

Vacuum formable nylon sheets

NYLONS AND
ACETALS

by Norbert Hendel

A new sheet material made of fiberglass reinforced, modified nylon enables parts to be vacuum formed, allowing new solutions in applications calling for wall thicknesses and sizes not previously possible by injection molding. The mechanical stiffness of this material permits the design of light, thin-walled parts with good rigidity.

Prior to introduction of this new material, vacuum forming of nylon parts from sheet was not an option. Parts were typically machined from extruded sheet. Now, for the first time, the advantages of fiberglass reinforced nylons may now be applied to vacuum formed, finished parts.

The basic material was developed in cooperation with Bayer AG, Germany, and

is a further development of ramified special materials which have been used successfully in the automotive industry (e.g., suction tubes). Modification finally resulted in a raw material which is especially suitable for the calender extrusion of vacuum formable sheets. The color black was chosen for production of the initial run. In cooperation with the company Illig, as well as other well-known German manufacturers of vacuum forming equipment, the necessary parameters for thermoforming were determined.

In September of 2002, a seminar was held at the Illig facility, announcing the new material and informing about the manifold possibilities of this product and the positive experiences gathered from all initial testing. The mechanical properties as well as easy processing capabilities of this material were confirmed by all tests.

Substitution of metals is possible

The vacuum formable sheet material offers the typical characteristics of fiberglass reinforced nylon: high strength, high stiffness, low specific weight, long term application temperature (140°C, 284°F), and chemical resistance to all common oils, fatty substances and fuels.

The integration of an impact modifier

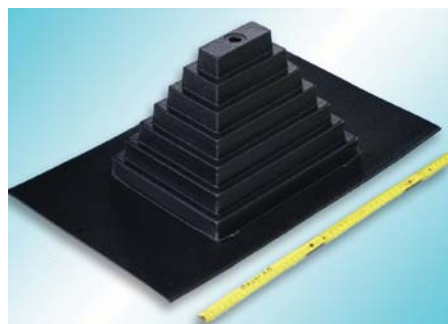
provides improved resistance to rupture when compared with conventional reinforced nylons, and also allows application under rough mechanical conditions and low temperatures. Not only is the continuous working temperature of 140°C significant, but this material can withstand temperature peaks of 170°C, 338°F. These characteristics could not be assigned to any other vacuum formable materials in the past. In addition to high continuous and peak temperature limits, there are additional advantages over alternative materials, opening the gate to completely new applications.

A high degree of stiffness allows for a remarkable reduction in the wall thickness of the material in comparison to other vacuum formable sheet products. This is an especially important factor in the automobile industry, where weight reduction is a priority.

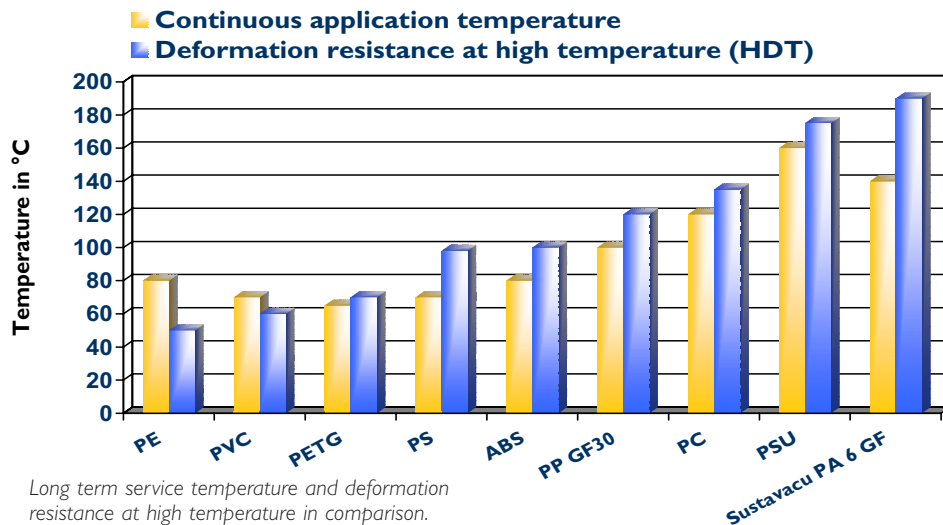
Besides engine compartment components, such as housings and components for noise reduction, the newly developed vacuum formable nylon type is also suitable for side linings of trucks or floor coverings and fenders. Other possible applications will certainly be found in the field of transport containers, and all kinds of covers and coatings.



Even wall thickness of the vacuum formable nylon sheet was maintained at an extreme expansion ratio of five.



Seven step pyramid made of Sustavacu vacuum formable nylon produced by Sustaplast KG in Lahnstein, Germany.

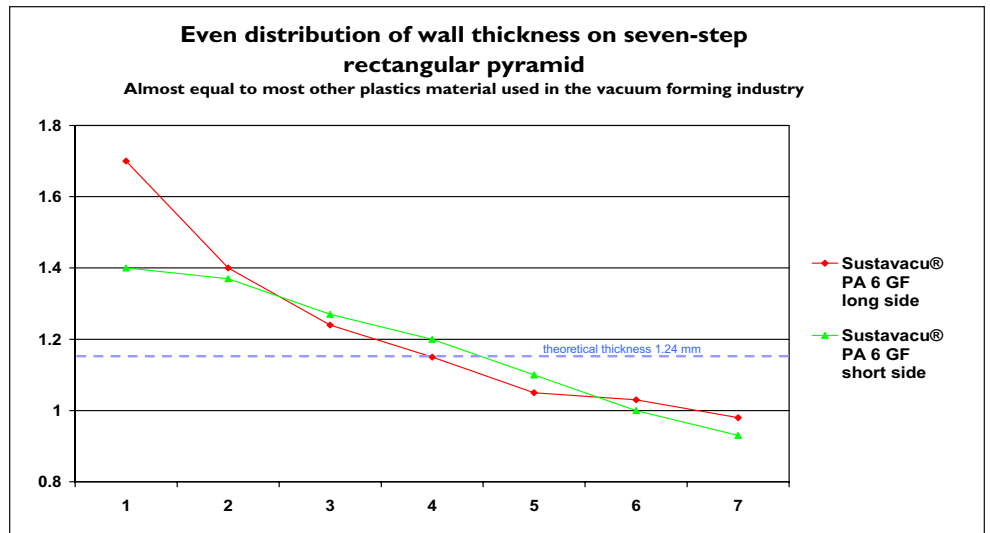


Wall thickness distribution was tested on various formed parts. These tests clearly proved that sheets made of this new vacuum formable nylon expand very evenly at high expansion rates. Even at the extreme draw ratio of 5, an even wall thickness was maintained on the top of the part. In general, the vacuum formability is equal to most other plastics materials commonly used in the vacuum forming industry. Like most nylon materials, the sheet material is hygroscopic. The sheets, like other thermoplastic materials (especially polycarbonate) must be dried prior to vacuum forming. From previous experience, it is recommended that the drying process be carried out at 110°C, 230°F. The drying period should be at least 1/2 hour per mm of material thickness.

The shrinkage of the material presents an important factor in construction. When the material cools down on the tool after the deformation process, a change of dimension takes place in relation to the tool size. This change must be anticipated.

The following values were established on sheets:

- Shrinkage in length (in the direction of the fibers): 0.2 - 0.4 percent.
- Transverse shrinkage (in direction perpendicular to the fiber): 1.3 - 2.1 percent.



These values should be understood as guidelines and should be taken into consideration for the construction of the tool. It should be emphasized that shrinkage is not just a typical characteristic of the material but also depends on the shape of the tool, the evenness of the thickness of the part, the temperature of the tool, the vacuum forming conditions and the deforming temperature.

Other positive results were also real-

ized in downstream work processes such as machining (drilling, sawing, milling) and laser cutting. Even varnishing and printing upon the finished parts are possible. These sheets offer distributors new solutions in demanding applications. ■

Norbert Hendel is innovation – market development manager of Sustaplast KG. For more details, contact Sustaplast KG, Sustaplast-Strasse 1, 56112 Lahnstein, Germany, +(49) 2621-693-0, fax +(49) 2621-693-125, e-mail: nhendel@sustaplast.de, www.sustaplast.de.