Introduction to Adhesives & Sealants Foaming Technology

George Pais, Senior Product Manager

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Types of Foam

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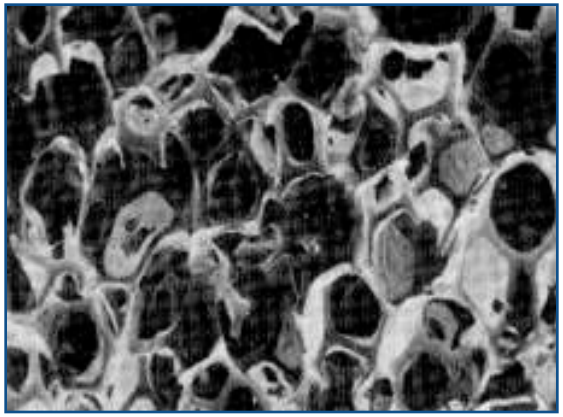
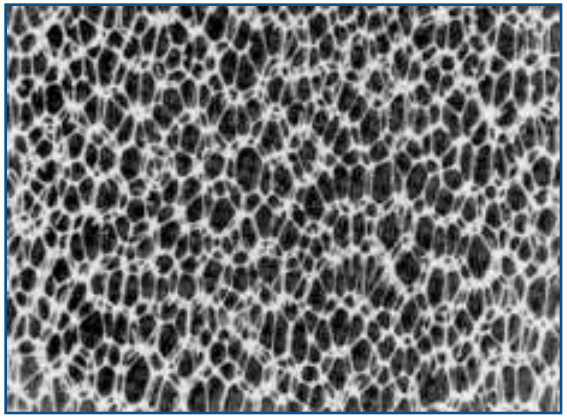
Open Cell Structure



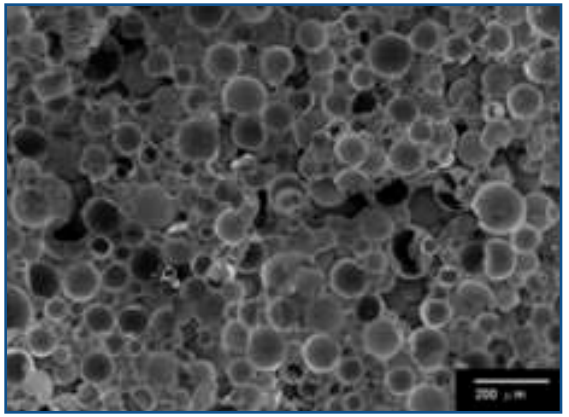
- Cell walls broken
- Soft, weak structure
- Insulation related to air
- Permeable to vapors
- Lowest density
- Absorbent properties

Closed Cell Structure



- Discrete cells (not continuous)
- Higher degree of insulation
- Lower permeability
- Higher density
- Gasketing/isolation properties

Syntactic Cell Structure



- Composite materials
- Polymer, glass or hydrocarbon balloons
- Controlled density
- No cross reactions
- Retains physical properties of base material

Choose Correct Cell Structure For Desired Application

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Production Methods

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Chemical Reaction

Liberate Gas via Chemical Reaction:

- Chemical compounds yield CO_2, O_2, N_2
- Multiple component/reactive/solvents/environmental impact
- Particle size of agent determines cell size
- Compatibility issues/corrosion/inflexible once compounded
- Expensive process to utilize and maintain

Mechanical

Gas Injection:

- Sealant materials are mixed with inert gas, producing a homogenous mixture
- The gas expands as material is dispensed, creating a closed-cell foam
- Uses no chemicals
- Foamed materials retain their basic physical properties
- Low cost to operate and maintain
- Uses conventional application equipment

Additives:

- Lightweight materials are mixed with base materials to reduce weight and cost
- Reduction of weight considered a “foam” process
- No other changes in physical properties of base materials
- Higher cost process than gas-injected foam
- Limited to certain materials and temperatures

Mechanical Foams Increase Material Flexibility

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Nordson Closed Cell Foam Solution

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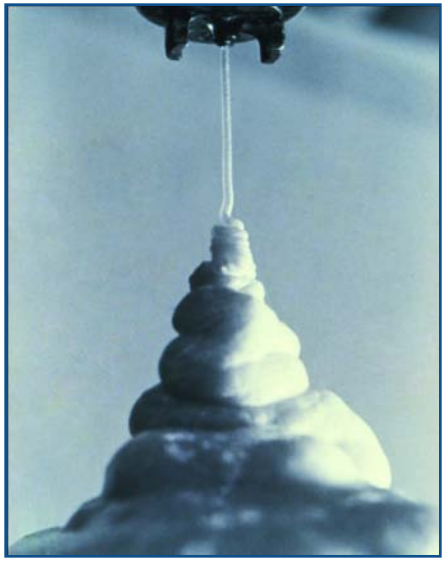

- **Hot melt materials, typically adhesives or sealants, are mixed with inert gas, producing a homogeneous mixture.**
- **As the material is dispensed, the gas expands creating a closed-cell foam.**

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Why Foam?

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Process Drivers

- **Material/weight reduction**
- **Cost reduction**
- **Improve process capability**
- **Material property enhancement**
- **New material/process development**

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Why Foam?

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Benefit Drivers/Justification

- Increased open time
- Faster set time
- Increased surface wetting and penetration
- Lower heat density
- Less force to apply
- **Volumetric increase without adding material**
- **Reduced adhesive consumption/reduced cost**
- **Minimize VOC emissions with solvent-free assembly**

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Benefits of Foaming/Increased Volume

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- Less Sagging – keep adhesive where it is wanted
- Greater Gap Filling – consistent application on “non-smooth” substrates
- Better Substrate Penetration
- Innovation Through Material Selection
- **Up to 2 Times Increase in Volume**

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Benefits of Foaming/
Material Savings - Conservation

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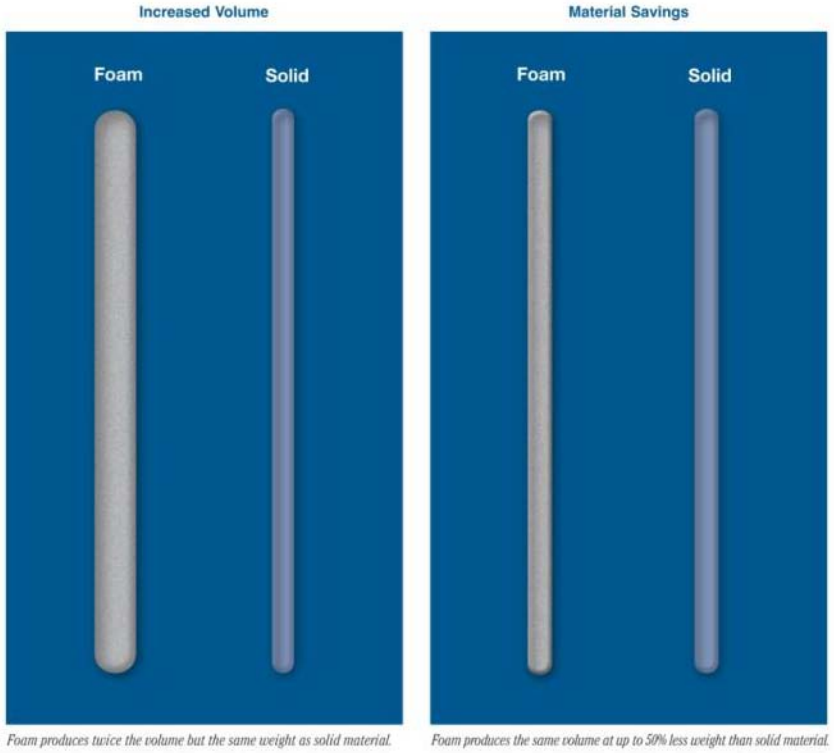
- Natural resource supplies will only continue to tighten
- Maximize adhesive utilization
- Make more bonds with same amount of adhesive (50% reduction in material, make 2 times the bonds)
- Ease of recycling



Foam produces twice the volume but the same weight as solid material.

Foam produces the same volume at up to 50% less weight than solid material.

Maximize Available Material, Reduce Waste, Improve Quality

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Benefits of Foaming/
Material Savings – Cost Reduction

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Reducing the Density of Material Means:

- Lower material usage
- Less part weight/shipping cost
- Less process energy

Look Past "Simple Math" to Total Cost of Quality

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Historical Uses

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Nordson has more than 30 years experience with foaming materials for a wide variety of markets and applications including:

- **Appliance**
- **Automotive**
- **Filter**
- **Woodworking**
- **Building & Construction**

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Historical Uses

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Nordson solutions can successfully foam a wide range of materials such as:

- **Silicone**
- **Ethylene vinyl acetate (EVA) hot melt**
- **Pressure sensitive (PSA) hot melt**
- **Reactive hot melt**
- **Urethane**

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SureFoam™

- Compact
- Compatible with variety of melters
- Bonding applications
- Up to 44 lb/hour output

FoamMelt®

- Self-contained system
- Excellent foam quality
- Gasketing, sealing, bonding applications
- Up to 50 lb/hour output

Ultra FoamMix™

- Multiple foaming stations capability
- Excellent foam quality
- Gasketing, sealing, bonding applications
- High output, ≥ 50 lb/hour

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Conclusions

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Global Market

- Continued globalization
- Emphasis on new form/function/growth
- Innovation
- Competition

Foaming Benefits

- Increase properties without increasing adhesive amount
- Increase process window without changing adhesive
- Reduce process cost
- Create process alternatives
- Reduce environmental impact

Utilize Foaming to Increase Quality… and Reduce Environmental Impact

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For The Future

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Foam Technology offers a significant opportunity to "Balance" your business model

Global Factors:
- ➔ Material availability
- ➔ Environmental responsibility
- ➔ Sustainability
- ➔ "Green" process

Business objectives:
- ➔ Innovation
- ➔ Growth
- ➔ Cost reduction
- ➔ Competition

Global Business Challenges

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For more information on
Nordson Foaming Solutions,
please contact Nordson Adhesives at
www.nordson.com/hotmelt or 800-683-2314

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