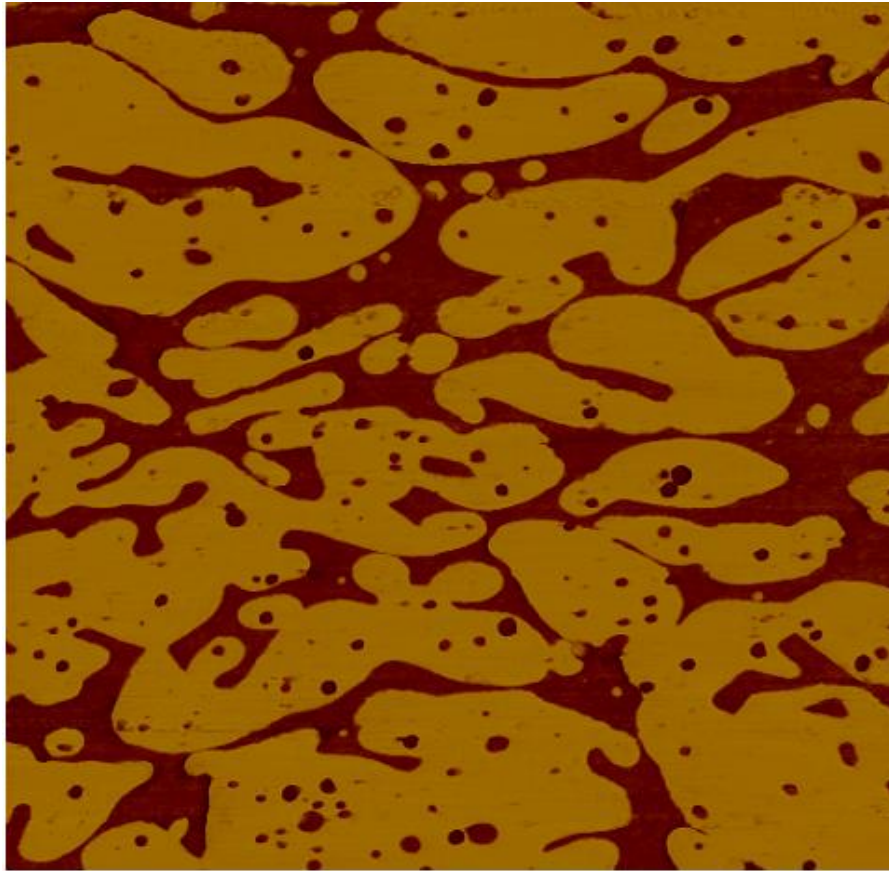


New Ethylene-Styrene IPN-based Products and their Applications

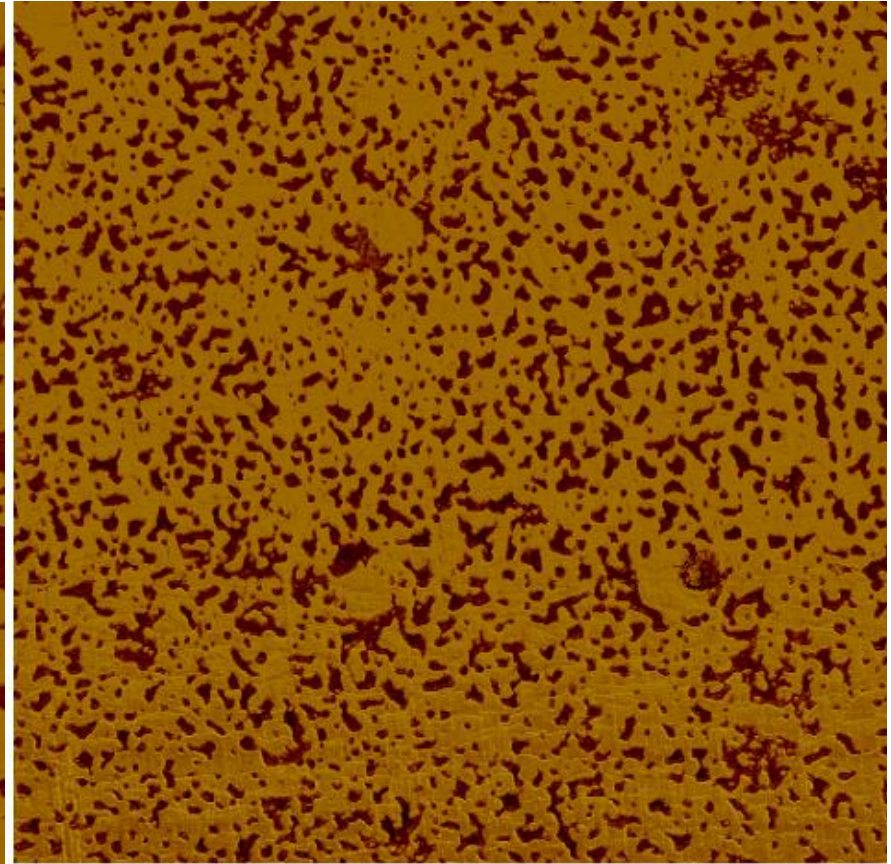
FlexPO 2008

Michel Berghmans and Eric Vignola
June 26, 2008

IP-73-U Morphology



0.0 2: Phase 40.0 μm



0.0 2: Phase 40.0 μm

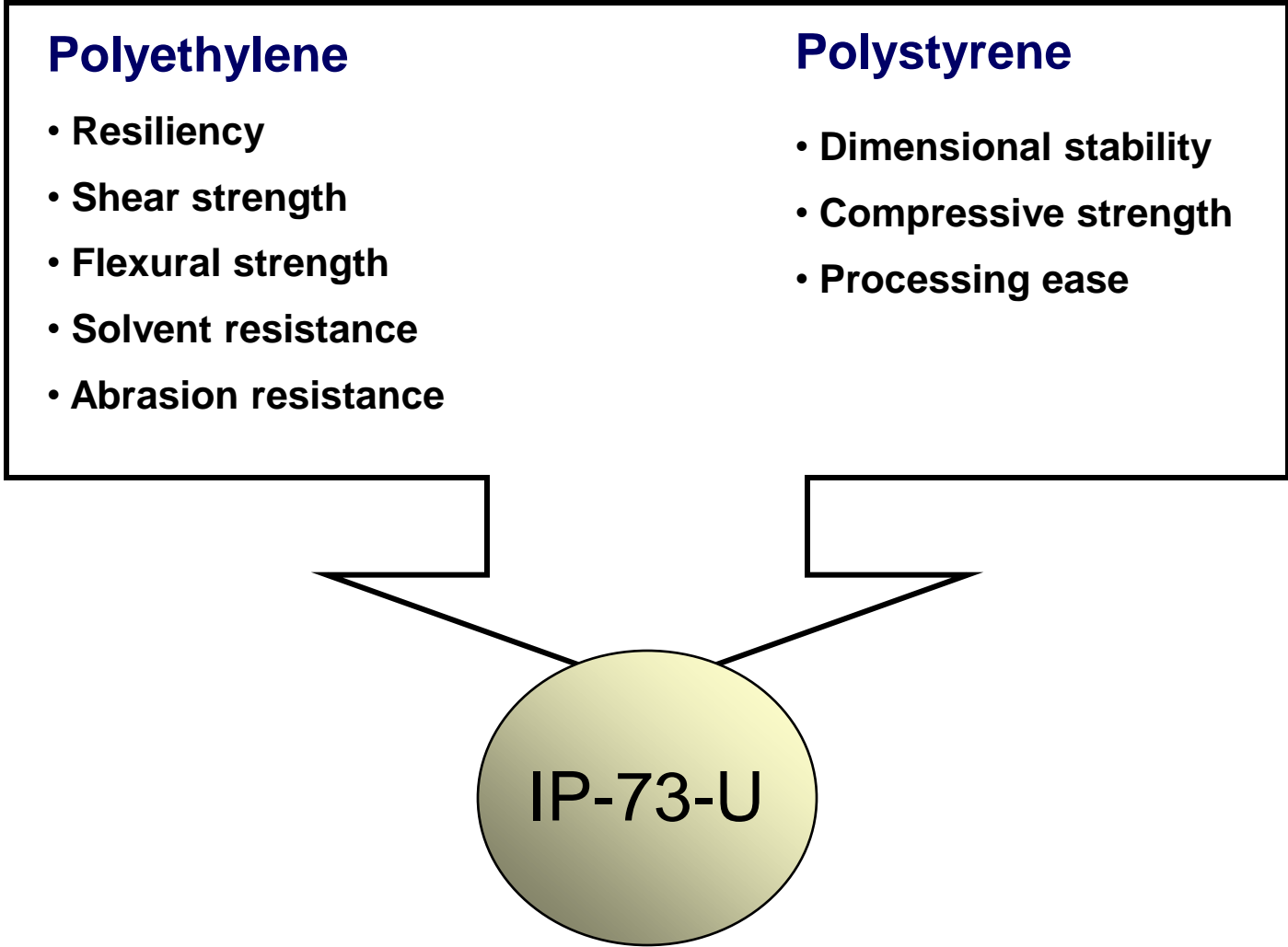
Polyethylene - Polystyrene Synergy

Polyethylene

- Resiliency
- Shear strength
- Flexural strength
- Solvent resistance
- Abrasion resistance

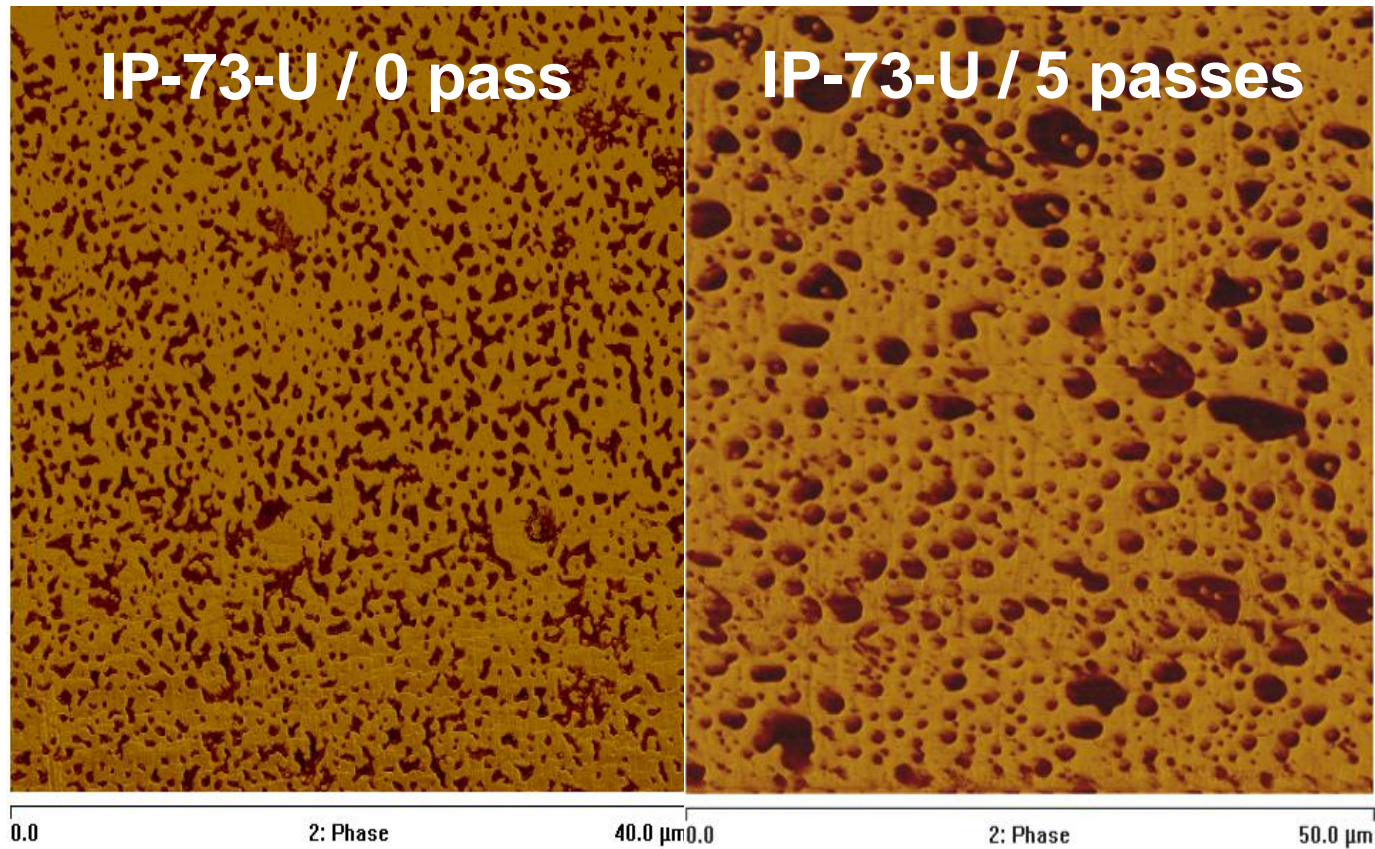
Polystyrene

- Dimensional stability
- Compressive strength
- Processing ease

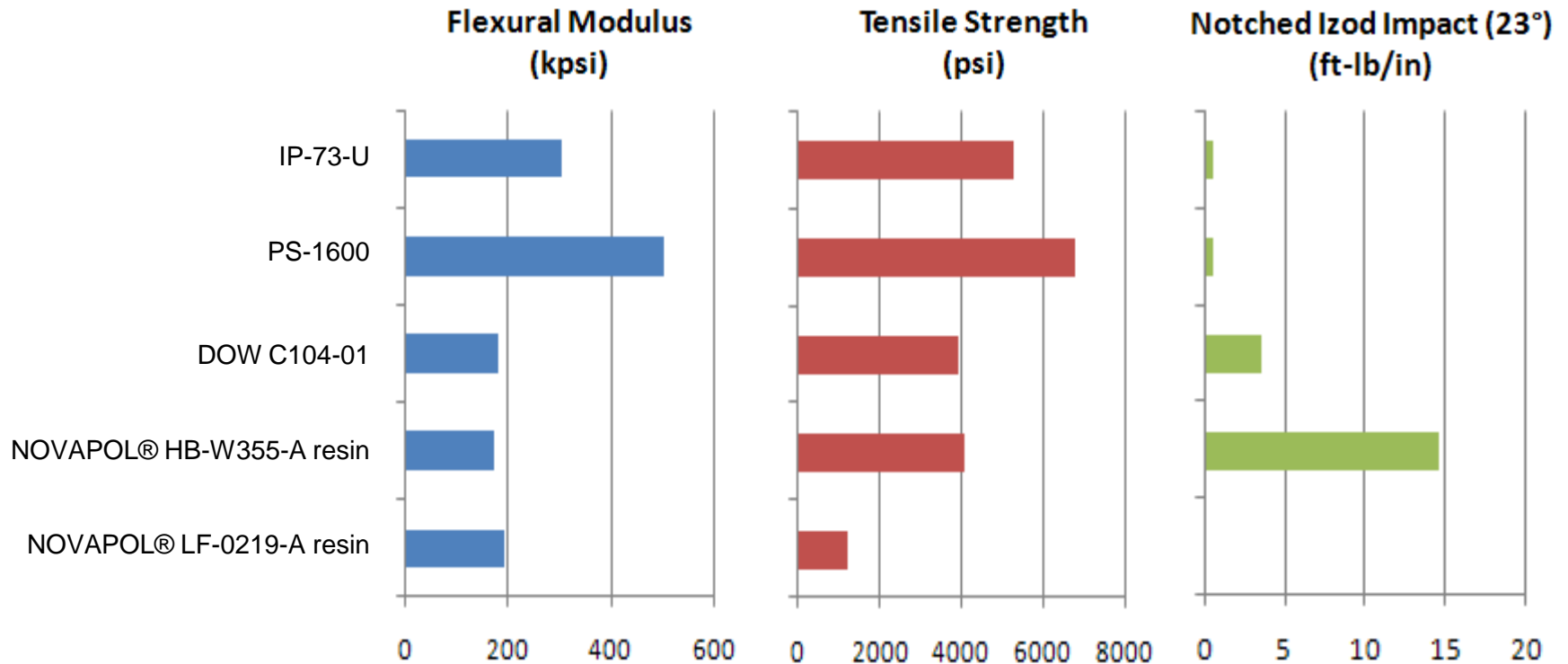


IP-73-U

Processing Stability



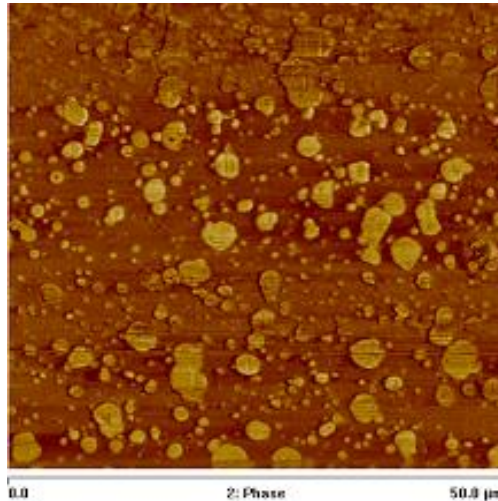
IP-73-U properties



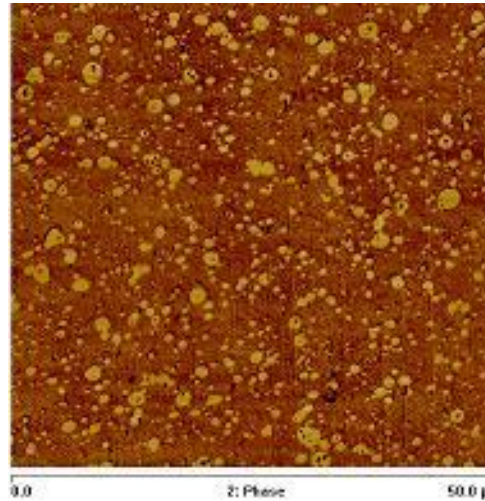
IP-73-U Properties

| Property | Value | Property | Value |
|---|-----------------------|----------------------------------|-----------------------|
| Tensile Strength at Break, M Pa | 37 | Flexural Strength at Yield, M Pa | 67 |
| Tensile Strain at Break, % | 2.7 | Flexural Strain at Yield, % | 5.0 |
| Tensile Modulus, M Pa | 2.1 x 10 ³ | Flexural Modulus, M Pa | 2.1 x 10 ³ |
| Notched Izod, J/m | 21 | Un-notched Izod, J/m | 667 |
| Density, g/cm ³ | 1.01 | Rockwell Hardness (R-scale) | 86.4 |
| Melting point, °C | 102 | Vicat softening temperature, °C | 101 |
| Melt Flow Index, g/10 min (230°C/2.16kg) | 0.24 | DTUL at 1.8 M Pa, °C | 73 |
| Water absorption, % | 0.04 | Surface tension, dynes/cm | 37 |

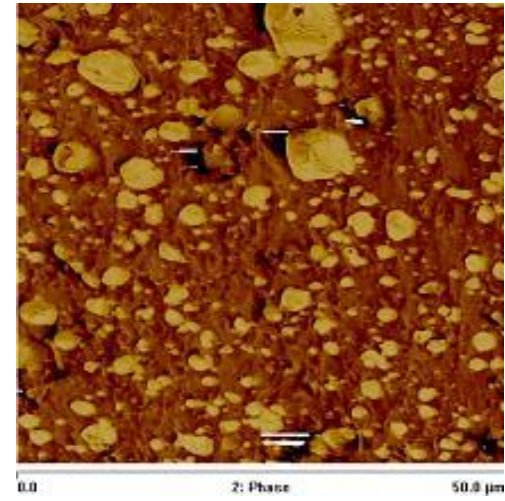
Blends of IP-73-U and PE



NOVAPOL® LF-0219-A resin



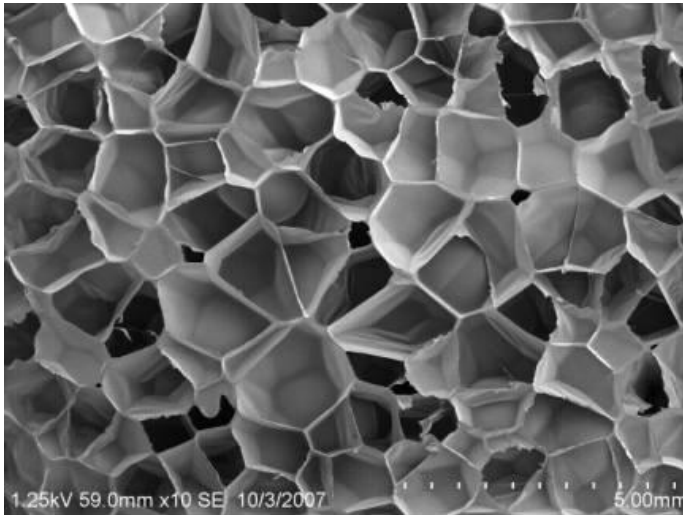
SCLAIR® 2710 resin



SURPASS® FPS-317A resin

| PE Phase | PE properties |
|--------------------------|-------------------------------------|
| NOVAPOL® LF-0219-A resin | LDPE foam resin (MFI = 2.3) |
| SCLAIR® 2710 resin | Injection molding resin (MFI 17) |
| SURPASS® FPS-317A resin | Octene s-LLDPE film resin (MFI 1.0) |

IP-73-U PO Foam Application



LDPE + 20wt% IP-73-U

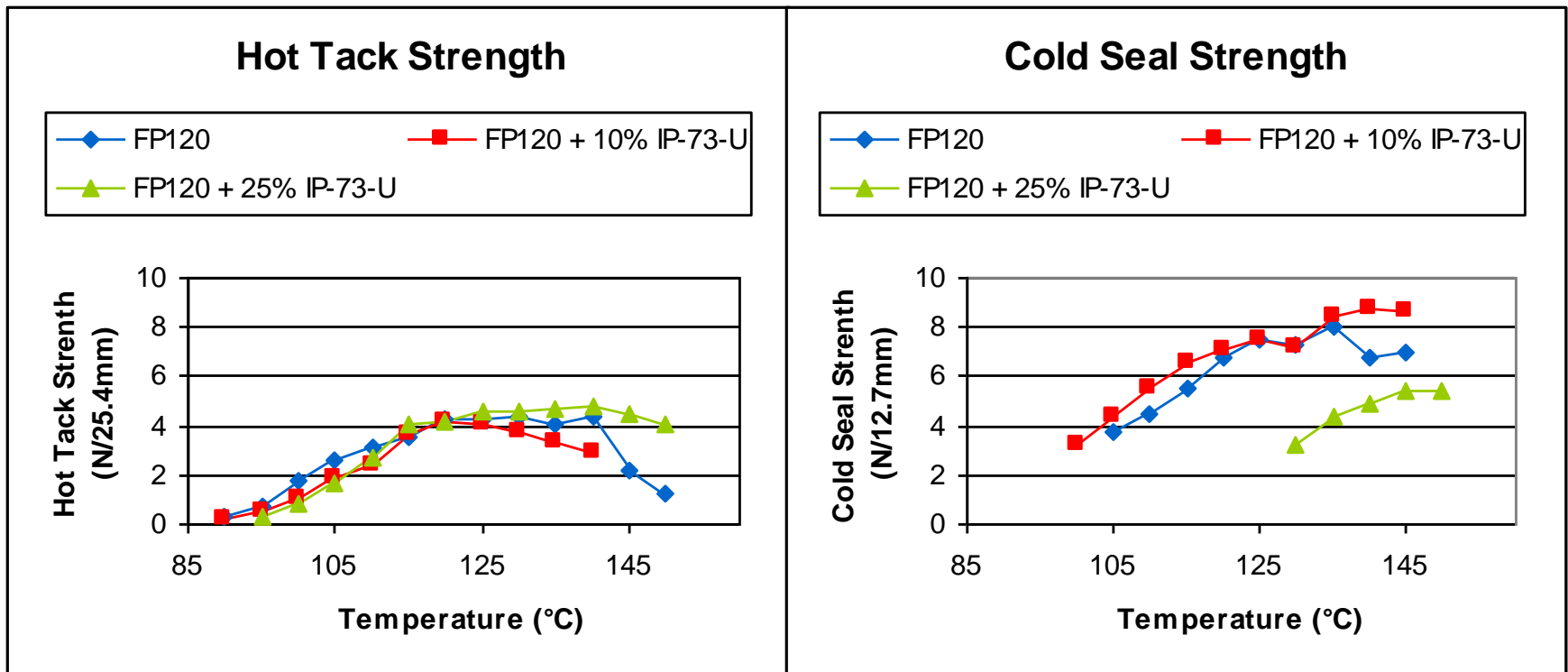
- Addition of IP-73-U to polyolefin foams can provide:
 - ▶ Increased stiffness at lower density
 - ▶ Increased dimensional stability
- **Cost savings through enhanced performance or lower material consumption**

Property improvements in LLDPE film (10% loading)

| Property | Improvement with IP-73-U |
|-----------------------------|--------------------------|
| Dart Impact (g/mil) | 50% |
| Sec Modulus – MD | 60% |
| Sec Modulus – TD | 45% |
| Tensile Break Strength – MD | 30% |
| Tensile Break Strength – TD | 20% |
| Elongation at Break – MD | 30% |
| Elongation at Break – TD | 10% |
| Tensile Yield Strength – MD | 20% |
| Tensile Yield Strength – TD | 15% |

IP-73-U is an opaque resin and will affect the optical clarity of film

IP-73-U Blend Seal study



IP-73-U Products

- Process allows to vary key properties
 - ▶ Molecular weight
 - ▶ Ratio of PE to PS
 - ▶ Important PE property parameters like density or MI
 - ▶ Comonomers
 - ▶ Additives

- 1st grade is commercial and further developments are underway

IP-73-U Offers:

- Compatibility with various polymers
- Mechanical properties
- Can be easily processed by extruder based techniques
- Foamable
- Additive friendly
- Scratch resistant
- Paintable
- Recyclable

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