



Basic Study: The Impact on Heat Seal and Hot Tack Performance when Downgauging Polyethylene in Extrusion Coated Products

Brady Hunnicutt

Technical Service Engineer

Westlake
Polyethylene™

Outline

- Background
- Experiment Parameters
- Thickness
- Melt Index
- Density
- Observations / Next Steps

Background

- What happens to heat seal and hot tack performance when LDPE is downgauged in extrusion coating?
- What would happen if I changed to another LDPE with different Melt Index and Density values?

Sample Preparation

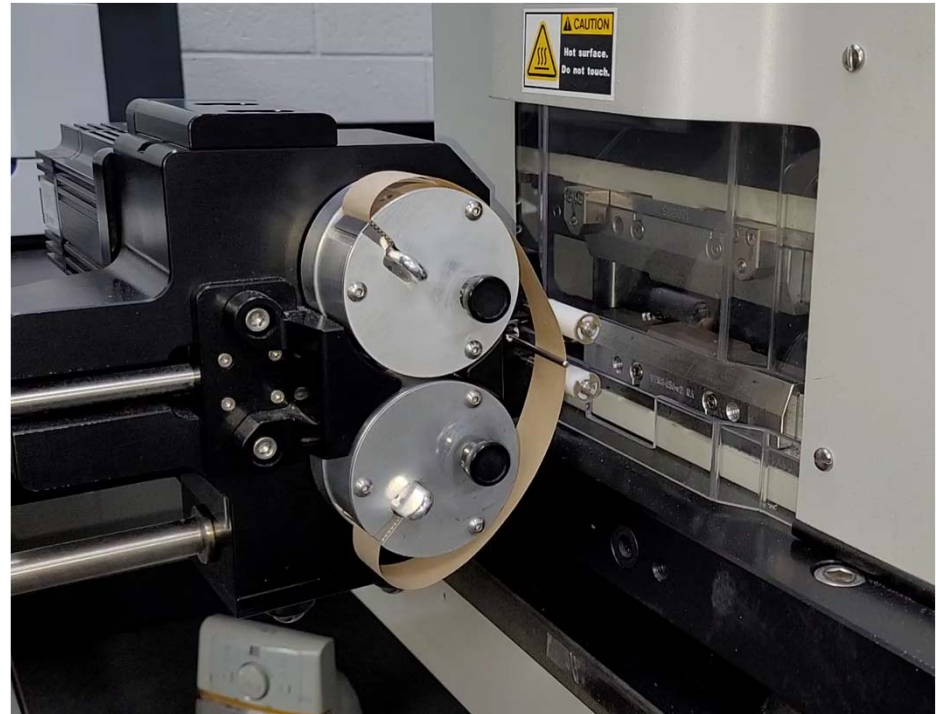
- Extrusion coat multiple LDPEs onto 40# Kraft paper at pre-determined thicknesses.
- Extrusion line parameters held constant.
 - Melt Temperature
 - Substrate surface treatment
 - Extruder throughput

Experiment Design

Melt Index g/10 min	Density g/cm ³	Coating Thickness Mils					
3.5	0.917				1.0		
10.0	0.917	0.3	0.5	0.8	1.0	1.5	2.0
5.6	0.922	0.3	0.5	0.8	1.0	1.5	2.0

Sample Testing

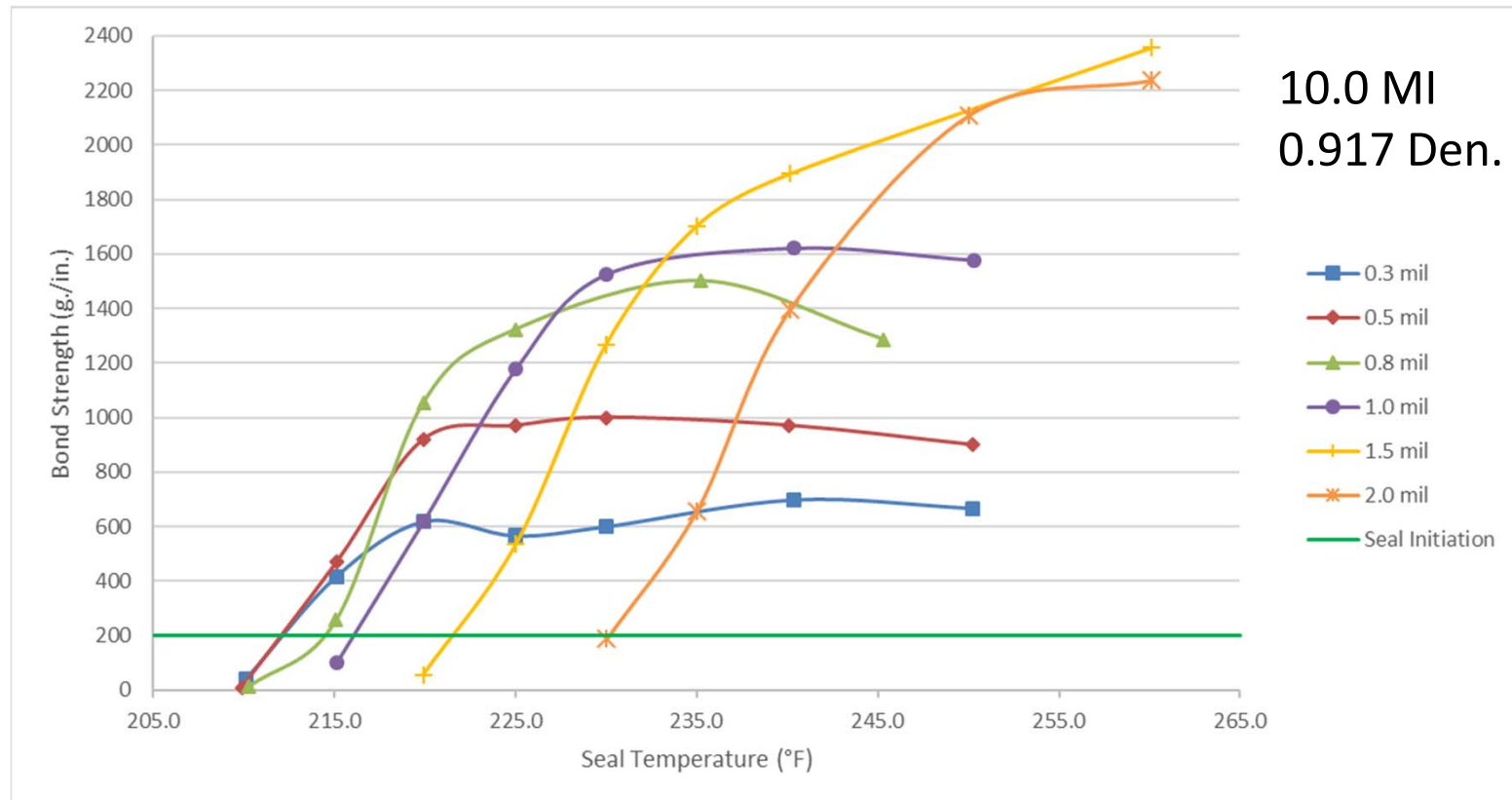
- Hot Tack Tester / Heat Seal Tester
 - 5 Specimen Average
- Parameters held constant:
 - Ambient Conditions
 - Dwell Time
 - Contact Pressure
 - Peel Velocity
 - Heat Seal Cooling Delay



Polyethylene Coating Thickness

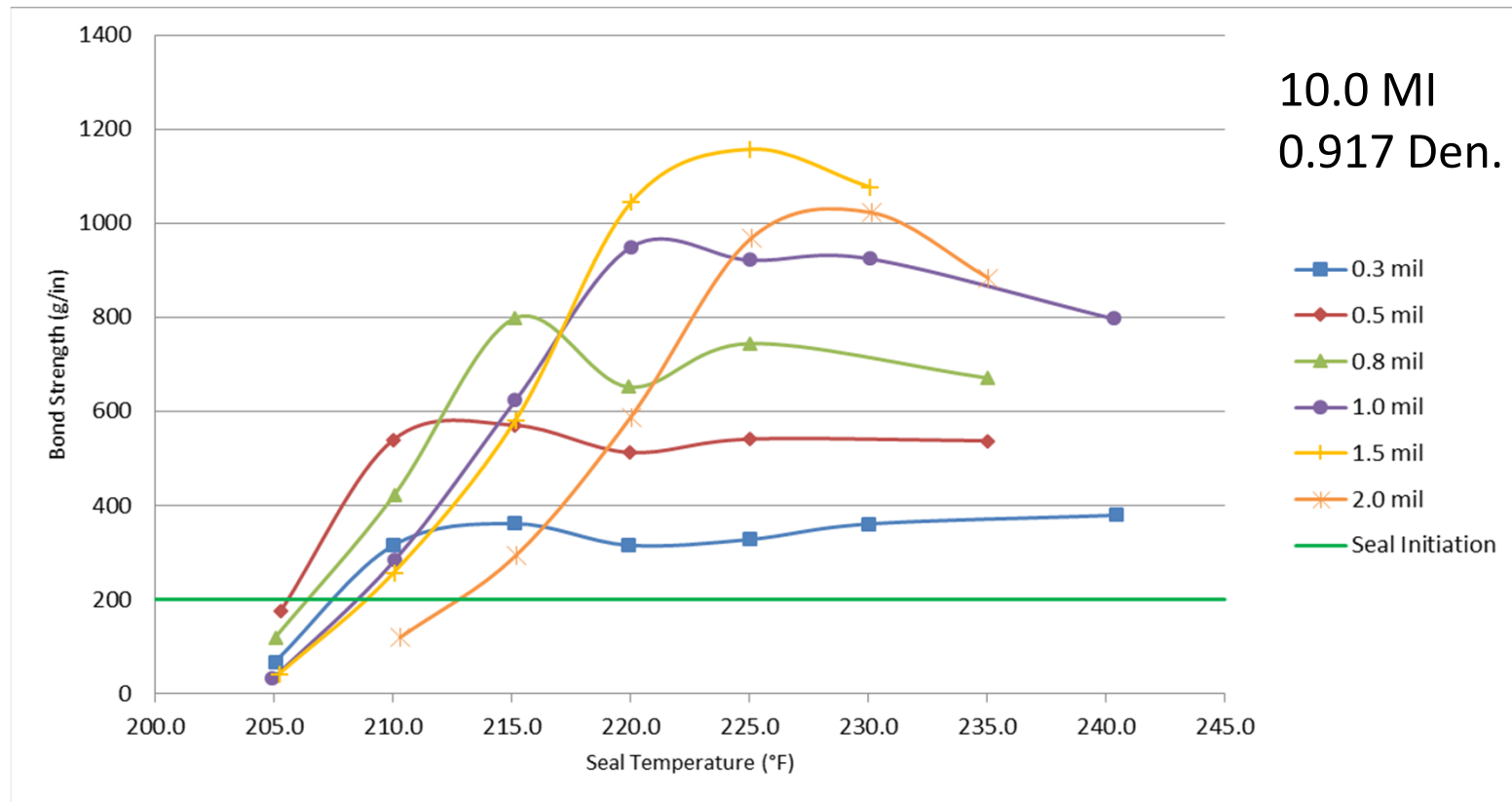
Impact on Heat Seal and Hot Tack Performance

Impact of Thickness on Heat Seal (20 sec. delay)



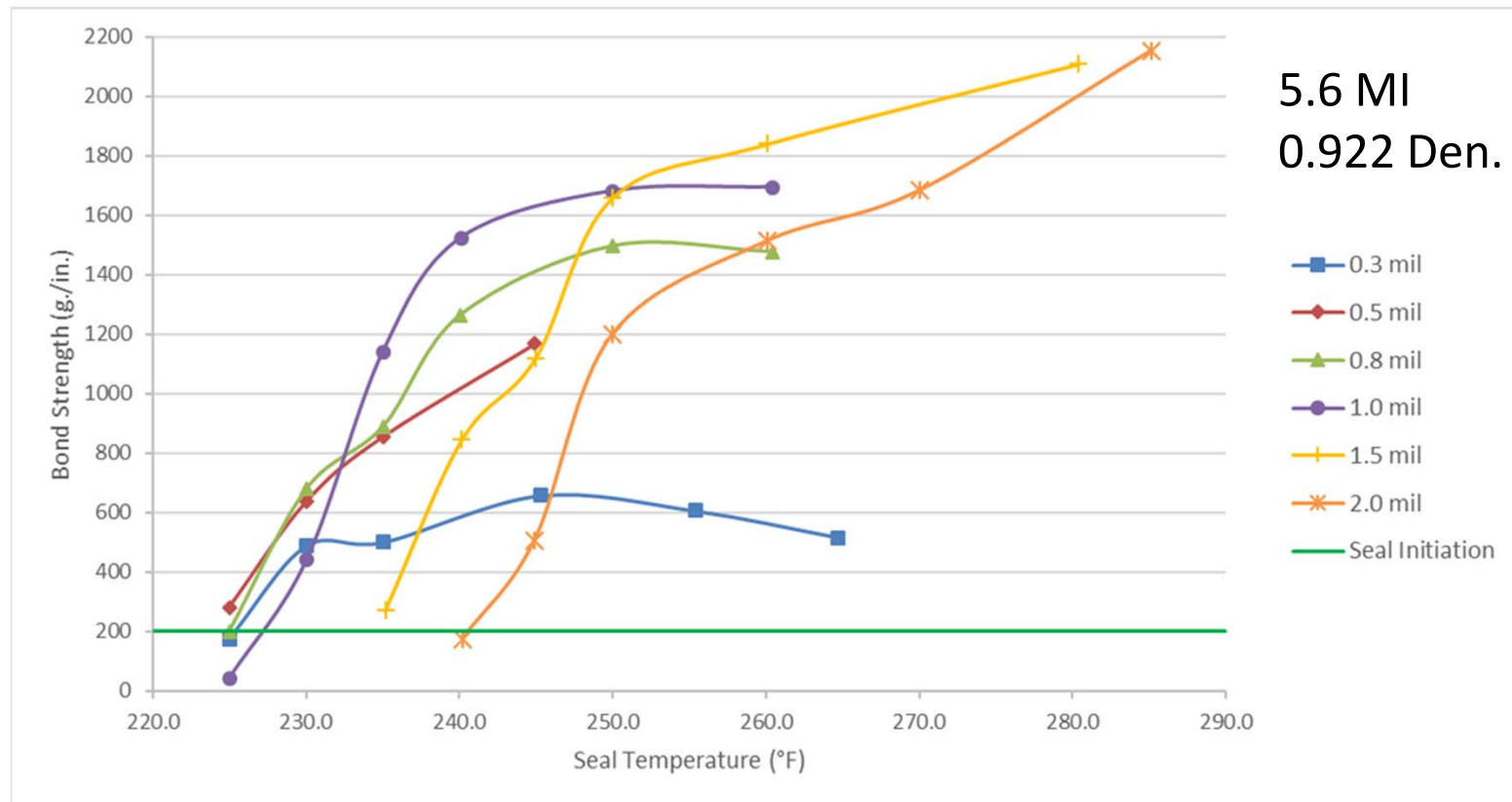
Heat Seal Initiation Temperature decreases as thickness decreases.
Maximum achievable bond strength decreases as thickness decreases.

Impact of Thickness on Hot Tack



Hot Tack Initiation Temperature decreases as thickness decreases.
Maximum achievable bond strength decreases as thickness decreases.

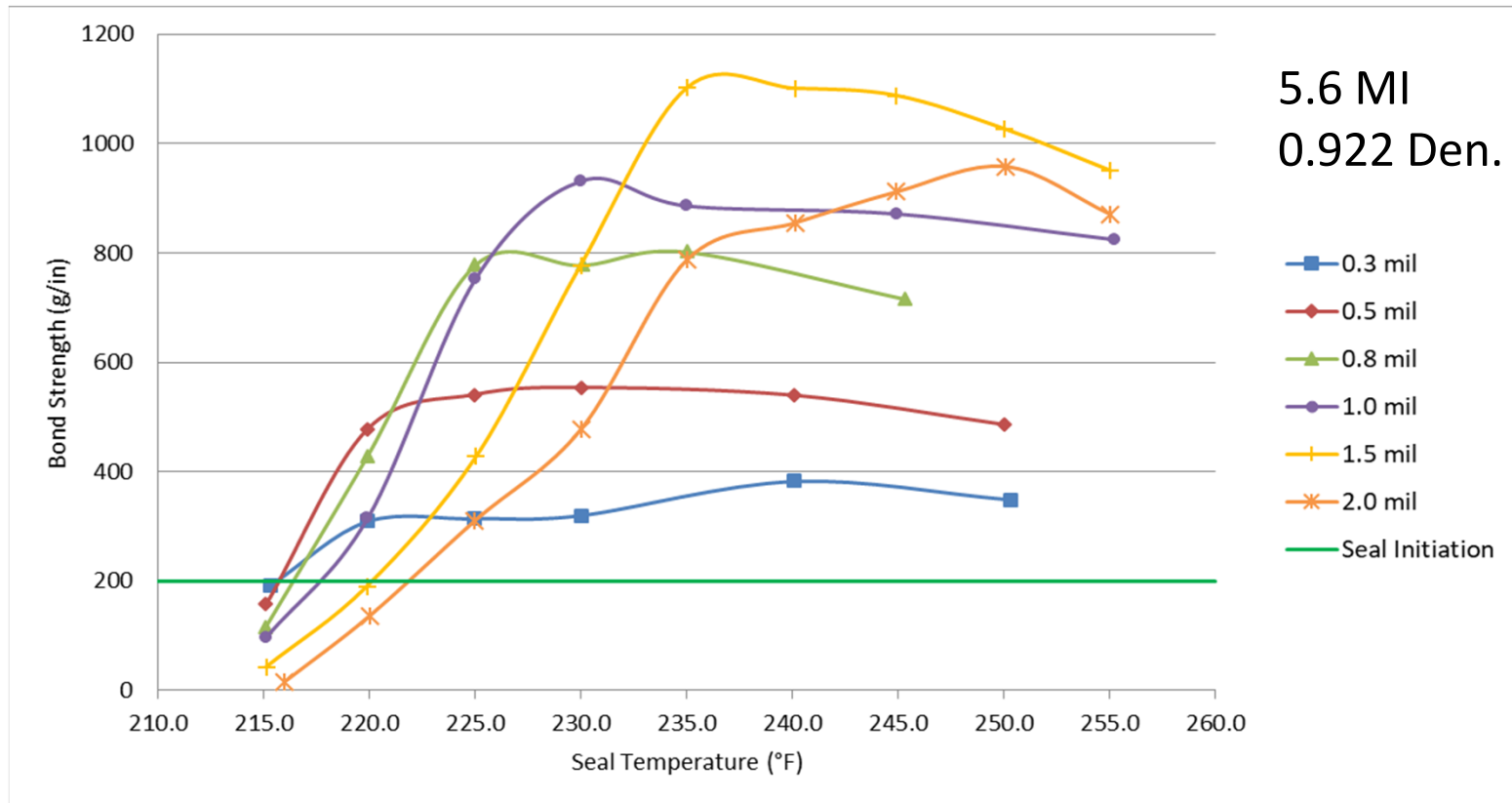
Impact of Thickness on Heat Seal (20 sec. delay)



Heat Seal Initiation Temperature decreases as thickness decreases.

Maximum achievable bond strength decreases as thickness decreases.

Impact of Thickness on Hot Tack

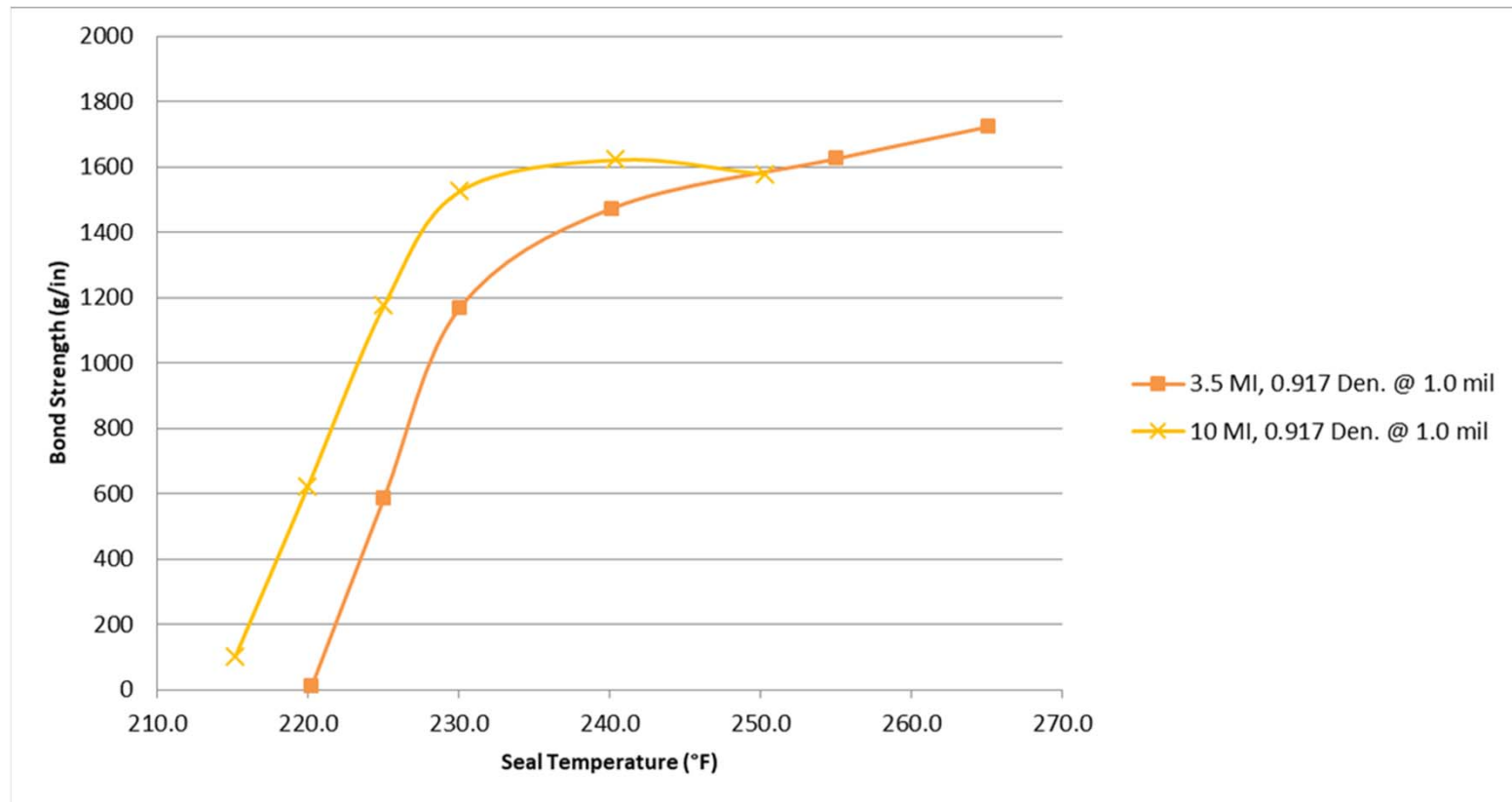


Hot Tack Initiation Temperature decreases as thickness decreases.
Maximum achievable bond strength decreases as thickness decreases.

Melt Index

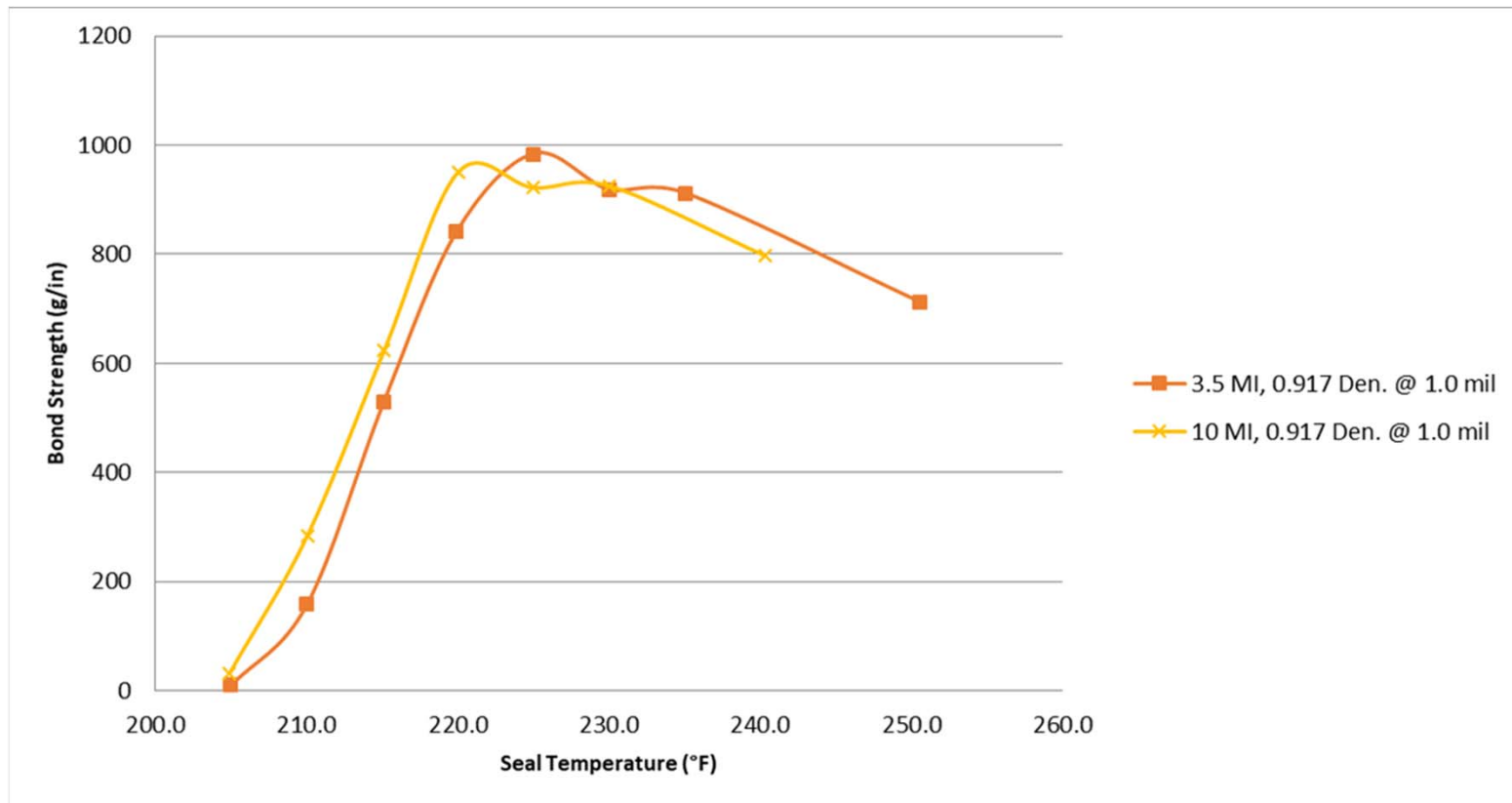
Impact on Heat Seal and Hot Tack Performance

Impact of Melt Index on Heat Seal (20 sec. delay)



MI and Heat Seal Initiation Temperature are inversely related.
Lower viscosity enables the polymer to diffuse more readily.

Impact of Melt Index on Hot Tack

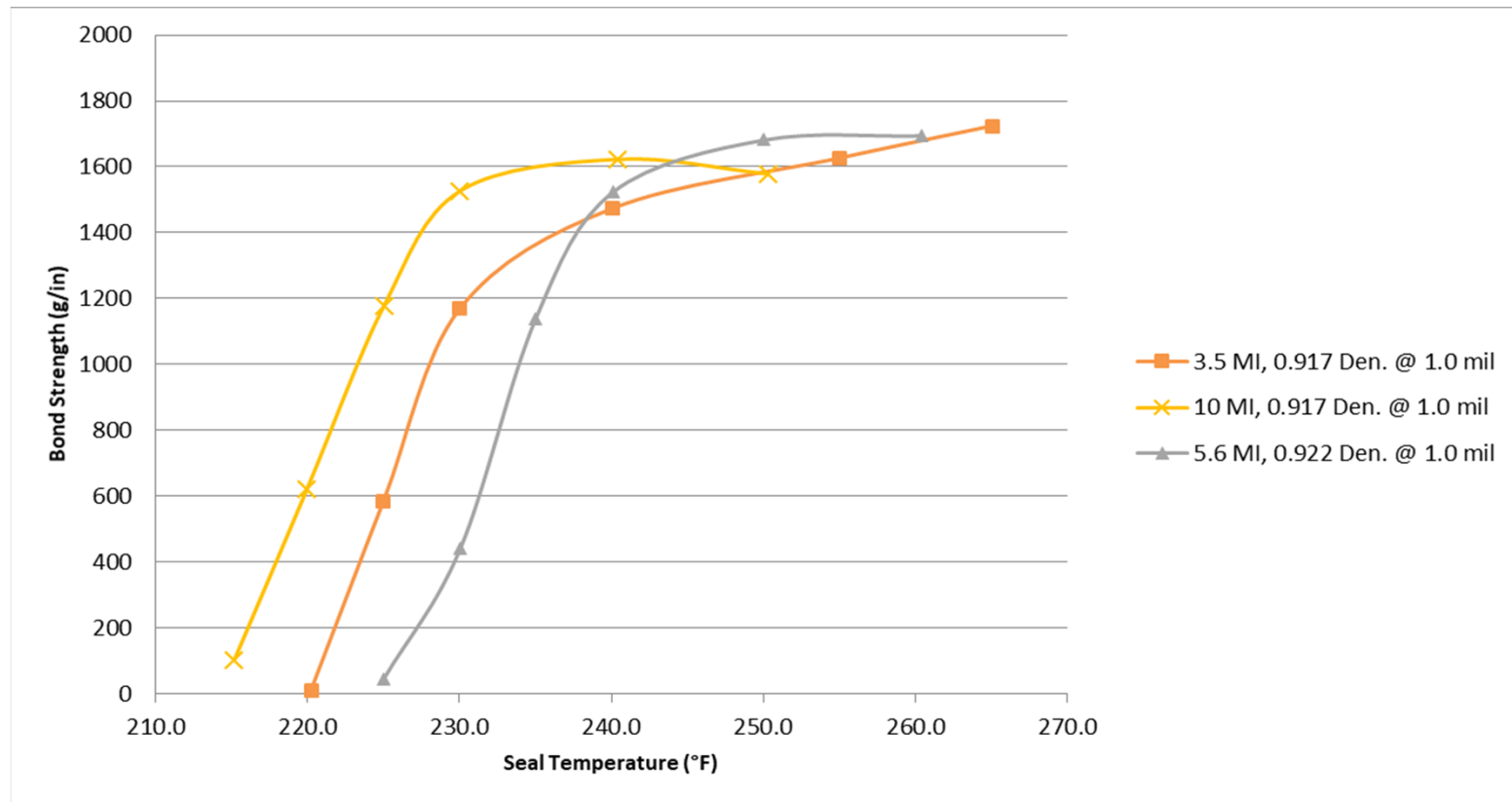


MI and Hot Tack Initiation Temperature are inversely related.

Density

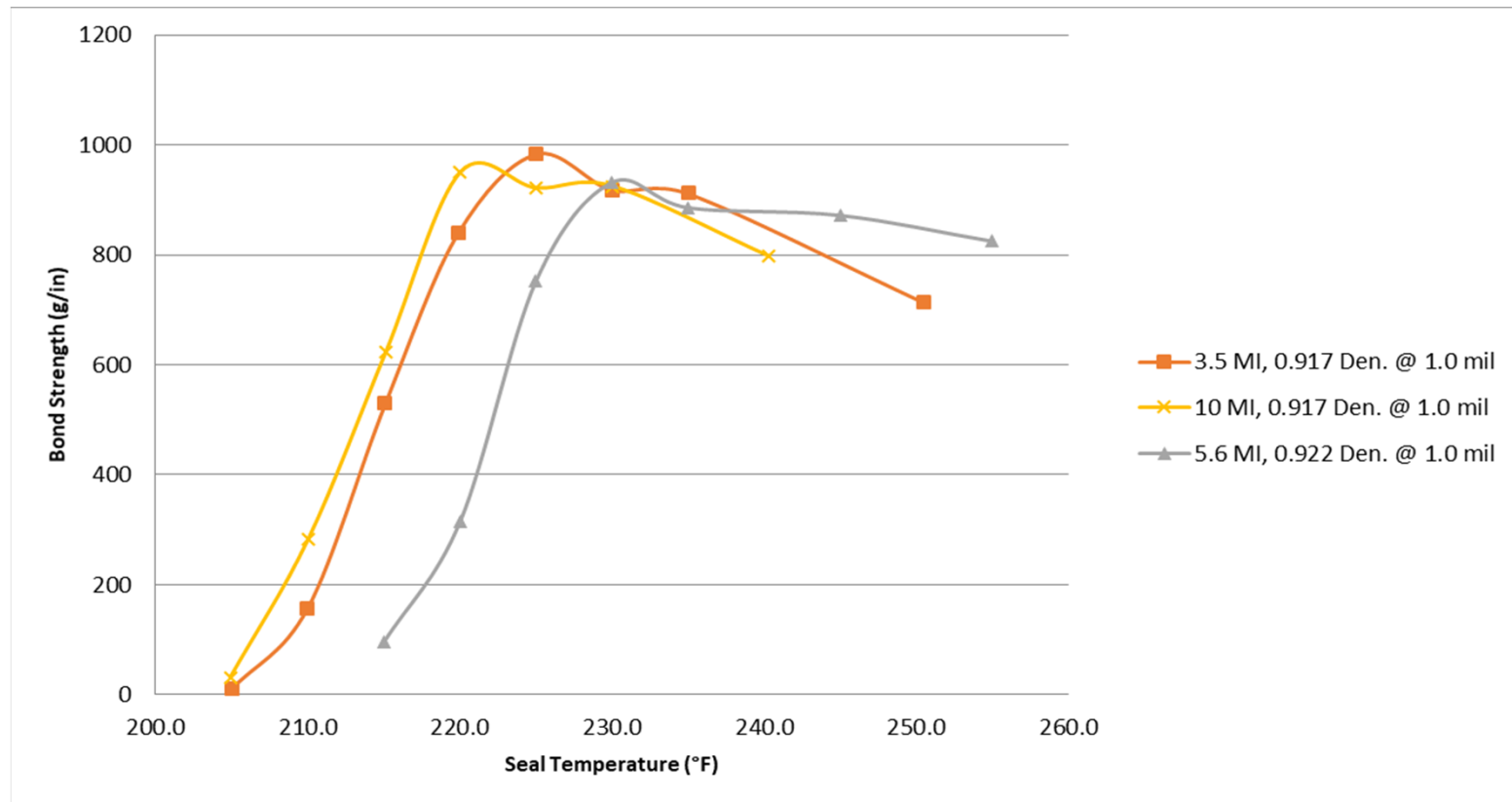
Impact on Heat Seal and Hot Tack Performance

Impact of Density on Heat Seal (20 sec. delay)



Heat Seal Initiation Temperature increases as Density increases.

Impact of Density on Hot Tack



Hot Tack Initiation Temperature increases as Density increases.

Observations

As LDPE coating thickness is decreased:

- Bond strength is diminished.
- Seal initiation temperature is decreased.

As LDPE melt index is increased:

- Seal initiation temperature is decreased.
- Lower viscosity enables the polymer to diffuse more readily.

As LDPE density is increased:

- Seal initiation temperature is increased.

Next Steps / Further Experiments

- Evaluate performance using different substrates.
- Evaluate the impact of ambient conditions on seal performance.
- Evaluate constant line speed with varying throughput.

Thank you for your time.

Brady Hunnicutt

Technical Service Engineer

bhunnicutt1@Westlake.com

(903) 242-7669



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