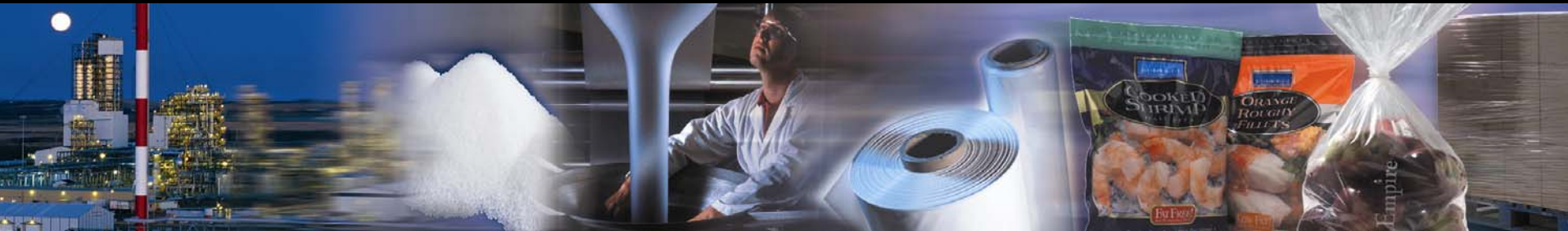


Polyethylene in Sealant Applications



Presented by:

Dan Ward & Norm Aubee
NPE 2006

Outline

- Sealing technology
- Key seal parameters
- Addressing key seal parameters through resin design
- NOVA Chemicals' testing capabilities

Sealing Technology

- Virtually all flexible packaging utilizes the sealing process to form the boundaries of a package
- Common methods for sealing polyethylene
 - Heat sealing
 - By far the most common
 - Ultrasonic sealing
 - Seal through contamination
 - Reduced thermal effects
- Focus continues to be in heat sealing technology

Key Seal Parameters

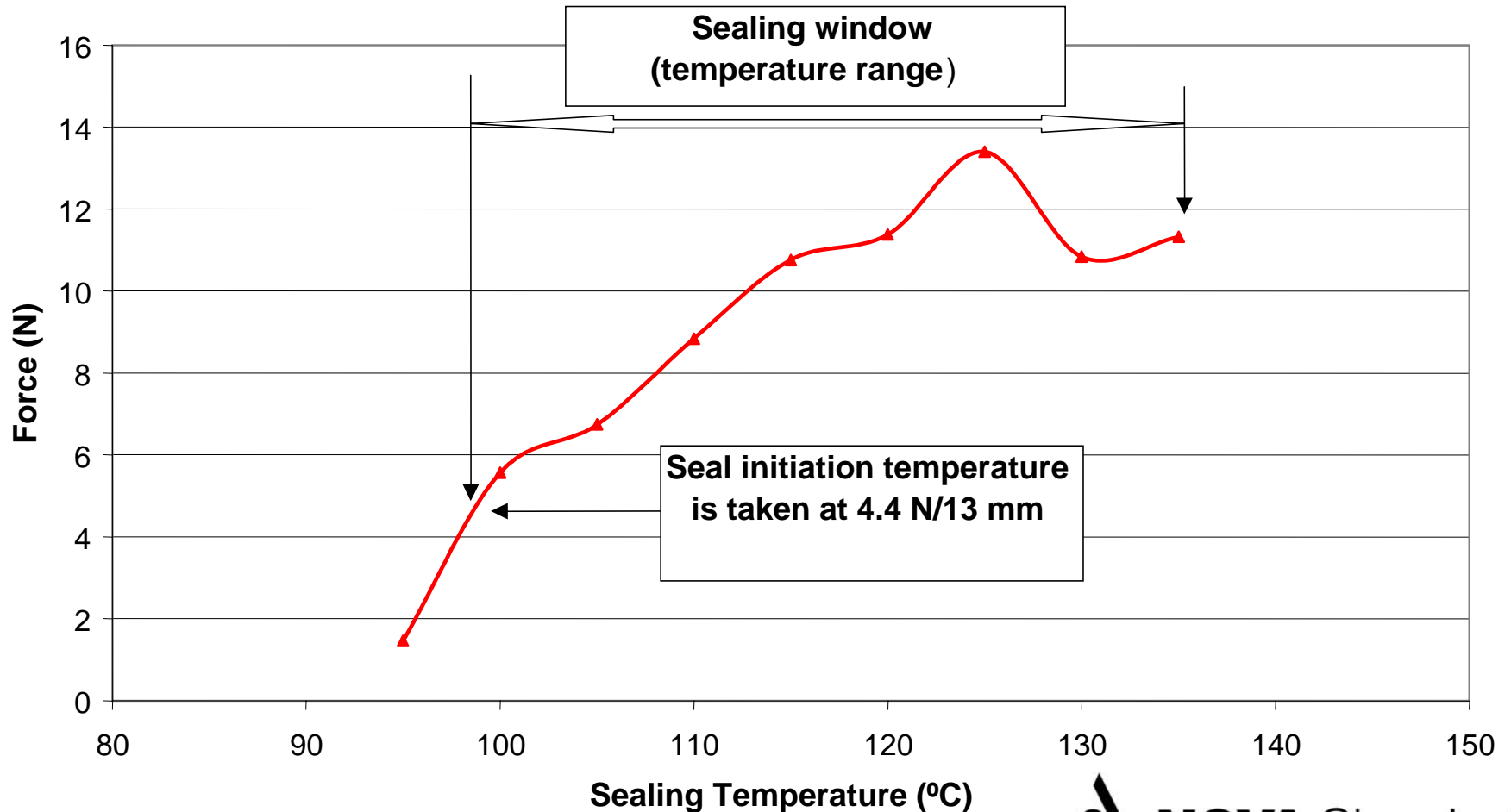
- Seal strength
- Heat seal window
 - Low end – seal initiation temperature
 - High end – burn through
- Peel strength
- Hot tack strength and window
- Seal through contamination
- Seal caulking

Seal Strength

- Maximum force required to separate a sealant either by interfacial delamination or other failure mode
- A function of the tensile strength in monolayer films
- Relates to package integrity

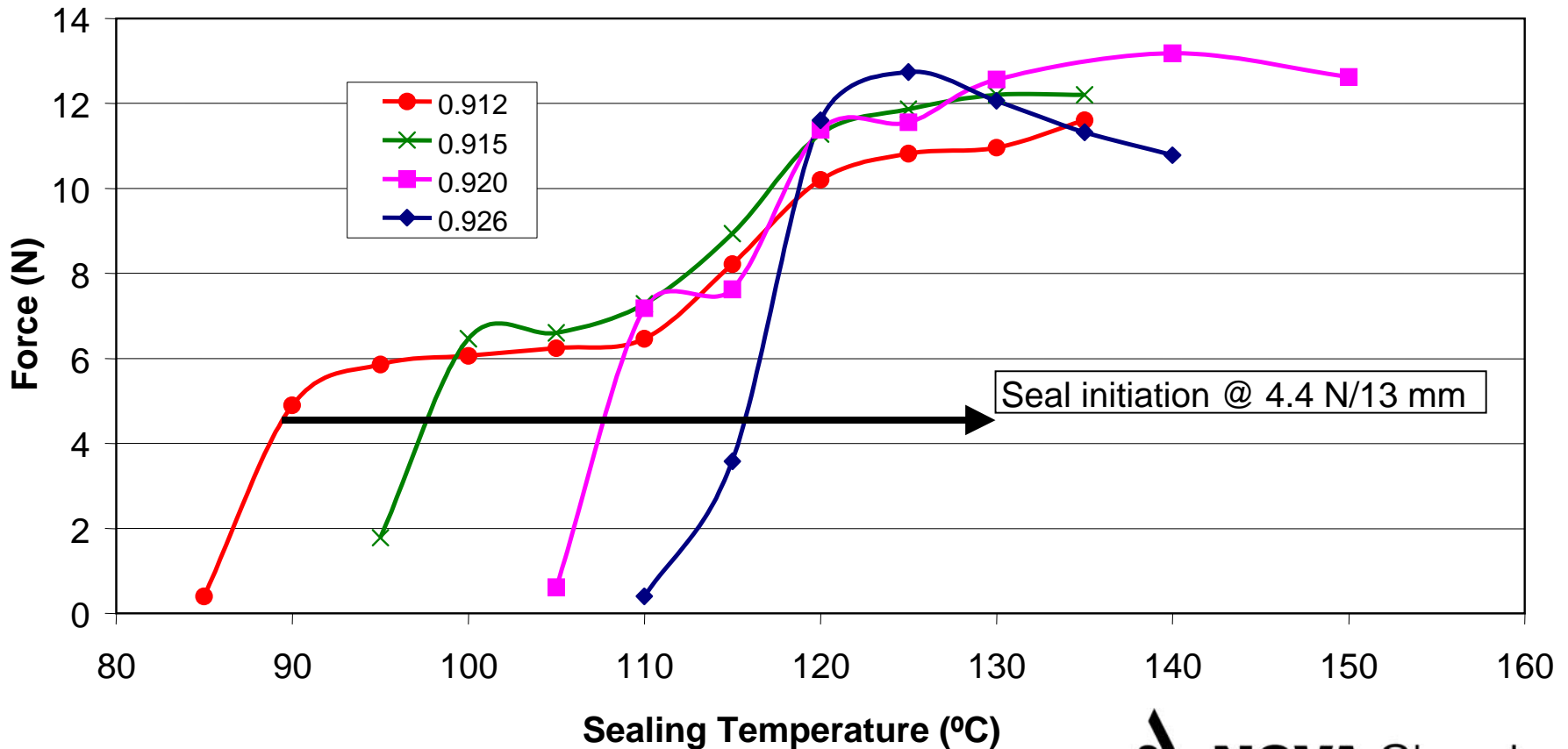


Seal Initiation Temperature and Sealing Window

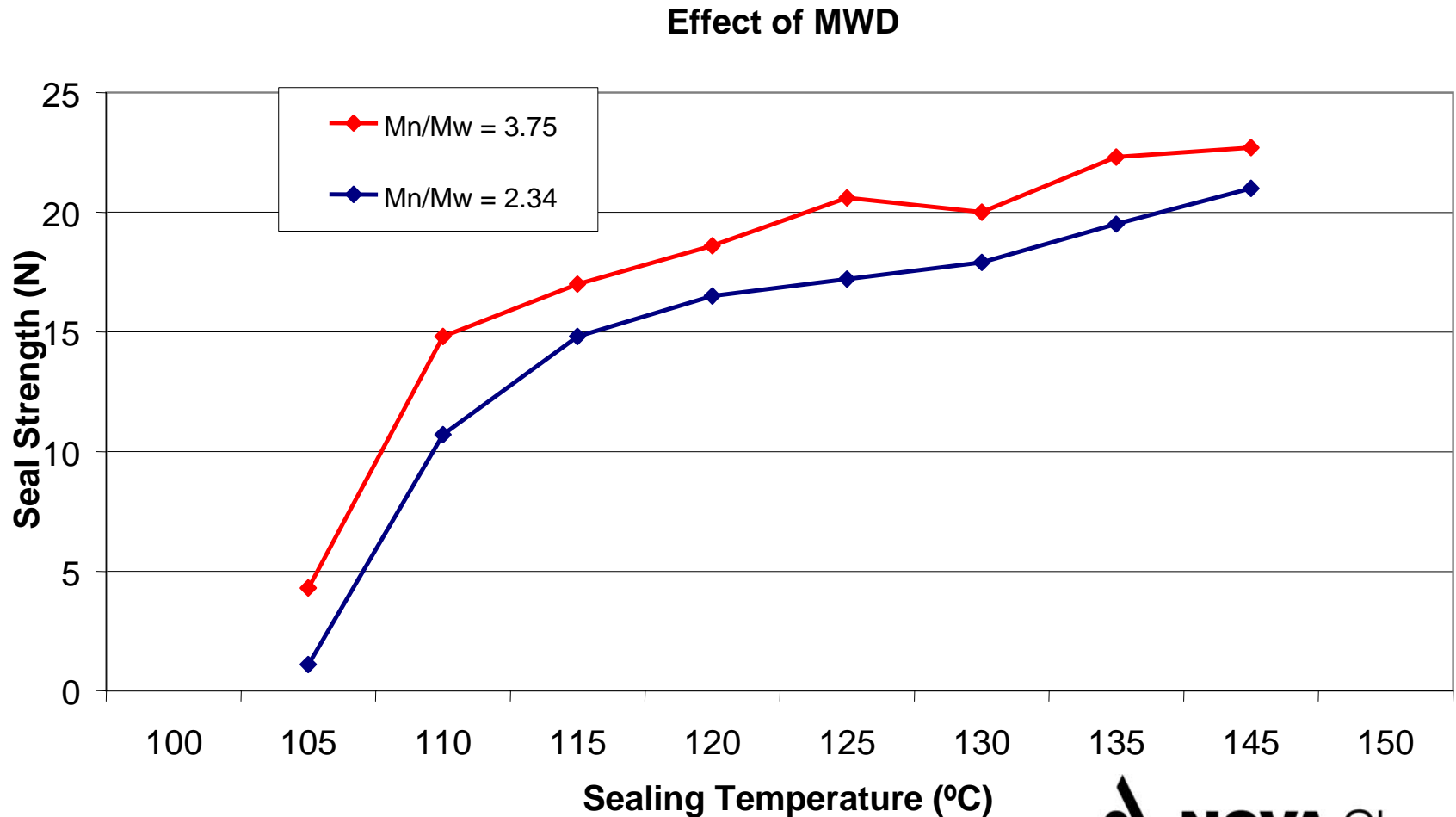


Sealing Window

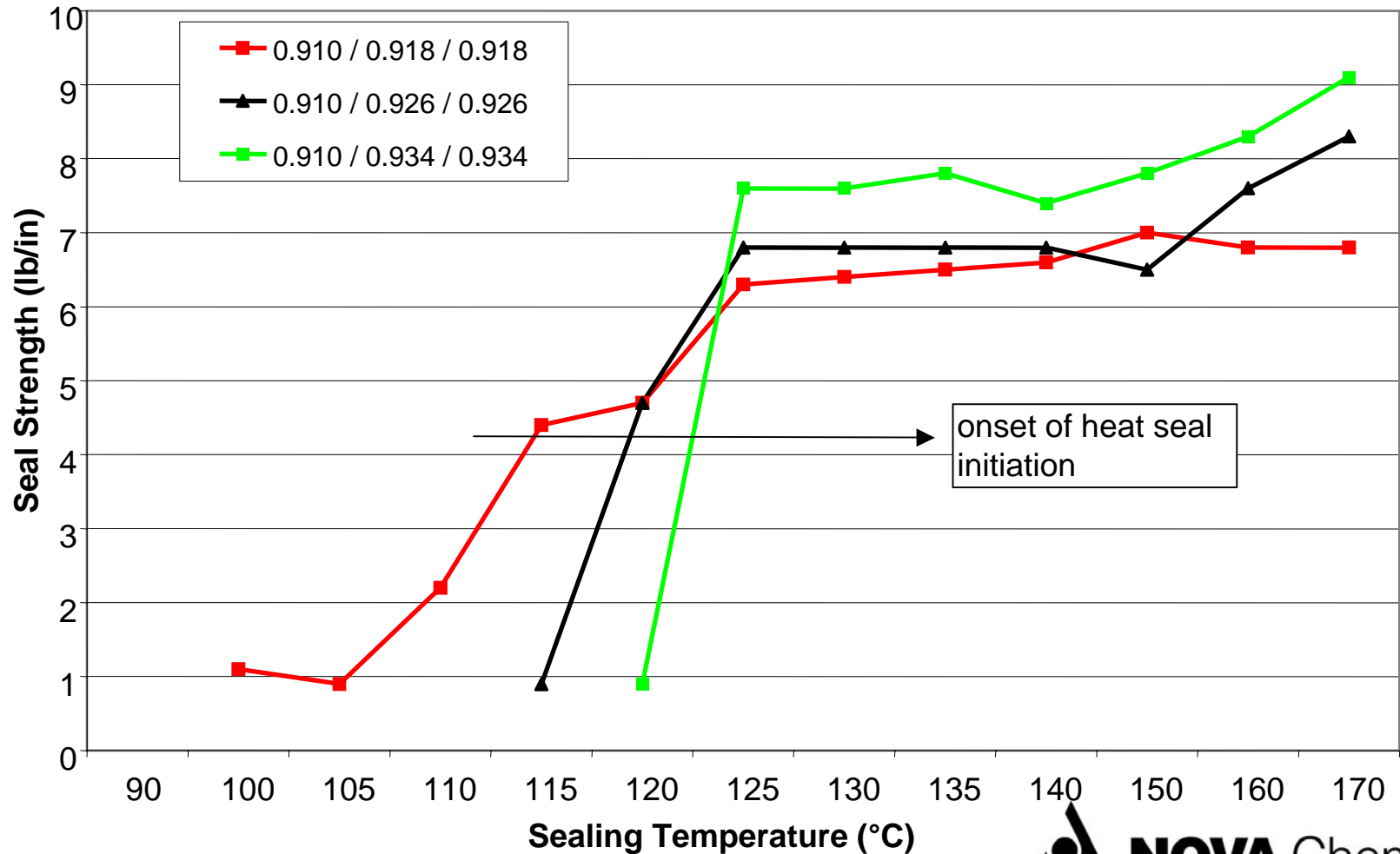
(Ziegler-Natta Products)



Sealing Window



Effect of Structure Design in Co-Extruded Films



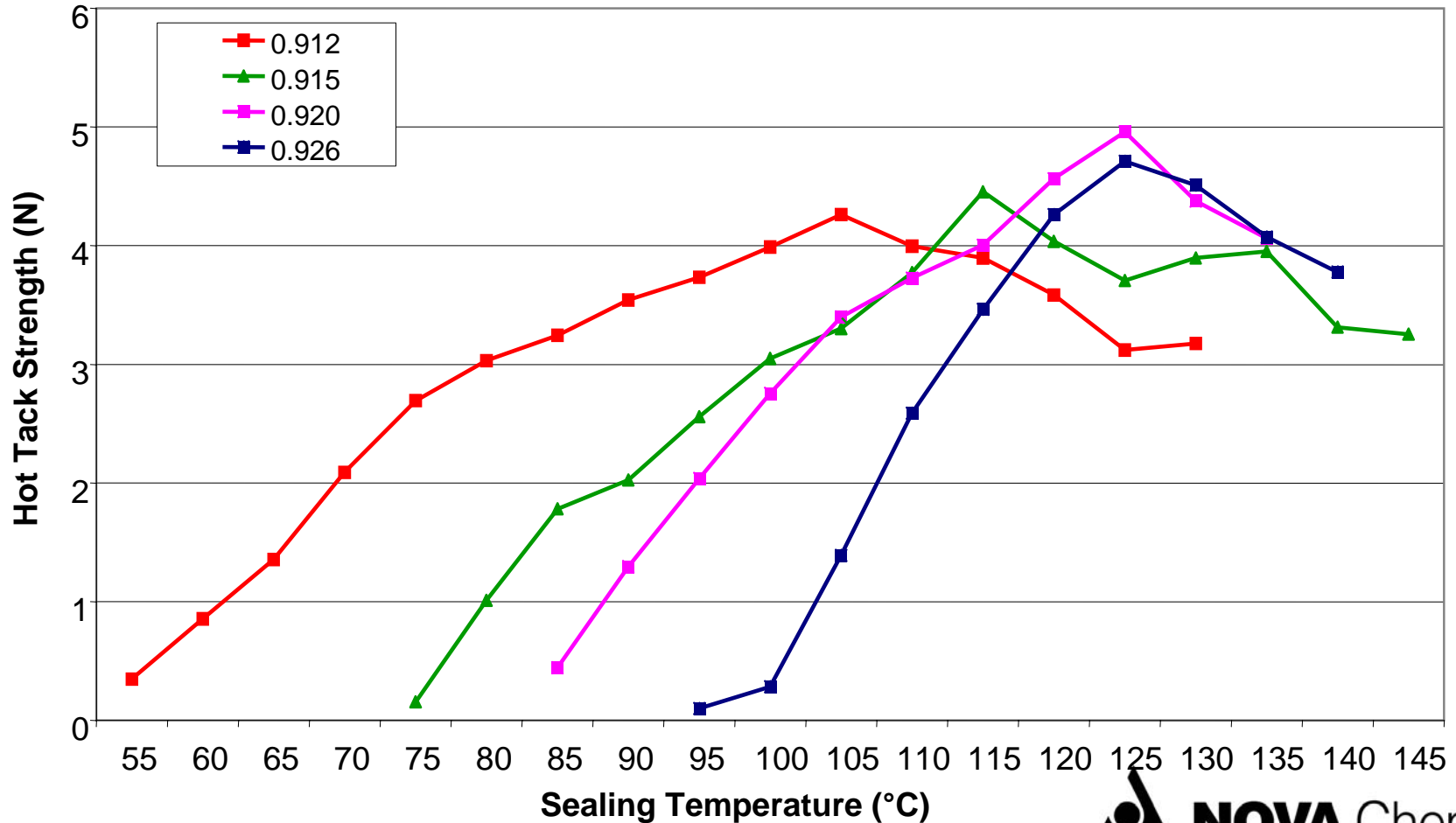
Hot Tack Strength

- Strength of polymer interfacial bond while still in the melt phase
- Key parameter for many packaging applications
- Both the maximum strength and the strength over a temperature range is important



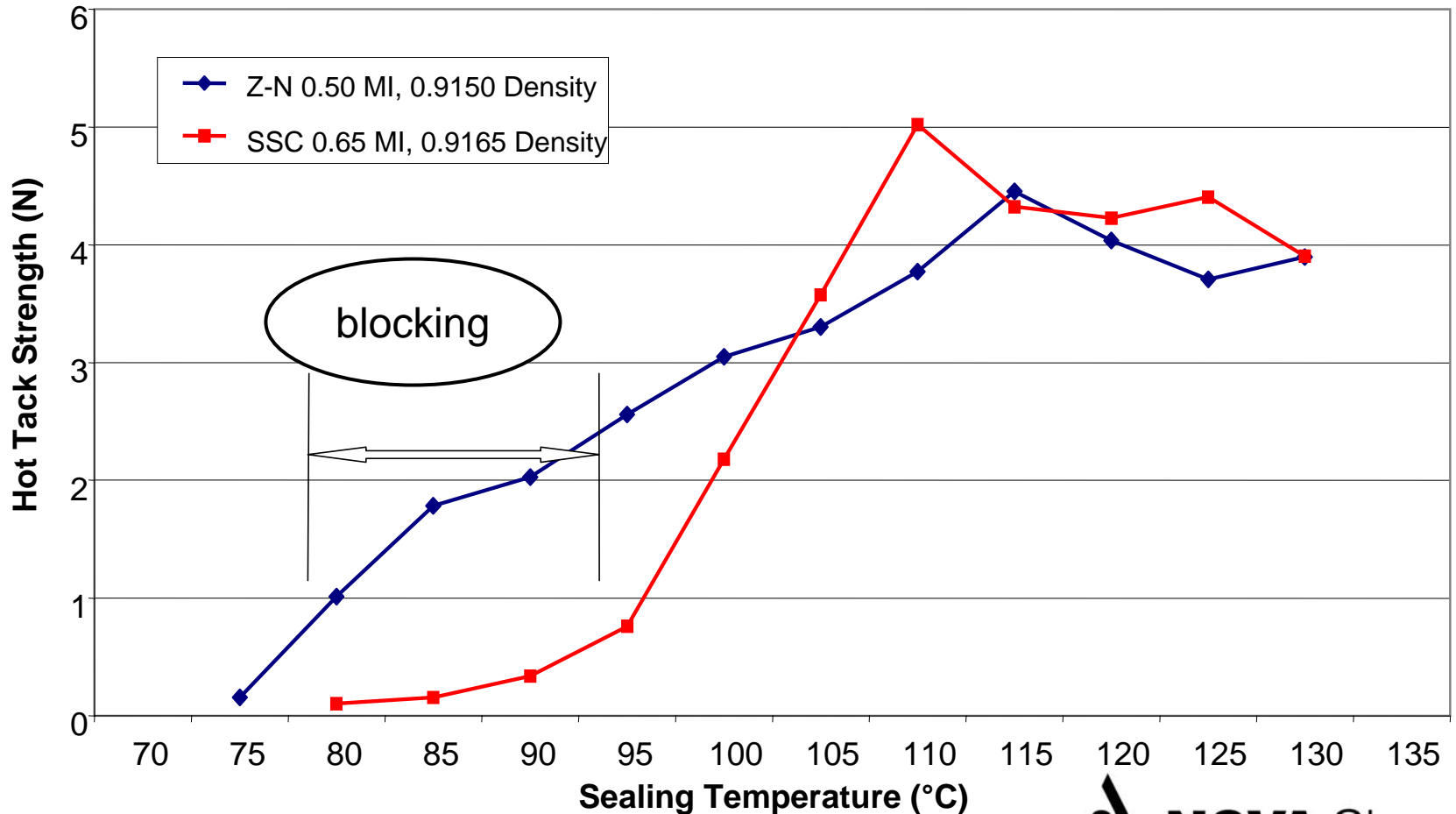
Hot Tack Window

(Ziegler-Natta Products)

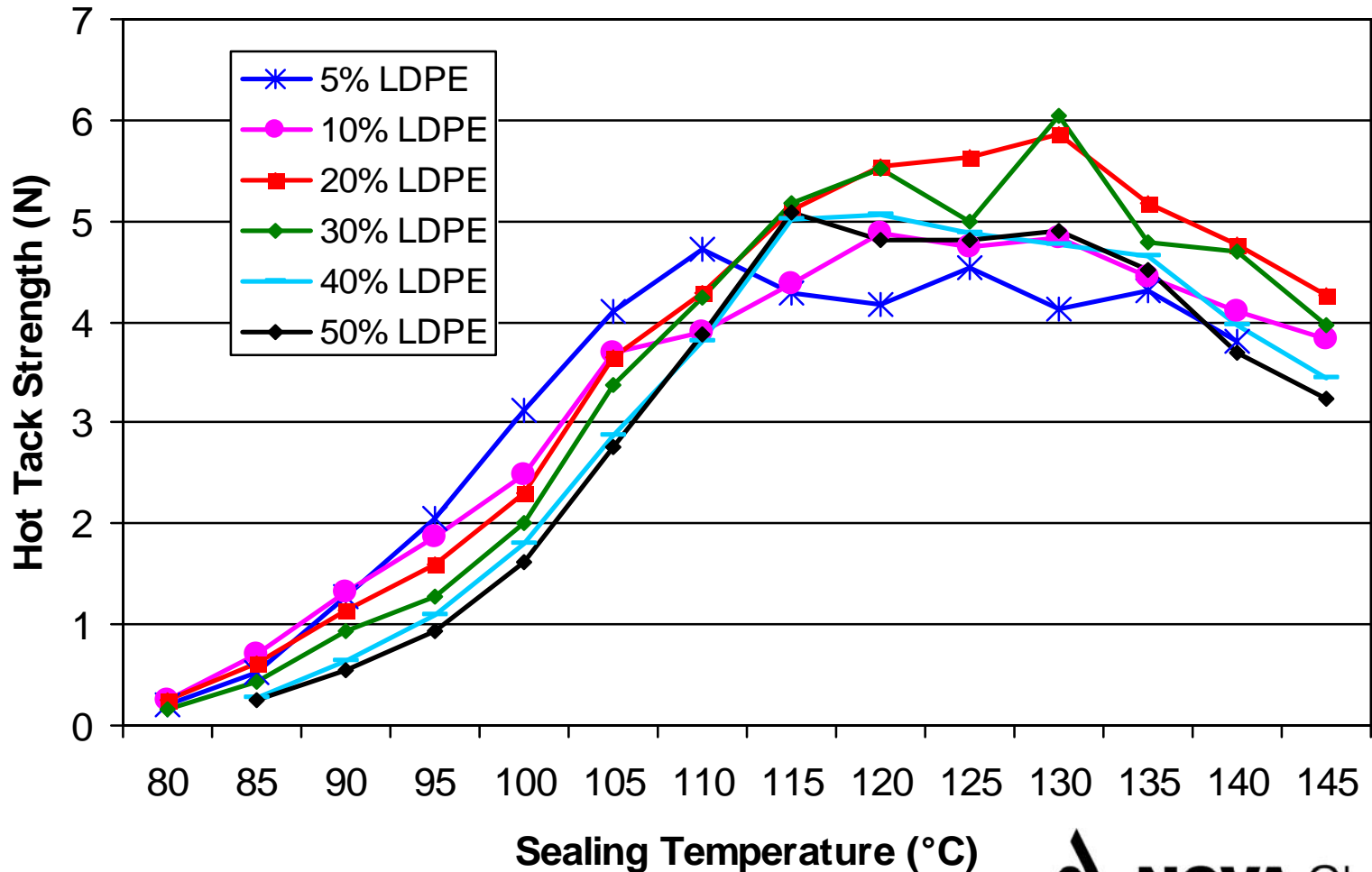


Hot Tack Window

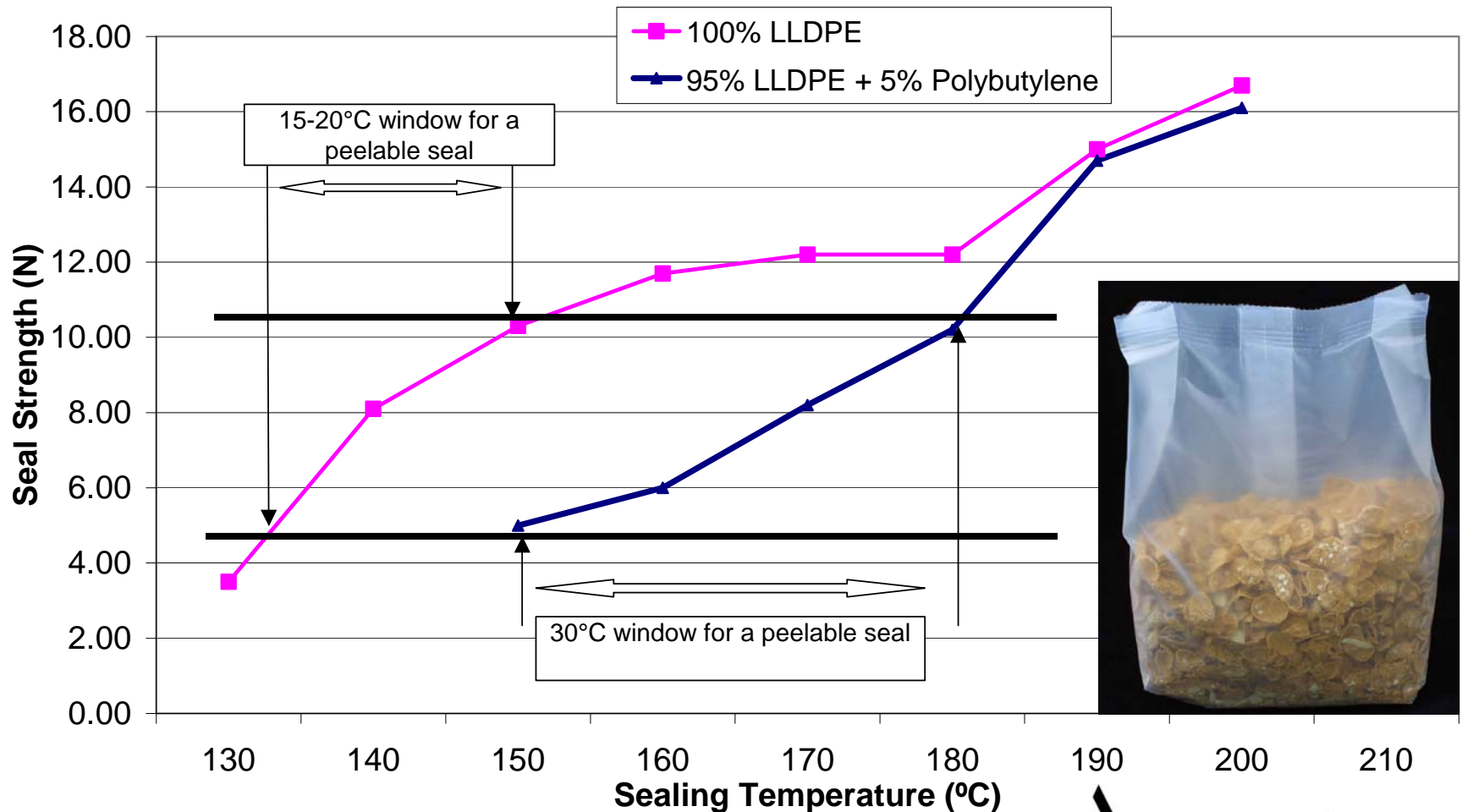
Ziegler-Natta vs Single-Site Catalyst



Blending to Improve Hot Tack Performance



Peelable Seal



Seal Through Contamination

- A material's ability to seal through or around a contaminate
- Critical for package integrity



Seal Caulking

- Ability of the seal material to flow and create seals
- Related to viscosity of material at sealing temperature



Polyethylene Sealant Resins: Design Considerations

Resin Design

- What key resin parameters affect sealing properties?
 - Molecular weight (melt index)
 - Molecular weight distribution
 - Comonomer content (density)
 - Comonomer type (butene vs hexene vs octene)
 - Comonomer placement
 - Additive package

Material Design

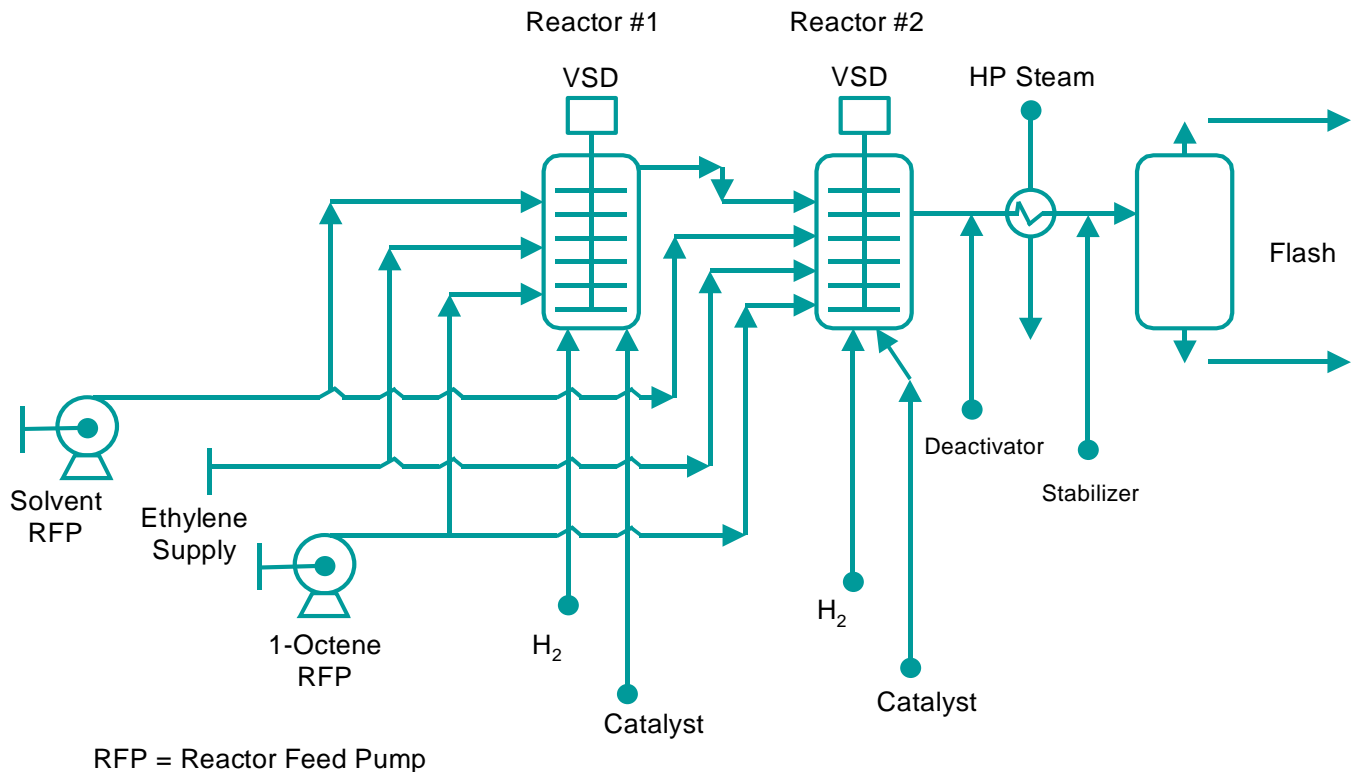
	Seal Strength	Seal Initiation Temperature	Hot Tack Strength	Caulking Performance	Seal Through Contamination
Molecular Weight	**	-	*	**	**
Molecular Weight Distribution	*	-	*	*	-
Comonomer Content (Density)	*	***	*	*	**
Comonomer Type	*	*	-	-	*
Comonomer Placement	*	**	-	-	*

Other Requirements of Sealant Materials

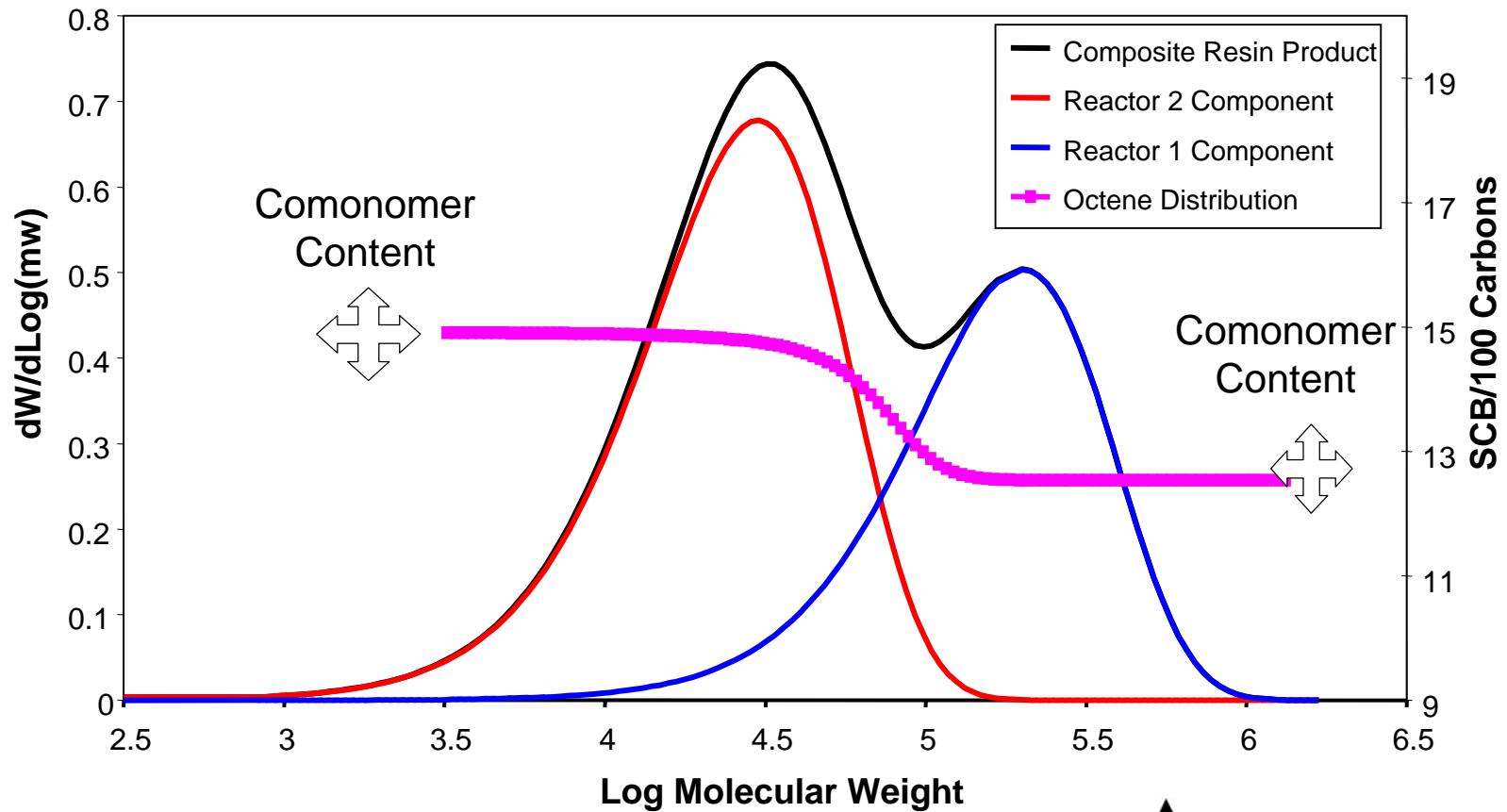
- Extractables
 - FDA requirements
- Organoleptic properties
 - Taste contribution
 - Flavor scalping
- Resistant to wide range of substances
 - Oils, acids, etc.
- Low gels
 - Eliminate pinholing, improve seal integrity

Resin Design Capability

Advanced SCLAIRTECH™ Technology Process Reactor System



Flexibility in Molecular Design



Advanced SCLAIRTECH Technology

- The technology delivers products with low grease levels, very low residual volatiles and low gel levels
 - Low grease
 - Improved organoleptic properties
 - Lower additive level requirements
 - Very low residual volatiles
 - Reduced odor
 - Low gel level
 - Few or no pinholes
 - Improved print appearance
 - Improved seal integrity

NOVA Chemicals' Testing Capabilities

How can NOVA Chemicals assist you?

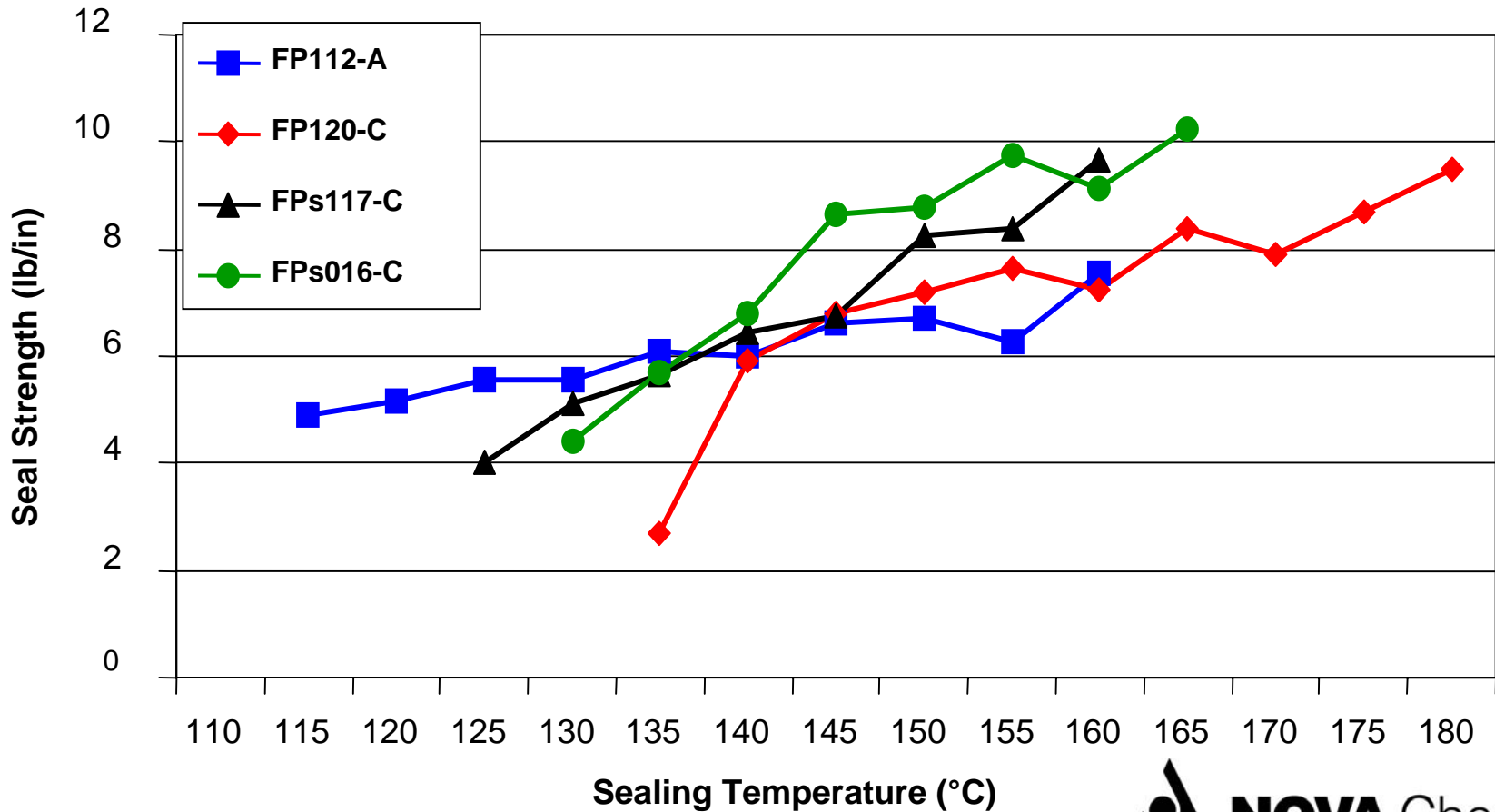
- Wide range of laboratory sealing and seal testing equipment
 - Heat sealer (various seal bar dimensions)
 - Hot tack tester (various seal bar dimensions)
 - Mechanical testers (measurement of seal strength)

What else can NOVA Chemicals offer?

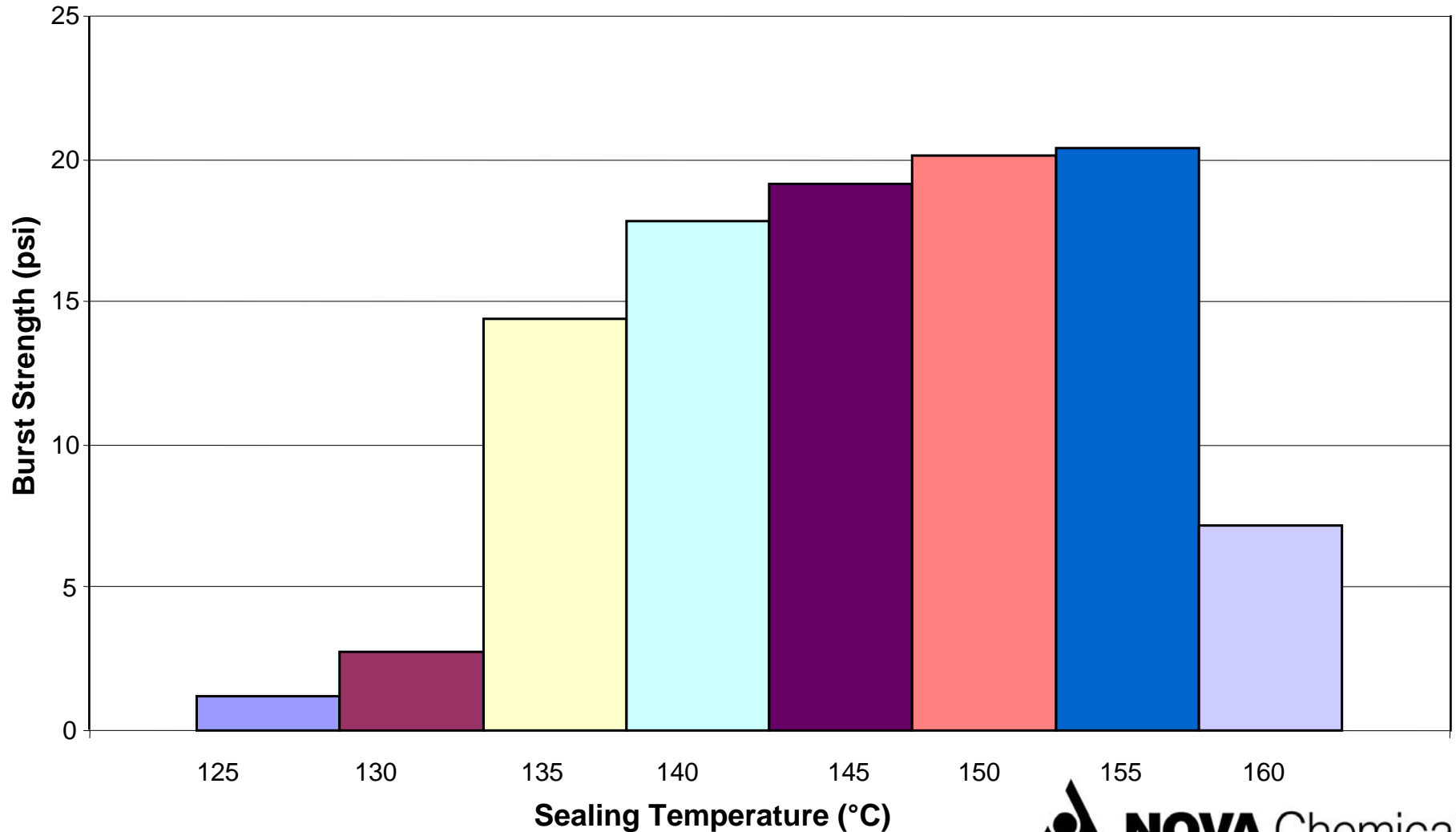
- Vertical form fill seal (VFFS) unit
 - Commercial line
 - Water fill capability
 - Handles a range of flexible materials
 - Monolayer and co-extruded films, laminates, etc.
- Pouch tester
 - Burst strength
 - Leak detection

VFFS Seal Curves

Seal Strength
(0.1 s dwell time)



Burst Strength





**Thank you
for your
attention**

SURPASS[®] resins

www.SURPASSresins.com

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