

Physically Cross-linked Polyethylene Foam "SlimAce"

1. INTRODUCTION

Cross-linked polyethylene foams commercially available can be classified into two types according to their production method: chemical cross-linking and physical cross-linking. Furukawa Electric produces a chemically cross-linked polyethylene foam by the trade name of "FoamAce" since the company began the production for the first time in the world. While the foam of each type has its own advantages thus finding suitable applications, Furukawa Electric has recently developed a physically cross-linked polyethylene foam named "SlimAce" in an effort to increase its domestic market share as well as to improve the properties of FoamAce. Now we can produce two types of cross-linked polyethylene foam, making this our strong point.

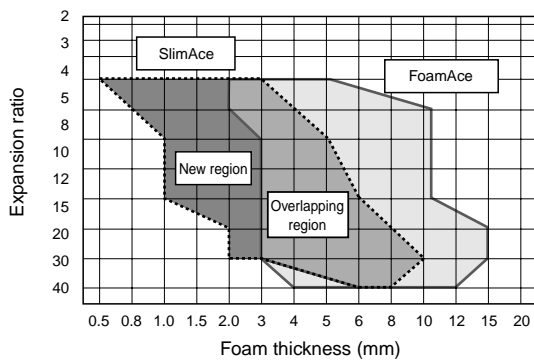


Figure 1 Production range of SlimAce and FoamAce.

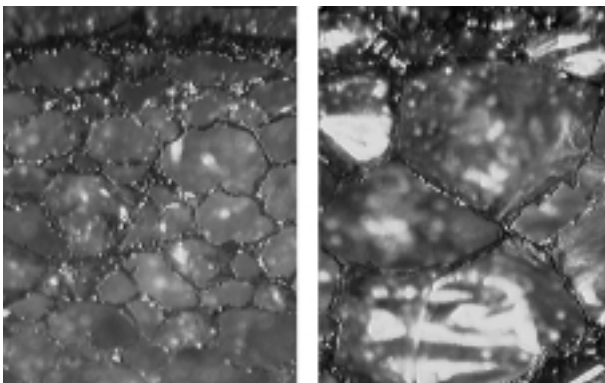


Figure 2 Cell structure of SlimAce and FoamAce (150 magnification) Left: SlimAce Right: FoamAce

2. FEATURES OF SLIMACE

Figure 1 shows the production range of FoamAce and SlimAce represented by the expansion ratio and thickness. FoamAce can produce thick products having a maximum thickness of 15 mm taking advantage of chemical cross-linking, but the minimum thicknesses are 3 mm and 2 mm for the high-expansion and low-expansion products, respectively. In contrast, SlimAce can produce thin foams such as 2 mm thick products for 30 times expansion ratio, 1 mm for 10 times and 0.5 mm for 5 times, variety of which allowing development of new products. In the production range where they overlap with each other, they permit diversification of products' properties.

One of the typical features of SlimAce is miniaturization of its cell structure. As can be seen in the magnified view of cells shown in Figure 2, cells near the surface are miniaturized improving surface smoothness as well as surface appearance. At the same time, the cell membrane and skin layer become thin, decreasing the stiffness of entire foam body and increasing the flexibility. Thus SlimAce improves in appearance, texture and soft feeling compared with FoamAce.

3. PROPERTIES OF SLIMACE

Table 1 shows the physical properties of SlimAce products. We have developed five types of standard grade: R-, K-, Z-, I- and J-grade as well as three types of special grade: flame retardant P-grade using halogen-free flame retarding agents, semiconductive D-grade and antistatic C-grade. Among these, the Z-, I- and J-grade are intended for property diversification and entry to new markets together with the R- and K-grade for property improvements in the existing market whereby replacing FoamAce.

Standard type

R-grade: Standard grade (Fine cell structure and smooth surface)

K-grade: Soft grade

Z-grade: Thin, high-strength grade

I-grade: Thin, high-strength, soft grade

J-grade: Thin, high-elasticity grade

Special type

P-grade: Flame retardant grade (Equivalent to UL94 HBF)

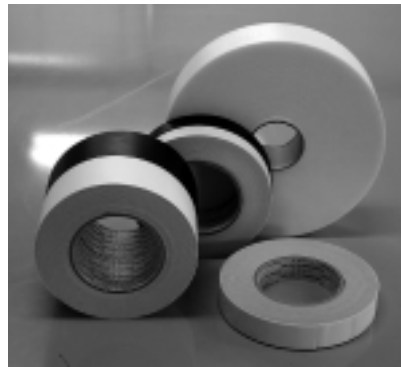
Table 1 Physical properties of SlimAce products.

Grade		R		Z		I		J	
		(Standard)		(High strength)		(High strength, flexibility)		(High elasticity)	
Item	Unit								
Expansion ratio	times	15	30	10	15	10	15	10	
Thickness	mm	3	2	1	1	1	1	1	
Density	kg/m ³	67	33	90	67	90	67	90	
Tensile strength	kPa	MD	1,210	440	1,790	1,470	1,700	1,240	1,560
		TD	580	230	850	580	980	650	930
Tear strength	N/cm	MD	27	13	49	34	52	38	47
		TD	46	21	68	54	54	50	45
Elongation	%	MD	210	190	220	170	420	320	560
		TD	210	150	220	230	420	290	500
Compression strength 25%	kPa	39	22	37	32	34	29	32	
Dimensional change 70°C X 22 hr	%	MD	-2.2	-1.5	-2.5	-3.1	-3.3	-1.4	-3.4
		TD	-0.9	-0.9	+0.5	+0.2	-0.3	-0.6	-0.4
Heat conductivity at 25°C	W/m · K	0.039	0.032	0.037	0.035	0.038	0.035	0.039	

Test methods are in compliance with JIS K 6767-1995



a) Flooring material



b) Substrate for adhesive tape



c) Airtight feedthrough

Figure 3 Applications of SlimAce.

D-grade: Semiconductive grade (Volume resistivity: $10^7\Omega$ or more)

C-grade: Antistatic grade (Surface resistivity: $10^{13}\Omega$ or more)

4. APPLICATIONS OF SLIMACE

SlimAce has a broad array of applications including architectural material for floor and wall (Figure 3a), thermo-insulating and waterproof sheet for roofs, cushioning and packaging material, various gaskets, substrate for adhesive tapes (Figure 3b), airtight component for houses (Figure 3c) in addition to general merchandise taking advantage of its smooth surface.

In the area of flooring material, SlimAce is laminated with other surface layers made of PVC or olefins, to be used as a sound-absorbing and cushioning material. The success of the products has been achieved by the ease of lamination due to the upgraded surface smoothness together with the improved flexibility.

In the case of tape material, SlimAce of small thickness is used as a substrate material to improve the adhesive performance of tapes by pressing effects, through the advantageous use of its high cushioning property, surface smoothness and high precision in thickness.

In the field of housing material, SlimAce is used at feedthroughs of highly airtight and thermo-insulating housings that are promoted under the Law for Promotion of Effective Use of Resources. Bonded or molded SlimAce products are used to fill the clearance between the wall and the penetrating pipes such as water supply. SlimAce is suitable for such uses because of its low transmission coefficient for water vapor in addition to its softness.

5. IN CONCLUSION

We have been successful in establishing two production systems for different types of polyethylene foams, thereby taking an advantageous business position over our competitors. Now we can make a proper selection from our

products to meet the customers' requirements. We hope we will be able to achieve customers satisfaction thus finding an opportunity for developing new products.

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