FlexForm

TECHNOLOGIES

Putting Natural Fiber to Work

Natural Fiber Composites

Manufacturing

Two lines:

Carding Line

Airlay Line

Two Divisions:

Transportation

Office Interiors

Four Products:

Mat, LD, HD

FR

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Flexform®
Natural Fiber Composites

- ## Natural Fiber
  - Jute
    - Tossa
    - Mesta
  - Hemp
  - Kenaf
- ## Polymer
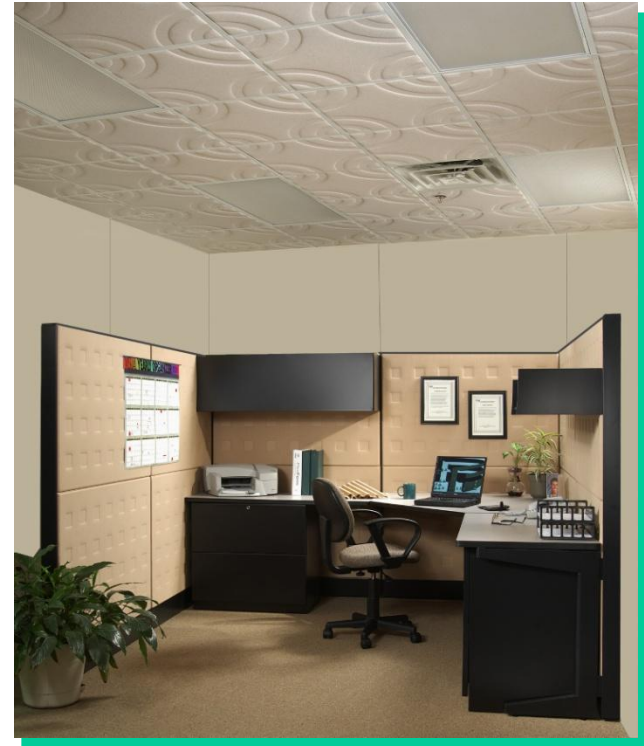 - Polypropylene
  - Polyester

Airlay and FR Line

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FlexForm FR

- Office interiors
  - Partition Panels
  - Architectural Walls

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Market Objective

- To provide a natural fiber based alternative to the commonly used glass mat in office interior panel applications that has a 'Class A' fire rating.

- To provide a green product that is as good or better in appearance and performance than the glass mat alternative.

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Product Description

- Blends

  - Up to 43% Post-Consumer Recycled Content

- Weights

  - 1500 to 1950 g/m^2

- Thicknesses

  - .165" to .32"

  - Target Tolerance   0.025"

- Variable Sheet Sizes up to 72" x 120"

  - Target Tolerance   0.25"

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Surface Burning Characteristics

- Specification
  - ASTM E84

- Class A Rating
  - Flame Spread Index = less then 20
  - Smoke Developed Index = 20

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Product Benefits

- Tack-able
  - Superior wear characteristics
- Structural Strength
  - Potential to reduce steel content
  - No need for backside reinforcements
  - Reduced damage and associated warranty costs
- Fastener Retention
  - Staples, tacks, screws
- Near White or Natural color options
- Environmentally Friendly
  - Rapidly Renewable Resource
  - Post Consumer Recycled Content
  - No harmful off-gassing

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FR Conclusions

FlexForm Carding Line

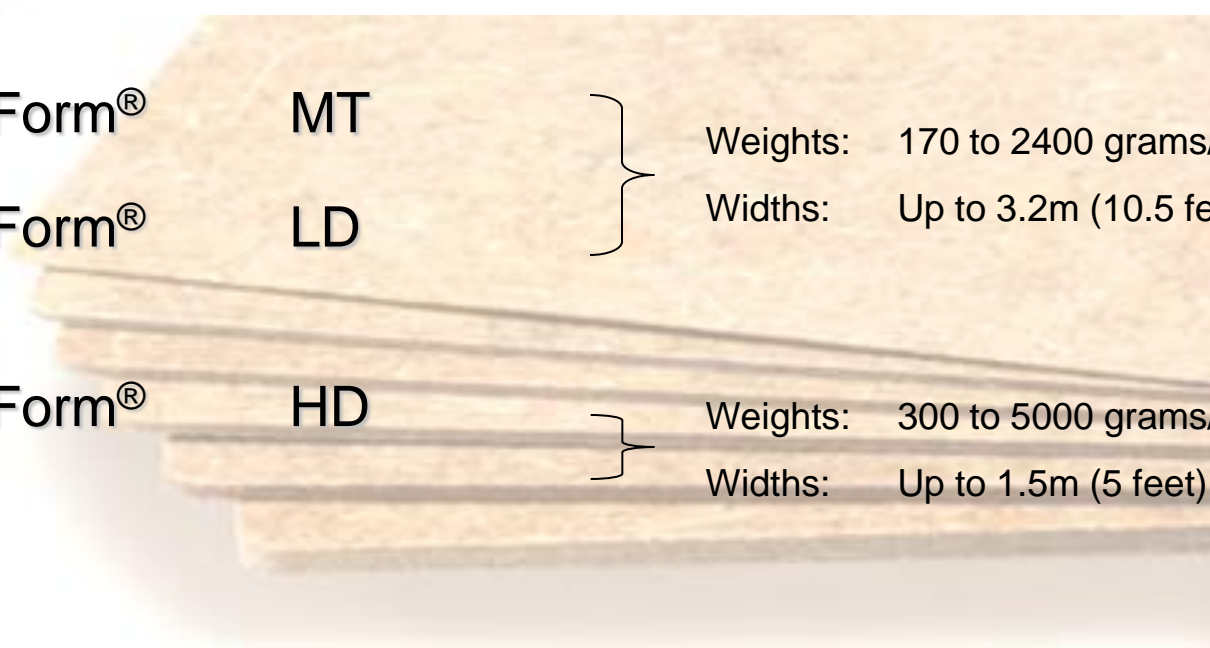# FlexForm Carding Line

FlexForm Carding Line

Product Line Up

- FlexForm®   MT

- FlexForm®   LD

                     Weights: 170 to 2400 grams/m^2

                     Widths: Up to 3.2m (10.5 feet)

- FlexForm®   HD

                     Weights: 300 to 5000 grams/m^2

                     Widths: Up to 1.5m (5 feet)

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Product Benefits

- ## Lamination
  - In-mold bonding of cover materials and secondary attachments **without** adhesives
  - **NO** De-lamination, sag, or wrinkling
- ## Match Metal Molding
  - Consistency
  - Quality
- ## Flame Retardant
  - FMVSS 302

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Product Benefits

- **Acoustical**
  - Variable
- **Fastener Retention**
  - High Load Capability
    - screws, staples, rosettes, etc.
- **Dimensionally Stable**
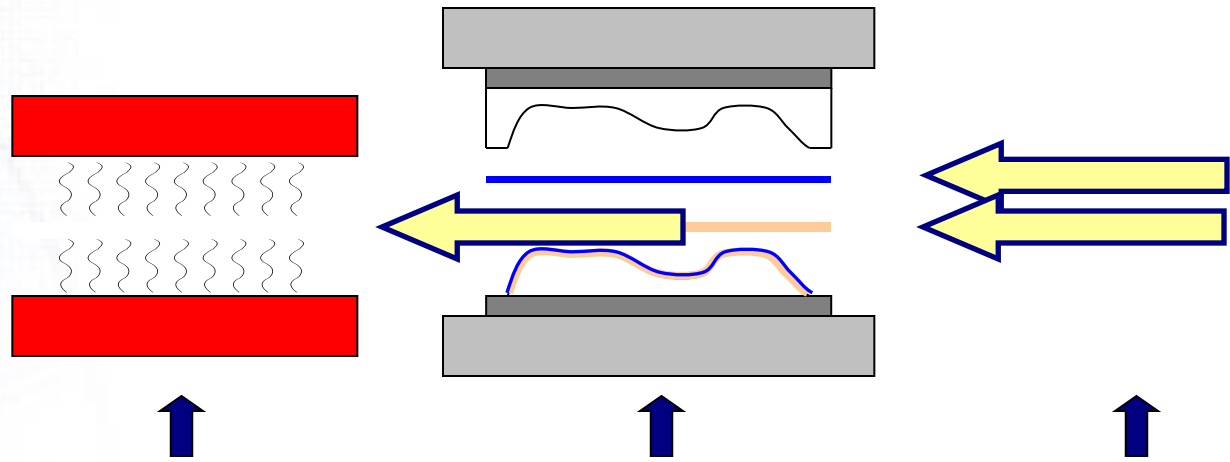 - Not Affected by Heat or Humidity

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Product Benefits

- ## **Significantly Less Weight**
  - Improved fuel economy
  - Simplified handling

- ## **Recyclable**
  - Reuse of trim waste
  - $$ Savings $$
  - End-of-Life Recovery

- ## **Environmentally Friendly**
  - **NO** Harmful Chemicals
  - **NO** VOC Off-Gassing
  - Sustainable Resource

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One Step Processing

➤ Optimal removal temperature for part of 35º C (95º F)

➤ FlexForm with cover material and optional attachments stable out of tool

➤ Parts can go directly into packaging or onto secondary operations

➤ Average total cycle time is **55 seconds**

Finished Component Costs

- **Savings over existing technologies**
  - Reduced capital investment
    - Processing equipment
    - Tooling
  - Reduced burden
    - Elimination of secondary operations
    - Elimination of costly adhesives
    - Lower cycle times

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Focus Market

- Automotive, heavy truck, and commercial interior trim
  - Door panels
  - Load floors
  - Pillars
  - Quarter panels
  - Rear package trays
  - Trunk liners
  - Overhead systems
    (under development)

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Customer Support

- Fully facilitated on-site laboratory
- Prototyping
  - Customer owned tooling
    - wood, fiberglass, aluminum, and steel
  - Tool design support
  - Process development
- Dedicated customer service
  - Part/process development support provided at customer sites as required
  - On-going technical support through production launch

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On-site Laboratory & Prototyping

Available for Customer Use

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Expanded Markets

- Commercial Farm Equipment
- Absorbency Pads
- Non-Commercial Aircraft Interiors
- Erosion Control
- Cargo Boxes/Highway Trailers
- Carpet Cushion

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Future Value Added Processes

- Cradle to Cradle
  - Accept returns of trim waste
  - Accept returns of end of life product

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Patent Applications

- Laminated hard board panel
- Exterior hard board panel - One piece painted surface
- Interior panel – One piece laminated finish wall
- Honeycomb laminated to NF board
- Recycling system
- Hardboard processing line system
- Ztruss® core system
- Ztruss® wall system – one piece
- Ztruss® lamination system
- Ztruss® manufacturing line
- Exterior wall composite (XLP)
- Light Weight Structural Composite (LSC)
- FlexForm® FR
- Anti-Microbial Carpet Underlay