Foam and Foam Tape Provide Versatile Solutions For Design Engineers

An experienced materials converter can help you select the right open or closed cell foam.

From protective packaging to seals and gaskets, foam and foam tape create new design opportunities in acoustics, aerospace, architecture, transportation, packaging, tooling, and modeling, to name just a few applications.

Engineers love foam for its wide range of characteristics and capabilities, yet are often unaware of how versatile this material can be and how best to use it. Working with foam can be difficult – from selecting the right foam material for a specific application to die-cutting foam to meet the design. An experienced materials converter with adhesive expertise, like Fabrico, can help a design engineer make the right decision and deliver the exact part.

What is foam?

Foam is formed by trapping gas bubbles in a liquid or solid – polydisperse gas bubbles separated by draining films. Foams can be gas, liquid, or solid.

Solid foam can be open cell or closed cell. Open cell foam has pores that are connected to each other to form a network which is relatively soft. Open cell foam will fill with whatever surrounds it. Filled with air, it can make a great insulator – as you might typically see in home insulation. Filled with water, its insulation capabilities are reduced.

Bonding, Joining & Sealing

Closed cell foam has no interconnected pores or cells. It has higher compressive strength due to its structure and is generally denser. It is also more expensive to produce than open cell foam. Closed cell foam is well known for its buoyancy and use in flotation devices. With a closed cell structure, the foam has higher dimensional stability, low moisture absorption, and higher strength than open cell foam.

There are many variations of foam — flexible, rigid, reticular, rate-responsive, and syntactic.

Engineers can specify, density, tensile strength, elongation, tear strength, and even thermal conductivity.

Within these two broad categories, there are many variations including flexible, rigid, reticular, rate-responsive, and syntactic – with new types of foam being developed regularly.

- Flexible – bend, flex, or absorb force without damage or delamination
- Rigid – matrix structure with very little or no flexibility; completely sealed it prevents fluid absorption or air penetration
- Reticulated – process performed on foam that removes the window membranes of each cell leaving an intact skeletal structure; gaskets, filters, and acoustical applications
- Rate-responsive – appears to be soft when pressure is applied relatively slowly, firm on impact; very good for cushioning
- Syntactic foam – composite material that consists of rigid microspheres of glass, carbon, or polymers held together by a metal, polymer, or ceramic matrix; lower density, higher strength, good resistance to compression, and a lower coefficient of thermal expansion
- Memory foam – viscoelastic polyurethane, well known for its application in mattresses; responds to heat to become more elastic and pressure-sensitive

Foam Composition and Chemistry

Foams can be made of the following materials: plastics and polymers, metal or metal alloys, ceramics, elastomer/rubber, thermoplastics, and thermoset/crosslinked materials.

The available chemical systems include:

- Polyurethane or PUR resins;
- Plastic or elastomer based silicone;
- Vinyl/PVC;
- Ethylene copolymer;
- Expanded polystyrene;
- Expanded polyethylene;
- Fluoropolymer;
- Latex foam;
- Polyester;
- Natural rubber/sponge;
- Polyether;
- Polyetherimide;
- Polyimide;
- Polyolefin;
- Polypropylene;
- Phenolic;
- Polyisocyanates.

When selecting a foam for an application, engineers can specify:

- Bulk density – the mass per unit area for a material
- Tensile strength – the maximum amount of stress necessary to fail or break the material under tension loading test conditions
- Elongation – the percent amount of deformation occurring during a tensile or other mechanical test
- Tear strength – used to measure the tear resistance of foam rubber, elastomeric foam, or other thin and flexible foam materials
- Noise reduction coefficient (NRC) – given to acoustical foam material indicating the material's ability to absorb noise
- Thermal conductivity – linear heat transfer per unit through a material for a given applied temperature gradient

Foam Tape

The range of capabilities that make foam a design engineering favorite, also apply to foam tapes. Foam tape usually consists of foam with adhesive on one or both sides. Foam tape is available in sheets or rolls of various widths and lengths. Tape can be cut to different sizes, laminated, slit, linered, kiss cut, and die-cut.

Important foam tape physical properties include tack and shear. Tack is measured in pounds per inch of width and gives an indication of how much force is necessary to remove the tape once it has been applied to a surface. Shear is measured in minutes to failure, and tests how strong an adhesive is when it is slid across a surface.

Foam tape adhesives are typically rubber- or acrylic-based. Rubber-based foam tape adhesives have high tack values, lower shear values, are inert (the bond doesn't get stronger over time), are not recommended for UV exposure, do not perform well on plasticized (low surface energy) surfaces, and are often lower cost.

Acrylic-based adhesives have a lower tack value, high shear value, bond strength increases over time, work well in extended UV exposure, perform well on plasticized surfaces, and are typically more expensive.

The Right Converter

The right converter can help a design engineer select the most appropriate foam or foam tape to use for the particular design and application, select the appropriate material and adhesive, identify the best source for the materials, and select the most appropriate and cost-efficient fabrication process to create the finished part.

At Fabrico, we offer design assistance, including determining part configuration, producing prototypes, setting up short or long production runs, delivering quality control, and ensuring that the finished part is easily integrated into the assembly process.

Fabrication for foam and foam tape might include:

- Laminating – films, foils, tapes, or other foams
- Flame-laminating – to add film, fabrics, and barrier materials to foam without adhesives
- CNC machining – create complex cavities with closed cell foams
- Water jet cutting – perfect for cutting all types of rigid materials following computer-generated patterns for complex shapes
- Die-cutting – almost all types of foam can be die-cut; laser die-cutting capabilities allow converters to cut both adhesive and non-adhesive foams to tolerances of +/-0.005"
- Kiss-cutting – pieces cut to size and rolled up on a non-stick liner
- Thermoforming – use heat to form foam into designs
- Slitting – foam and foam tapes precisely slit to very thin widths

Auto Logos

A company serving the automotive manufacturing market needed help in bonding pieces of trim to the outside of vehicles and affixing a variety of different manufacturers' logos. The customer needed a foam and adhesive that could withstand high and low temperatures, was weather and UV resistant, would form a strong and durable bond to painted surfaces, and could be die-cut to match a logo exactly. With our broad range of materials and adhesive suppliers, we were able to recommend two alternatives that worked.

Irrigation Controls

In this application the customer produces irrigation systems. These systems presented two challenges: the first involved protection for an antenna used to communicate with a system controller; the second involved a protective case for a handheld tester used by service personnel.

The miniature transmission antenna is used to communicate with controllers that run the irrigation system. Covered by a plastic dome, the antenna sits atop a metal housing in an outdoor environment. The dome has a 6" by 2" oval footprint and is 4" high. The foam was required to seal the unit. By selecting a UV resistant neoprene blend, Fabrico kept out moisture without the foam becoming brittle in sunlight.

Foam can be die-cut or cut using a water jet system.

In addition to foam, foam tape consists of foam with adhesive on both sides.

The dome was attached to the housing with four screws. By making a print of the dome – including the screw holes, Fabrico was able to die-cut 1/8" double coated neoprene foam tape.

In the second application, the customer was looking for a case with protective foam for an expensive handdheld tester. Working with EIS, Fabrico's parent company, a case and foam inserts were developed. The customer provided the five separate pieces that make up the tester. Fabrico was able to specify an inexpensive 3.5" thick foam. Unlike the tape used with the dome, this foam could not be die-cut. Instead, Fabrico's water jet cutting system was used to cut the foam and the custom cavity for each tester piece.

Protecting Communication Boards

One communications company needed to protect their communication circuit boards during shipment. Fabrico needed an anti-static packaging foam that could be slit with the water jet to accommodate the boards. A foam was selected with static dissipation qualities that held the circuit boards snugly.

Meeting military specifications

One government contractor needed to provide helmets and respiratory products for military use. All specifications were provided and Fabrico selected foam from 1.5" down to. 125" thick. All parts were well within range for our die-cut capabilities. In addition to the protective and filtration uses of foam in this application, often applications include filtration materials, flexible plastic, carbon fiber resins, and additional foams.

Material Suppliers

Fabrico has strategic relationships with world-class materials suppliers, such as 3M, Saint-Gobain Performance Plastics, Pregis, and Rubberlite, to assist its customers in selecting the best material for the intended use and to expedite materials sourcing. Whether adhesive films or liquids, all critical material properties are considered in any Fabrico project, including chemical, thermal, and moisture resistance.

With more than 30 years of materials experience, Fabrico engineers also understand the impact of a material selection on the overall manufacturing process, and design material systems that optimize production efficiency and improve overall cost-effectiveness.

3M Preferred Converter

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