Laminating Adhesives: Enabling Sustainable Flexible Packaging

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Agenda

- Who is HB Fuller
- Trends in Packaging
- What is a Flexible Package?
- Innovation
Global Organization

H.B. Fuller is organized geographically:

- The Americas
- Europe, India, Middle East
- Asia Pacific
H.B. Fuller Company

- 125 years of success as a manufacturer of specialty chemical products
- Headquartered in St. Paul, Minnesota
- Recognized for quality adhesives, sealants, coatings, and paints
- Global with direct presence in 39 countries, 3300 employees, and customers in more than 100 nations
- 2011 sales of $1.56 billion
- Public company listed on NYSE (FUL)
- Component stock of the Standard & Poor’s Small Cap Index (S&P 600)
Trends in Packaging

- Lower Life Cycle Cost
- Improved Performance
- Enhanced Consumer Experience
Drivers of the Trends

Availability of lighter weight materials reduces inbound truckloads of packaging.

Increased fill good to package ratio decreases outbound truckloads required to deliver goods.

Increased demand by manufacturers, retailers and consumers to reduce spoilage and damage.

Increased demand by consumers for convenience - retort, microwavable, boil-in bag.

Increased desire to differentiate brand through package.

Consumer desire for ease of use – opening and closing features.

Cost

Performance

Experience
Flexible Packaging Revenue, 2000-2010

Compound Growth Rate 2.6%/yr

*FPA Estimate

Source: Census Bureau and Flexible Packaging Association
Total U.S. Packaging Sales %

Breakdown by Segment

- Corrugated (23%)
- Flexible Pkg (19%)
- Metal Cans (13%)
- Paperboard (13%)
- Glass (4%)
- Misc Rigid Plastics & Bottles (16%)
- Others (12%)

Total $134 billion

Source: Latest Census Bureau ASM data and Flexible Packaging Association estimates
Packaging Requirements

- Contain food stuff
- Protect from vermin
- Protect from environmental contaminants
- Provide light barrier
- Control gain or loss of moisture and oxygen
- Resistance to components of the food stuff
- Billboard for the product and brand

Performance/Protection
Flexible Packaging

- Single film cannot meet all package requirements
  - Protection/Barrier
    - Oxygen
    - Water
    - Aroma
    - Gas flush
  - Package forming
    - Sealing
    - Forming
    - Puncture
- Multiple films must be brought together via a lamination technique
  - Extrusion
  - Adhesive

Multiple Films = Performance
Laminated Structure

- Outer layer
- Printing ink
- Adhesive
- Inner layers / Sealant film, barriers,..
- Printing Ink
- Adhesive
- Printing Ink
Flexible Packaging Converting Process

- Print
  - Provides brand image
- Laminate
  - Gives the resistance properties
  - Gives barrier properties
- Slit, Pouch, and Fitments
  - Gives ability to act as a container
  - Provides opening and closing features
What is Your Definition of Sustainability

The sweet spot of sustainability
Sustainability in Flexible Packaging
A Sequence of Events

Today – Focus is on Films and Their Source

Where they come from
- Sustainable polymers for films
  - Print film
  - Sealant film
  - Functional
- Supply chain and scale – Economic sustainability

End of Life
- Recycling
- Composting
- Incineration
Sustainability in Flexible Packaging
A Sequence of Events

Future – Completes the Package Life Cycle

How a Package is Made
- Manufacturing processes
- Energy
- Waste

Secondary Components
- Adhesives
- Printing inks
- Barrier technology
  - Coating
  - Additives
Why is Adhesive Critical

- Avoid waste of film and contents from failure due to adhesive
- Aggregate film properties - performance
- Food protection
- Extended freshness – shelf life
- Format and fitments

Scanning Electron Microscopy (SEM)
Thickness 1-5µ
~2-6% of a lamination is adhesive

Enabler of sustainability
ADHESIVES
Adhesives Today

- Can contain some renewable raw materials
- Bond a variety of films including those from renewable sources
- Facilitate sustainable manufacturing process
- Enable sustainable options of end of life
Renewable Raw Materials in Adhesives Today

- Renewable raw materials have been available for years
  - Starch
  - Casein
  - Rosin Esters
  - Terpenes
  - Fatty Acids
  - Fatty Alcohols
  - Dextrin's
  - Modified Cellulose

- Performance has been the challenge
Variety of Combinations for Flexible Packaging

- **Renewable**
  - Renewable Cellophane
  - PLA
  - Paper
  - Aliphatic-Aromatic Polyesters
  - Bio – Polyethylene
  - PHA
  - Starch Based TPUs

- **Traditional**
  - Polyester
  - Polypropylene
  - Polyethylene

- **Hybrids**
  - Combinations of the above
Adhesives Today Enable Sustainable Manufacturing

- Reduction in use of organic solvents
- Reduction in energy requirements
- Increasing speeds
- Waste
  - Start up
  - Package failure

Solvent Based

Water Based

Solvent Free

North America

Europe

Energy Costs
Adhesives Today can Enable Sustainability for End of Life

- Certain Products
  - Come from degradable materials
  - Allow composting
    - DIN CERTCO EN13432
    - ASTM D 6400
      - Unique adhesive chemistries allow biodegradable “green” laminations
      - Approved by the market for PLA/PLA, PLASiOx/PLA or PLA/starch modified PE
      - “Green” solution for dedicated end uses
      - Good machinability on Solvent Free laminations
      - Excellent optical clarity

- Adhesives can generally be safely incinerated
  - Typically made from non-hazardous materials
  - Small component of the overall package
Adhesives of the Future

- Move away from synthetic, hydrocarbon content
  - Mindful of lifecycle inventory
  - Realistic scale
  - Maintaining
    - Performance,
    - Price
- Manufactured in increasingly sustainable manner
  - Reduction of energy consumption per pound
  - Reduction of waste in process
  - Reduction in water usage
Ethylene Impacts Key RM Supply

- Vinyl Acetate monomer
- Ethylene glycols
- Polyolefins (LDPE, LLDPE, EVA)
- Styrene

- Acrylate monomers
- APAOs
- Propylene glycols
- Polyether polyols
- Epoxy resins

- Isobutylene
- Butadiene

- Isoprene
- Aromatics
- Resin Oil

- Butyl rubber
- Styrene Block Copolymers

- Styrene
- MDI
- Epoxy resins
- Polyester

- Hydrocarbon resins

Waterbase Polymers, Adhesives and Sealants
Hot Melt Adhesives and Sealants
Reactive Adhesives and Sealants
Flextra Quiet™ 1000 Laminating Adhesive

**Designed for Sound Reduction**
- Renewable and compostable polylactic acid (PLA) and other films are made quieter by laminating with Flextra Quiet™ 1000
- Reduces sound to levels of conventional film laminations

**Designed for Many Applications**
- Snack food packaging
- Dry goods packaging
- Fresh-cut produce packaging
- High modulus films

**Designed for Performance**
- Facilitates use of renewable film
- Excellent for breathable film applications
- Excellent clarity
- Can be easily blended with a co-reactant
- Rapid slit and cure time
- Excellent adhesion to metalized films
Flextra Quiet™ 1000

PLA Film Lamination without Flextra Quiet Adhesive

95 decibels

PLA Film Lamination with Flextra Quiet Adhesive

78 decibels

SOUND DEADENING ADHESIVE

Outer Film — Loud Compostable Film

Flextra Quiet™ Adhesive

Inner Film — Loud Compostable Film
Feature Solventless Product: Flextra® SFA8210 / XR1210

Compostable SF Adhesive

- DinCertco and O.W.S.
- Fragmentation vs. time and ecotoxicity.
- BPI typically accepts DinCertco and O.W.S. testing
- Laminates tested:
  - Unprinted PLA/SFA8210 + XR1210/PLA
  - Printed PLA/SFA 8210 + XR1210/PLA
  - Unprinted PLA/SFA8210 + XR1210/PE starch modified
  - Cellophane coated/SFA8210 + XR1210/cellophane heat seable coated
  - Starch modified PE//SFA 8210 + XR 1210//Starch modified PE
- Multiple companies tested. All companies passed the fragmentation test.
- Liquid samples submitted for ecotoxicity tests to DinCertco and passed.
In Summary

Adhesives enable renewable flexible packaging

- Advancing key trends in flexible packaging
- Enhancing consumer perception of flexible packaging
- Allowing broader variety of renewable films to be used
- Balancing sustainability and performance
- Opening the doors to 100% sustainable flexible packaging

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