



EFFECT OF PROCESSING ON THE PERFORMANCE OF WATERBORNE HEAT SEAL COATING

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Outline

- Heat-Seal Coatings.
- Introduction to BLUEWAVE™ Technology.
- Raw Materials and Characterization Tests.
- Performance Comparison.
- Conclusions

Heat-Seal Coatings (HSC)

Defining Characteristics:

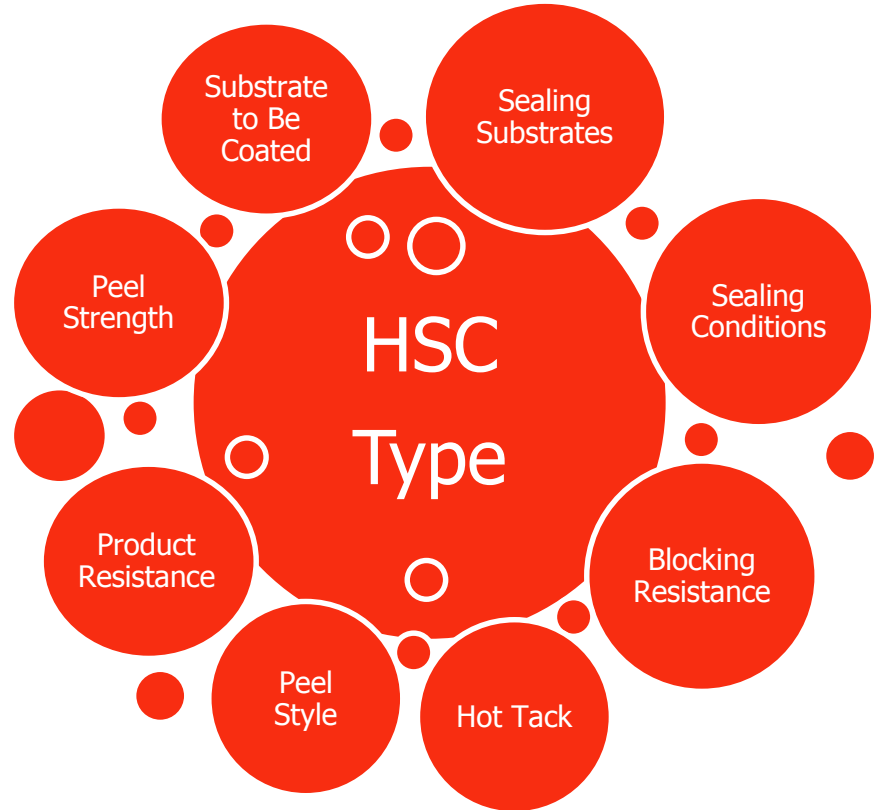
- Thermoplastic materials.
- Rigid or flexible substrates.
- Solidified and tack-free.

Creating Permanent Bond:

- Heat.
- Press.
- Cool.

Selected Applications:

- Industrial.
- Medical - Pharmaceutical.
- Food.



Heat-Seal Coatings (HSC)

Different Chemistries:

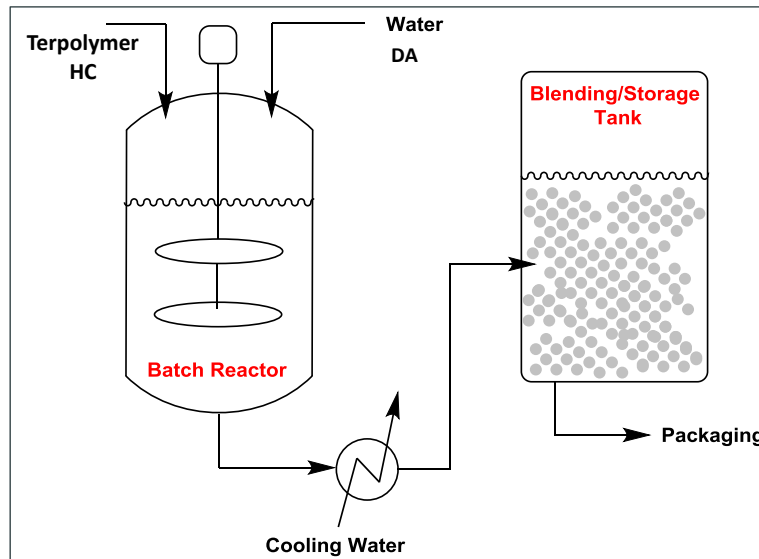
- Vinyl - Acrylic.
- Polyester.
- Ionomer.

Dispersing Medium:

- Water-based.
- Solvent-based.

Other Components:

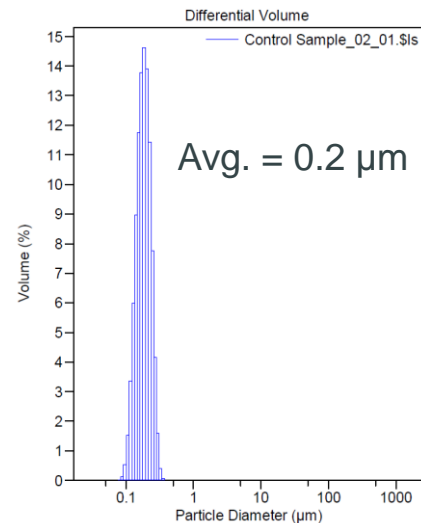
- Fillers.
- Tackifiers.
- Stabilizers.



HC = Hydrocarbon Compound.
DA = Dispersing Agent.

Batch Process:

- Reaction Time.
- Energy Intensive.
- Labor Intensive.
- Higher Variability.



Introduction to BLUEWAVE™ Technology

Defining Characteristics:

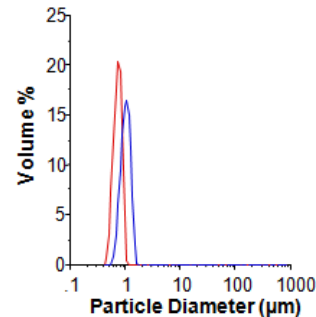
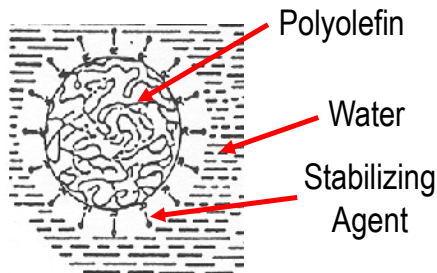
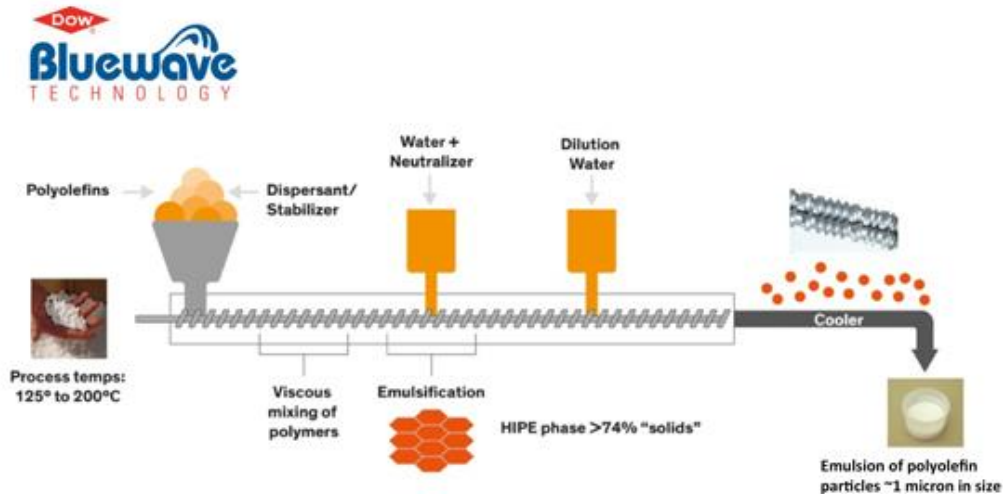
- Commercially viable.
- Continuous.
- Solvent-free.
- High-quality dispersions.

Enables processing:

- High Molecular Weight (Mw) Polymers.
 - > 75k Mw
- Non-self Dispersing Polymers.

Selected Applications:

- Heat Seal Coatings.
- Industrial Paints and Coatings.
- Home and Personal Care.
- Composite Materials.
- Oil and Gas Additives.

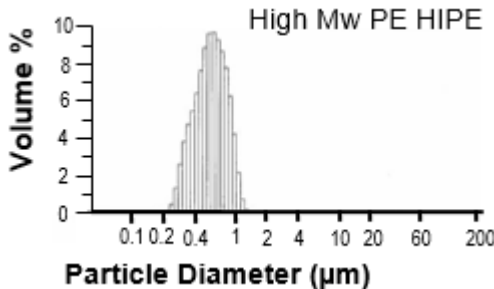


BLUEWAVE™ Technology – Droplet Formation Mechanism

Dow HIPE Process

Mother

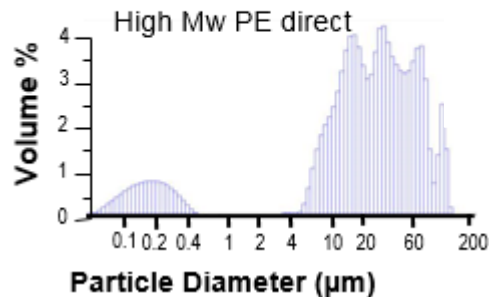
- Small Size (< 1 µm).
- Narrow Distribution.
- Highly Reproducible.
- Relative Low Shear.



“Entire Family”

Direct Emulsification Process

- Large Size (> 5 µm).
- Broad Distribution.
- Poorly Reproducible.
- High Shear.



Mother

“Children”

$$d = \frac{\gamma}{\text{shear}} \cdot f \left[\frac{\eta_{\text{dispersed}}}{\eta_{\text{continuous}}} \right], f(T, t)$$

- IFT (formulation)
- Viscosity ratio (formulation)
- Shear (equipment)



BLUEWAVE™ Technology – Properties of Dispersions

Properties:

- Average Particle Size = 1 μm .
- 30 – 55 % Solids Content.
- Viscosity < 500 cP.

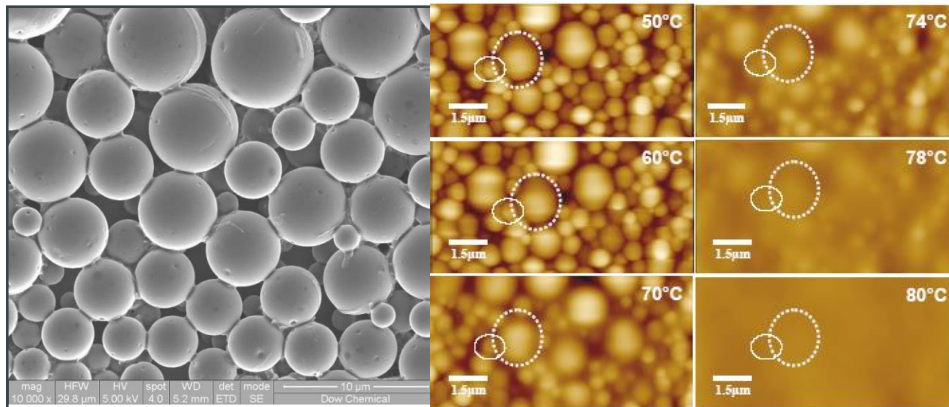
Raw Materials:

- LDPE, HDPE, Olefin Elastomers, Functional Olefins.
- Different Properties:
 - Tg, % Crystallinity, Mw.

Tailor Properties such as:

- Toughness.
- Haptics.
- Moisture Barrier.
- Adhesion.

Film Formation – Hot Stage Microscopy



Suitable for Industrial Applications with Cure Cycle,
Semi-crystalline polyolefin dispersion, Tm $\sim 70^\circ\text{C}$

Common Applications:

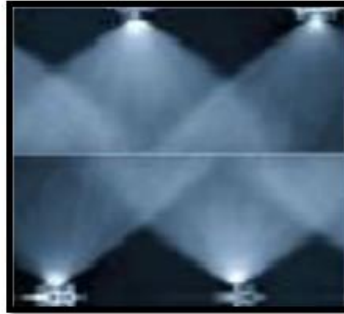
- Paper Coatings, Hot Melt Adhesives.
- Pressure Sensitive Adhesives, Health and Hygiene, Hair Care.
- Plastic Coatings, Gaskets for Metal Closures.
- Carpet Backing.

BLUEWAVE™ Technology – Application Methods

Stable Liquid Dispersions



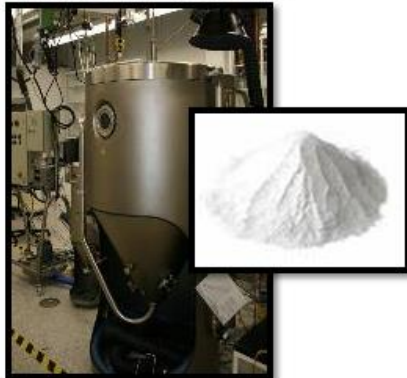
Spray Application



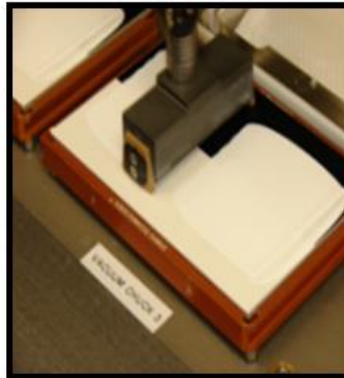
Dipping



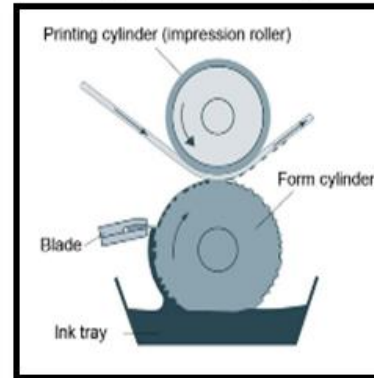
Spray Dried Powders



Draw Downs



Rotogravure & Inkjet



Raw Materials and Characterization Tests

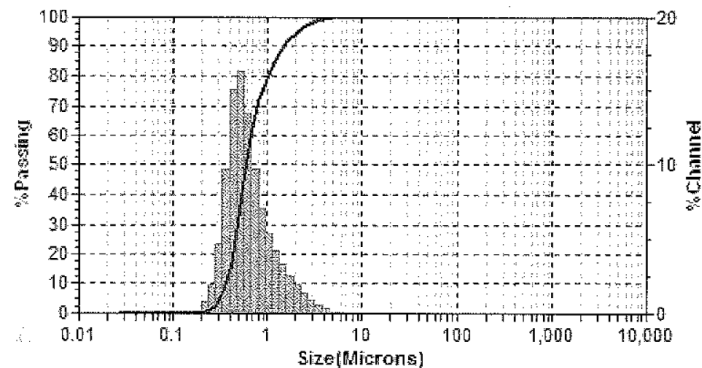
Material	Material Properties	Density (g/cm ³)
Terpolymer	*MI = 6 g/10 min	0.96
HC – 1	**MT = 59° C	0.96
DA – 1	MT = 144° C	1.069

*Melt Index (190 C/2.16 kg).

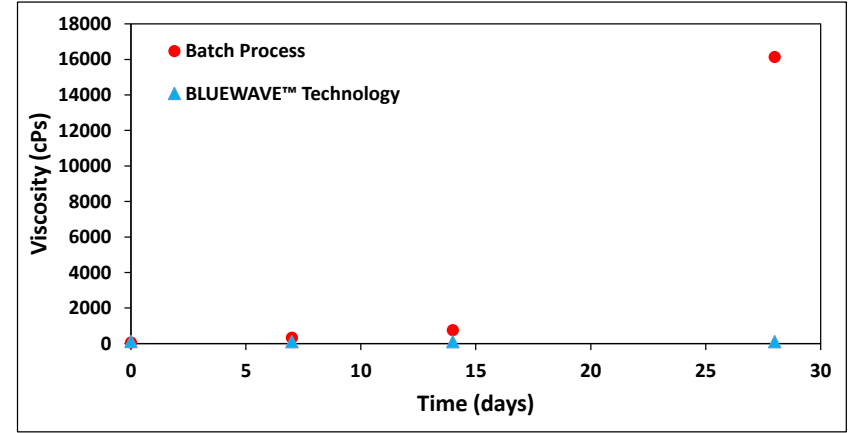
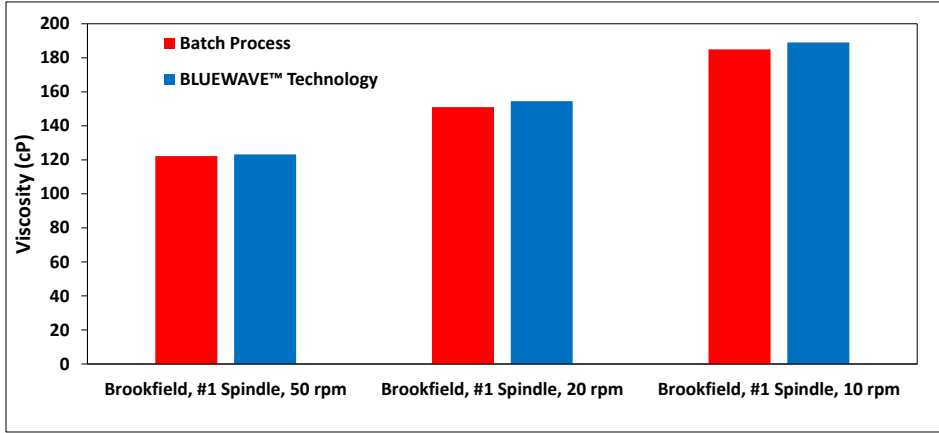
**Melting Temperature.

Measurement	Instrument Used	Condition
Particle Size	LS 13 320 Beckman Coulter particle size analyzer	Test done with dilute solution of sample
Viscosity	Brookfield viscometer	RV2, 50 rpm
Solids	Sartorius moisture analyzer	1 g sample at 120 °C

Dispersion Properties	Batch	BLUEWAVE™ Technology
Average Particle Size (µm)	0.2	0.86
Viscosity @ 20° C (cP)	120	122
Solids (wt%)	40	39.8
pH	10.4	10.2



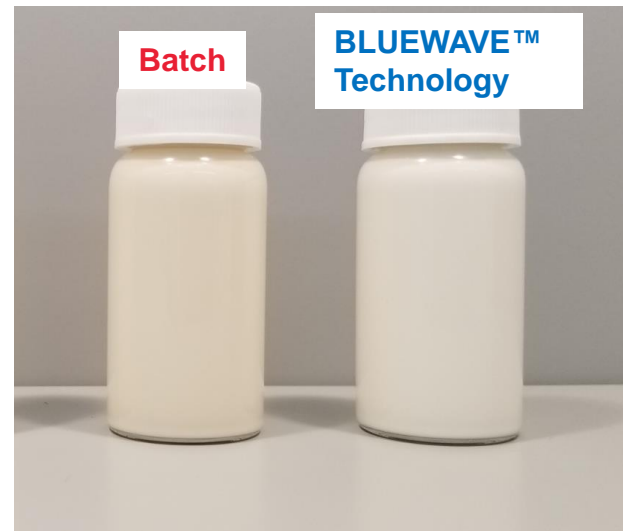
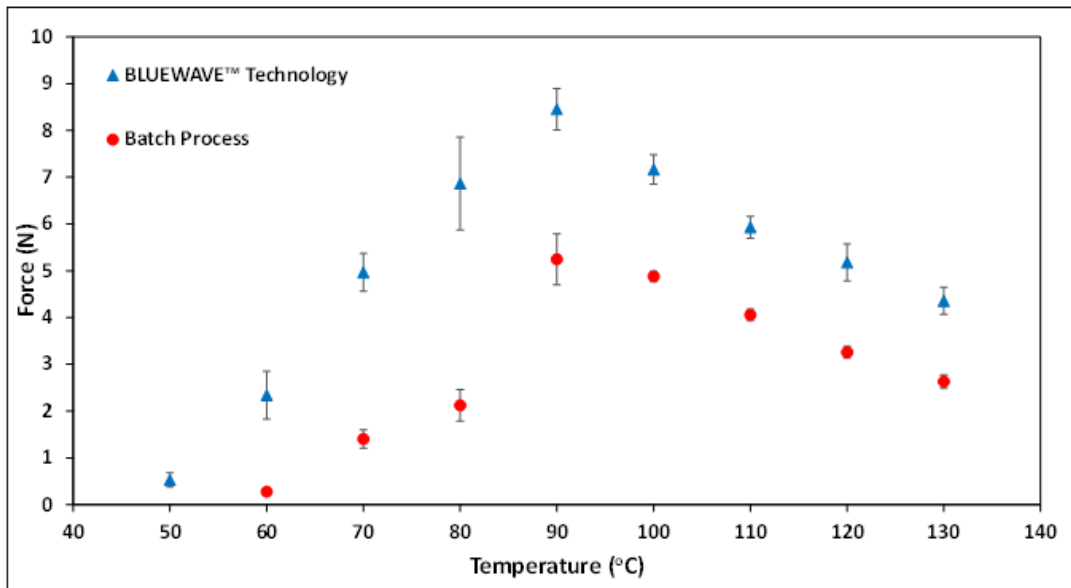
Viscosity Behavior



BLUEWAVE™ Technology material has similar viscosity of as Batch-Process material

Batch-Process samples had significant viscosity build over 2 – 4 weeks.

Hot Tack and Appearance Response

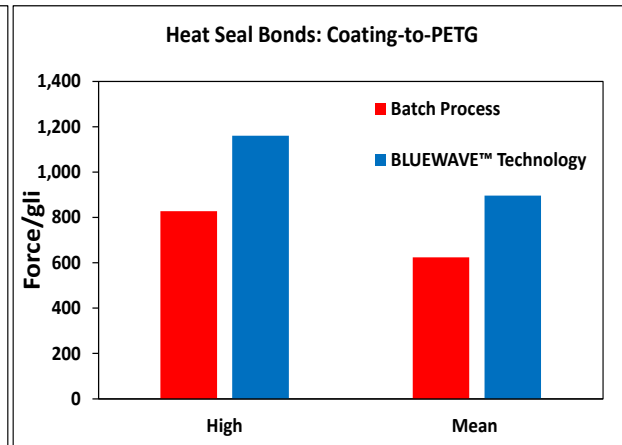
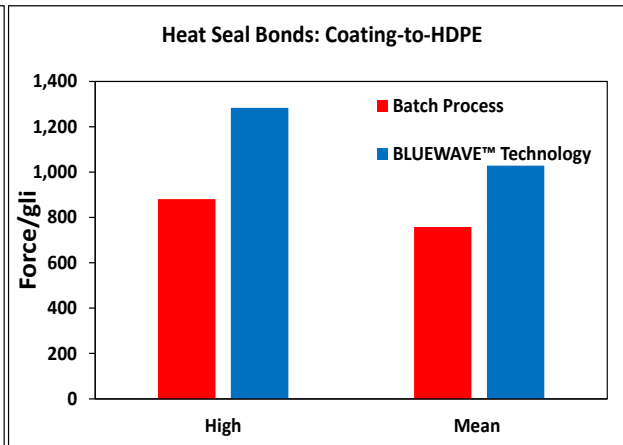
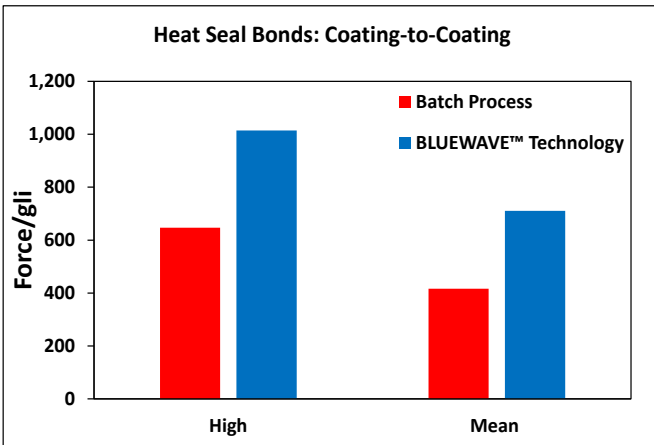


BLUEWAVE™ Technology material has an effective, lower, on-set temperature and higher bonds than Batch-Processed materials at a given temperature.

BLUEWAVE™ Technology material is milky white suspension in solution – Color improvement from Batch-process material (milky off-white).



Heat Seal Bond Strength Response



BLUEWAVE™ Technology material has similar-to-higher bonds than batch-processed material on a variety of substrates:

- Coating-to-coating
- Coating-to-HDPE
- Coating-to-PETG



Conclusions

- BLUEWAVE™ Technology samples perform equal to or exceeds that samples produced by means of a batch process.
- Viscosity remains constant.
- Longer shelf-life.
- Batch Process vs. BLUEWAVE™ Technology.
- BLUEWAVE™ Technology samples exhibit lower on-set temperature and higher bonds.
- BLUEWAVE™ Technology samples offer similar-to-higher bond strength on a variety of substrates.



Thank You!

