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New Solutions for the Trim of Automotive Vehicles

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DYNAMIT NOBEL was the first European company to manufacture cross linked polyethylene foam by the Furukawa method as of the end of 1972. Market research showed the motor car industry to be the best potential market for this type of material. Dynamit Nobel therefore concentrated its research activities particularly in this sector. Since mid 1973, specific subjects have been developed in cooperation with leading European motor car manufacturers.

The aim of these developments was to arrive at new components which would have the advantage of being inexpensive, lighter and more comfortable than conventional parts.

The favorable characteristics of this new foam are its thermoformability, resistance to chemical agents and rotting, and its variability in regard to density and hardness when laminated to textiles, other plastics and metal. These features have permitted the development of new components, some of which have already gone into production, while others are still in the testing stage.

The following areas of interest will be discussed in this paper:

1. Interior Trim
1.1 Roof Lining
1.2 Floor Coverings
1.3 Seats
1.4 Partition between Interior and Trunk
2. Trunk
3. Hood

1. INTERIOR TRIM

In addition to minor applications of PE foam such as profiles, stamped gaskets, seals, and insulations which are already mass produced, there are a number of applications in interior trim which will be described below.

1.1 ROOF LINING - The conventional types of roof lining made of artificial leather insulating material and metal supports require a considerable amount of labor at the assembly line.

Motor car manufacturers are looking for ways to reduce assembly time. Two approaches are under discussion or even partly in practical use:

Snap-in roof lining
Prefabricated lining glued to the roof.

The conventional snap-in linings in use are made of resin bonded fibers and are comparatively heavy.

We have developed two distinct types of lining:

ABSTRACT

Based on the merits of cross linked polyethylene foam, i.e. good thermoformability, low weight, strength, and laminability to other materials, Dynamit Nobel has developed new techniques and components for the trim in automotive vehicles.

We have described trim parts such as roof linings, floor coverings, seats, trunk lining, and hood lining which are either being tested or already installed on standard models. They offer advantages over traditional components with regard to weight, comfort and price.

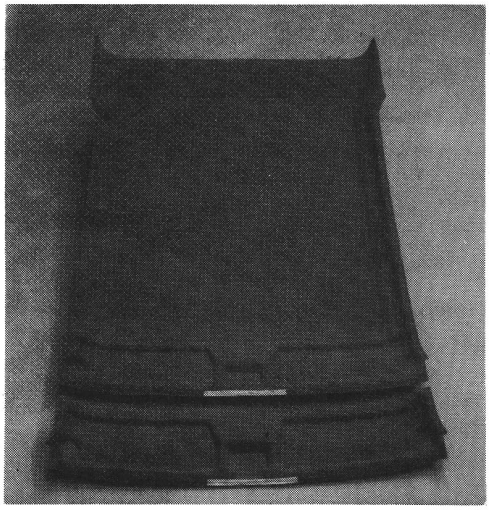

Fig.1 -Snap-in roof lining

1.1A Snap-In Lining - already installed in test vehicles (Fig. 1). It is a sandwich consisting of:

A support material (e.g. metal or rigid PE foam),

A cushioning (PE foam),

A surface finish (PVC film or textile).

The polyethylene is used to give the compound its shape and enables motor car manufacturers to design roof linings with integral sun visors or hardware which can be adapted quickly and economically to a deluxe model using relatively inexpensive tooling. This type of lining is more expensive than the conventional type of artificial leather and metal frame but lighter than linings made of resin bonded fibers.

1.1B Adhesive Roof Lining made of PE foam with decorative finish (film or textile) Fig. 2).

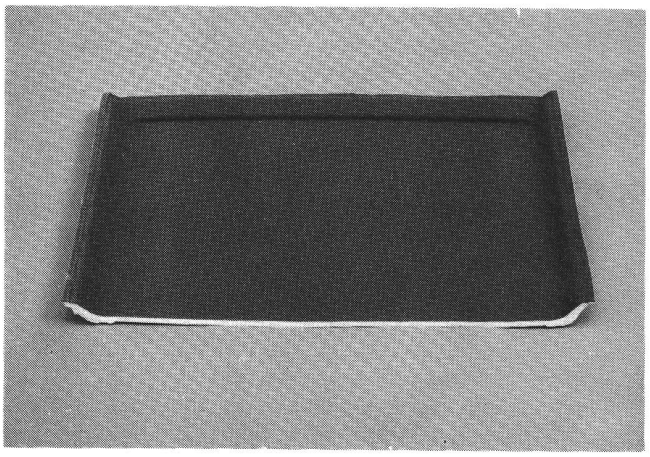

Fig.2 -Adhesive roof lining

In its simplest form, it consists of a flat PE foam sheet with an ornamental PVC film finish. The lining is perforated to facilitate its gluing to the roof. On the assembly line one man can adapt it to the shape of the roof and make the installation. Suitable glues are already on the market. About 1,500 test cars equipped with such roof linings are on the roads at the moment. This type of roof lining, including installation labor is less expensive than the conventional type and weighs about 50% less, i.e. about 710 g instead of 1520 g, and it gives about 20 mm more head clearance.

an optically improved version of this lining using a polyamide fiber jersey finish is being developed. It is a thermoformed PE sheet glued in with the same type of adhesive.

The advantages are lower weight and more head room. It will cost about the same as traditional types, but improve the appearance of the interior.

1.2 FLOOR COVERINGS - The majority of European motor car manufacturers use thermoformed carpets or rubber mats for the car floors. Wadding and bituminous layers are used for sound proofing. The carpets are impregnated with polyethylene on the reverse side. That impregnation is rigid and often causes the carpet to bulge.

Rubber mats provide very little foot comfort.

Waddings easily absorb water. The precut sound proofing material is not easy to apply and frequently extra time is needed to remedy faulty fitting.

The development of new methods comprised several stages:

The first step consisted of a combination of the traditional tufted carpet with PE foam, using a reduced amount of PE impregnation. The reasons for this were better adaptation to the contours of the car floor, better appearance, more comfort, a lesser risk of rotting than with wadding, good thermal and - to some extent - sound insulation.

Today, fully or partly PE foam backed carpets are used by Ford, British Leyland, Jaguar and others. Daimler Benz and VW have adopted PE foam insulation which is separately inserted under carpet (Fig. 3).

In addition, two new approaches were made:

Low priced, lightweight floor coverings for the standard models,

More comfortable floor coverings as a complete package of carpet and sound proofing.

Both versions are undergoing field tests.

The Lightweight Type will replace rubber mats and tufted carpets in the standard models.

Thermoformed floor coverings of about 6 mm PE foam, density 50 kg/m^3, with a film finish are being field tested, the laboratory tests having been positive. These new coverings have a mat finish and offer practically

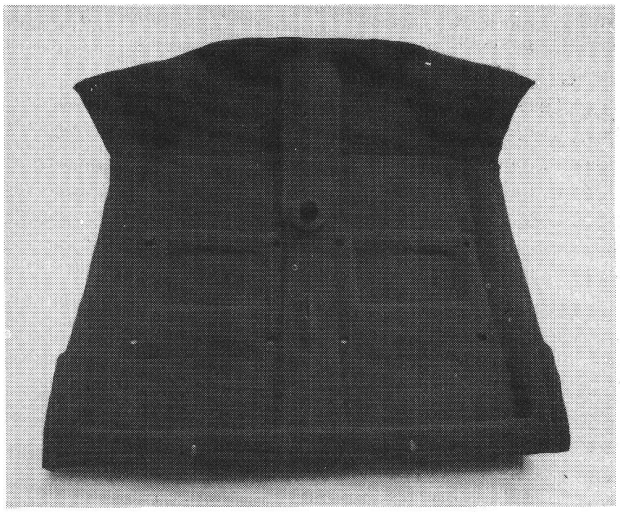

Fig.3 -PE foam-backed carpet

unlimited variations. The sheets are thermoformed in a vacuum press and result in a weight saving of 60 to 70% (the weight is 2 to 3 kg compared to about 8 kg for a conventional rubber mat).

Floor coverings made from non-woven type carpets flame laminated to PE foam and thermoformed in special presses not only provide appealing designs but also better comfort. Depending on the type of non-woven material used, they are lighter than conventional tufted carpets.

The More Comfortable Floor Covering consists of PE foam (sometimes combined with PU foam), a heavy layer and the carpet. The heavy course is either extruded and then laminated to the carpet or directly applied to the carpet. The PE foam is laminated to the heavy layer. The latter weighs about 5 to 8 kg/m^2. The entire compound is thermoformed in one operation on a special press. The floor covering is fitted in either one or two parts (front and rear part of car).

Installation and storage costs are lower than for conventional materials. They can be fitted easier and more efficiently than the conventional carpetings. Although the cost of the material may be about equal, the lower handling cost is bound to reduce the total cost of the floor covering.

1.3 SEATS - The manufacture of seat covers still requires a considerable amount of labor (sewing, welding, fitting). New techniques make it possible to reduce these costs to a minimum.

The textile industry has developed fabrics which stretch easily and are thus suitable for thermoforming extreme shapes. On vacuum presses, these fabrics, flame laminated to about 3 mm thick PE foam, can be thermoformed into seat covers. Depending on the shape of these covers, the cushioning can be formed during the same operation to produce the complete seat. Such seats have successfully passed the laboratory tests of motor car manufacturers.

The development of this type is not yet completed as a few problems are yet to be overcome: air permeability, the correct grade of harness, etc.

1.4 PARTITION BETWEEN INTERIOR AND TRUNK - Some car models do not have a steel partition between passenger compartment and trunk but a combination of cardboard or laminates, wadding and leatherette covers. Installation entails a great amount of labor.

A PE foam sheet, 6 mm thick and of 30 kg/m^3 density, thermoformed on a vacuum press can replace all these components (Fig. 4). Proposals for such parts have been submitted to a number of motor car manufacturers. At this time, price comparison is not yet completed.

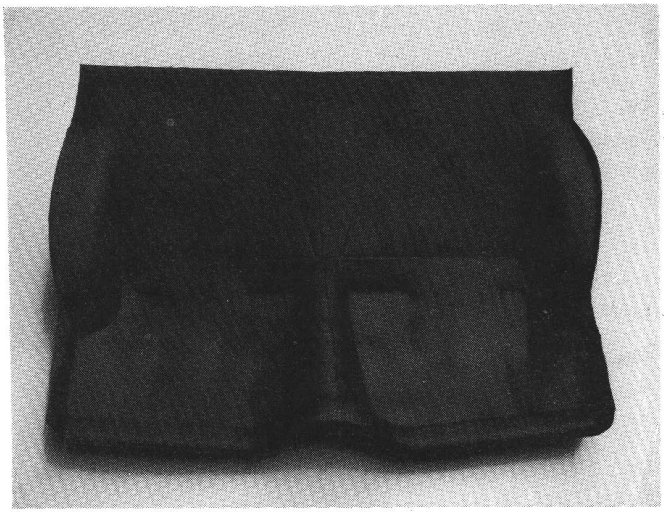

Fig.4 -Partition wall

2. TRUNK

Trunk trim comprises: floor covering, trimming of the sides.

Dynamit Nobel started by concentrating its efforts on the trunk mat. In view of PE foam's excellent thermoformability, it is highly suitable for trunk mats of cars with intricately shaped trunks (Fig. 5). So far, such trunks are equipped mainly with rubber mats. After extensive laboratory and field tests with trunk mats of PE foam, 4 mm thick, 100 kg/m^3 density, produced on a new vacuum press, Ford Europe has decided to adopt these mats on standard models beginning in 1976. These were the decisive factors:

Weight saving compared with the traditional rubber mat, about 3 kg per car (a PE foam mat weighs about 0.5 kg),

Better styling,

Odorless,

Lower cost.

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