

IN•TOUCH®

INFORMATION ON FLEXIBLE POLYURETHANE FOAM

IN•TOUCH® is a regular publication of the Polyurethane Foam Association (PFA). It covers topics of interest to users of flexible polyurethane foam and is designed as a quick reference for background information on key issues. To get more detailed information about a particular topic, consult a PFA member.

Latex Foam Rubber and FPF: Different Product Technologies With the Same Comfort Objectives

Journals documenting Charles Goodyear's invention of the vulcanization process for rubber in 1839 referenced many of the product uses he envisioned for this new, durable, elastic material. Goodyear's list of possible applications suggested the idea of chairs and mattresses made of rubber. Long after his death, his dream was fulfilled.

Today, nearly every chair and mattress sold in the United States contains a great deal of flexible foam cushioning with rubber-like qualities. While flexible polyurethane foam (FPF) by far holds the greatest share of the foam cushioning market in home furnishings, latex foam rubber also occupies an important niche among premium-priced products. And, while both FPF and latex foam rubber serve the same comfort, support and durability objectives, they are very different from one another in composition, production technology and have distinct performance attributes.

The purpose of this issue of IN•TOUCH® is to help end-users of flexible foam products differentiate the chemical make-up, production methods and physical performance attributes of FPF and latex foam rubber.

What is Latex Foam Rubber?

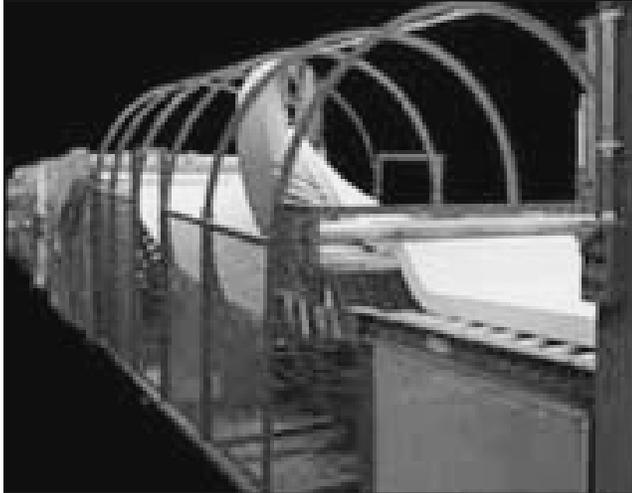
Latex is NOT flexible polyurethane foam. In its natural form, latex is a milky white liquid tapped from the trunks of rubber trees (*hevea brasiliensis*) and then combined with water to create a thick suspension.



Filling a Talalay mold with latex suspension

In manufacturing natural latex foam rubber, the latex suspension is whipped to a froth and poured into carousel molds, onto a conveyor, or into sheets (for sponge rubber carpet cushion), sometimes additionally frothed using CO₂ gas, chilled to below freezing, and then heated to the point of vulcanization (about 240° F). During vulcanization, molecular crosslinks are formed giving the resulting foam rubber the ability to recover its shape after compression.

Traditionally, vulcanization is effected by heating the frothed latex suspension while exposing it to elemental sulfur, one or more organic accelerators, a metal oxide (ZnO) and an organic acid (stearic acid). There are many different processing formulations to accommodate different rubber and synthetic rubber blends and there are two different mechanical processing technologies used today. The Dunlop method and the Talalay mechanical process account for all latex foam rubber used in home furnishings products.



Production of latex foam rubber using the Dunlop continuous process

What is Synthetic Latex Foam Rubber?

Synthetic latex foam rubber is NOT flexible polyurethane foam. To use the terms “foam rubber” and “polyurethane foam” interchangeably is an injustice to both cushioning products. Synthetic latex foam rubber represents a group of materials manufactured using methods similar to natural latex foam rubber on the same processing equipment. Synthetic latex foam rubber can be the product of natural rubber suspension and rubber substitute blends, or it can be produced using a totally synthetic process such as used to produce styrene-butadiene rubber (SBR) and polymerized chloroprene, known as neoprene, introduced by DuPont in 1932. There is no polyurethane content in natural or synthetic foam rubber and, conversely, no natural or synthetic rubber content in FPF.

Today’s synthetic foam rubber can provide many of the physical performance characteristics of natural foam rubber, with more attractive economics. Certain performance attributes can result from the chemical properties of synthetic rubber products. In the case of neoprene, the resulting cushioning product is known for its high degree of fire retardancy. Just as with FPF, latex foam rubber (natural or synthetic) combustion performance can be effected by fire retardant (FR) additives. With FR additives, latex foam rubber cushioning has the ability to meet existing FR requirements for residential, commercial and high risk occupancy applications.

The Economics of Rubber

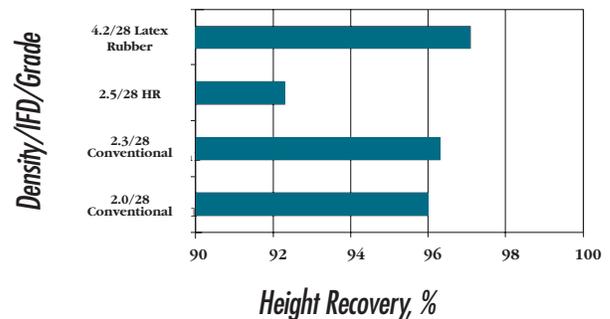
Rubber production is big business. Dozens of industries worldwide, producing hundreds of different consumer and industrial products, drive the demand for rubber. And natural rubber is an expensive commodity compared to rubber substitutes. The efficiency of the vulcanization process also provides an opportunity to improve production economics.

Unfilled vulcanized rubber has superb tear and elongation strength characteristics. In some cases inorganic fillers may be added. In applications, such as for sponge rubber carpet cushion, filler concentration may approach 75% of the final weight of the product. But, just as in FPF, less filler generally results in better performing products.

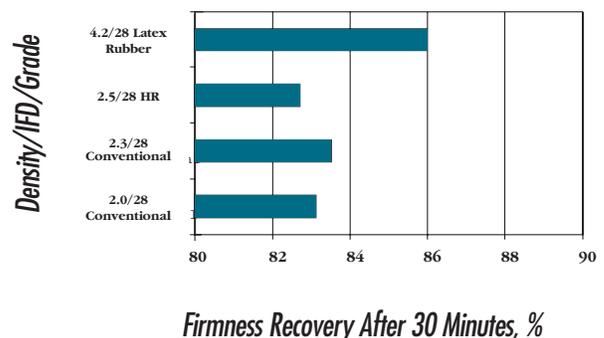
How Well Does Latex Foam Rubber Cushioning Perform?

Using ASTM testing standards, a number of performance evaluations have been made to compare commercial samples of unfilled latex foam rubber to various grades of FPF. It is not surprising that in most cases latex foam rubber surpassed the physical capabilities of FPF samples. After all, quality latex foam rubber is considered by many experts to be the ultimate high performance cushioning material. Of course, density plays an important role in rubber’s physical performance capabilities. Latex density typically runs 4 pounds per cubic foot and higher. And while premium performance can be achieved with latex, it is accomplished at a premium price.

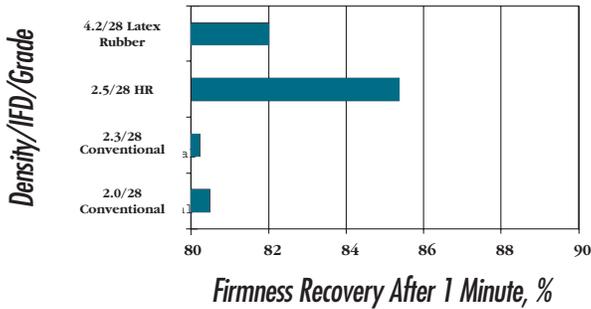
Dry Compression Set



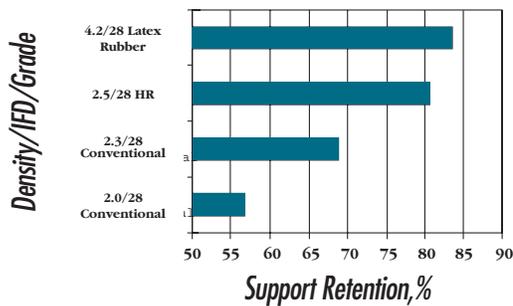
Static Fatigue Resistance



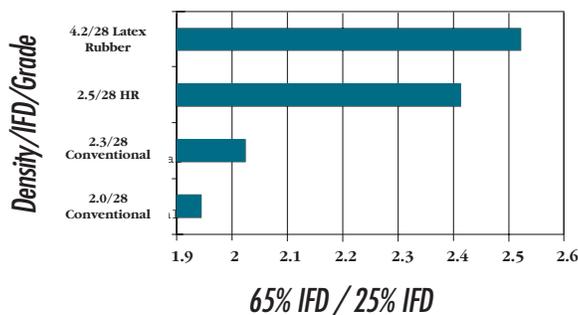
25% IFD Recovery



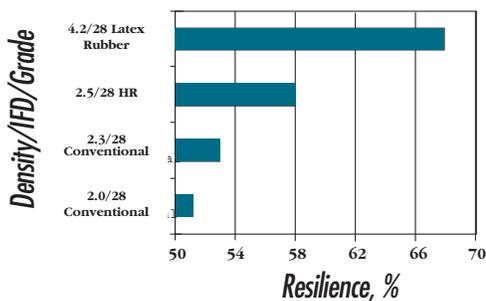
Dynamic Fatigue Resistance by Roller Shear



Support Factor



Surface Liveliness



Data presented at the Polyurethanes World Congress, September 1991, Nice, France.

Latex Foam Rubber and the Environment

Although no unusual environmental issues are associated with the manufacture of all types of latex foam rubber, like most industrial processes, care must be taken with disposal of waste water accumulated from the washing of molded latex foam parts. Latex parts may contain soaps and trace amounts of zinc from the vulcanization process that are released through multiple washings and must be monitored and controlled.

Latex Foam Rubber Recycling

Like FPF, latex foam rubber recovered as manufacturing scrap or recovered from post consumer use can be chopped and utilized when mixed with polyurethane scrap, as bonded carpet cushion. Latex foam rubber generally has a relatively high density and is soft, thus latex foam rubber can only be used in limited amounts in the production of bonded carpet cushion.

About Latex Allergy

There have been reports of individuals experiencing allergenic reactions attributed to exposure to natural latex products. For the most part, these cases allegedly involve dermatological contact with latex gloves, clothing or bed covers. According to companies involved in the production of latex foam products for cushioning applications, the vast majority of these cases are dermatitis related and occur primarily with people in the medical industry who wear natural latex gloves as protection over a long period of time.

Natural proteins from the rubber tree have been attributed by health professionals as the primary cause of allergic reactions. Some companies advise that if an individual is known to have allergies to plant antigens, they should avoid contact with natural latex based products. Synthetic latex does not contain natural proteins that can cause an allergic reaction and so synthetic rubber products provide options for individuals having concerns about exposure to natural latex.

Summary

While flexible polyurethane foam (FPF) is not in any way related to latex foam rubber, and vice versa, both product technologies can provide high levels of comfort, support and durability in home furnishings cushioning and carpet cushion applications.

The following summarizes latex foam rubber technology and performance capabilities:

- ▶ 1. Latex foam rubber in home furnishings applications can be natural rubber, synthetic rubber, or a blend of the two.
- ▶ 2. Latex foam rubber derives its physical performance properties from the vulcanization process that creates long molecular chains with strong crosslinked bonds.
- ▶ 3. The use of filler materials in latex foam rubber does not improve most physical performance attributes.
- ▶ 4. Physical testing results indicate that quality latex foam rubber is capable of exceeding the physical performance of flexible polyurethane foam, however the density and cost of latex foam rubber is also much higher.
- ▶ 5. With the use of FR additives, natural latex foam rubber products are capable of meeting flammability requirements for residential, commercial and high-risk occupancy applications.
- ▶ 6. Chloroprene (neoprene) synthetic latex products are inherently highly resistant to ignition, however FR additives are still required to meet combustibility requirements for high-risk applications.
- ▶ 7. As is the case with FPF, natural and synthetic foam rubber scrap is recyclable and can be used in limited amounts in the production of bonded carpet cushion.
- ▶ 8. Although it would be unusual for an individual sensitive to natural latex to come into direct physical contact with the core material of a foam rubber cushion, synthetic latex provides an option.

This information is provided as a service of the Polyurethane Foam Association to improve the understanding of key issues that affect flexible polyurethane foam cushioning. To learn more about specific foams, contact your foam supplier.

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