SeatComfort
creation of solution

VAN DE WIELE
CARPET AND VELVET WEAVING MACHINES

Ernst J. Hauer

Comfort in Car Seats

a new material offers
hydrothermal comfort
in car seats

Hydrothermal Comfort in Car Seats

SeatComfort SarL in Cooperation with Van de Wiele has developed a pressure resistant 3-D woven product as base for any seat application. The open structure allows unforced venting which gives hydrothermal comfort.

A good seat climate means that the humidity of the passenger transpirations is released, vented without any arrier from the contact area. The presently predominantly used seat materials prevent a seat comfort climate.

Car Seats

The car seat is the component with the largest contact area between the passenger and the car and should receive large attention.

Some of the requirements are:

- Ergonomically adapted to the passenger, with orthopedic fitting for the scull
- Safety in crash situations
- Hydrothermal comfort for the thermoregulation of the passenger
- Aesthetic appearance

Passengers are attached by the seat belt, pushed on to materials that do not breathe. The predominantly used materials produce bad hydrothermal conditions. After a short time it makes them feel uncomfortable.

Thermoregulation of the Seated Passengers a Hydrothermal Challenge

The standard foam has a very high water vapor resistance. In the contact area between passenger and seat, the temperature raises up to 32°C and 85 % rH within 20 minutes. The foam blocks any humidity absorption. The consequences are that hydrothermal comfort is lost.

Seat Conditions in the contact after 20": The humidity and temperature are far out of the comfort zone, the humidity release is blocked by the foam.

The trim has very limited capacity for sweat absorption, particularly among the dominantly used hydrophobic trim materials. The maximum absorption of the trim is 10g/m², compared with the body's sweat production of ± 120g/m². Leaving the vehicle, the driver has to vent and relive the humidity of their clothes, causing cooling and chilling due to the drying effect.

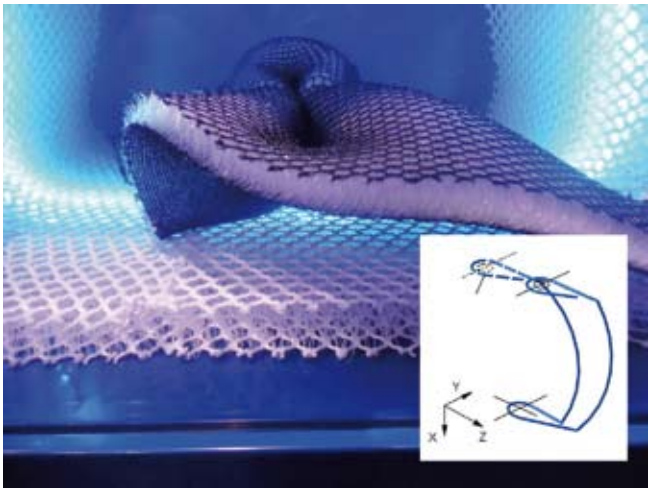
Hydrothermal Comfort means; a minimum thermo regulating effort to maintain constant body conditions. The heat and sweat flow should not be hindered in any way. The climatic exchange should not be noticeable, rather prompting a high degree of unconscious comfort feeling.

Climate Seats are offered in mid- and upper-range cars. The wet air from the skin/seat interfaces is sucked by vans through the trim via an open 3D-kitted fabric and vents the passenger seat in the contact areas. Distribution channels under the 3D-knitted fabric guide the air to the vans. Multiple material layers and cable work for power and control requires a significant effort, with consequences including a heavier weight, more space and more energy preventing its widespread use in lower-range cars. All these efforts are counterproductive for lower cost and space saving seats.

Materials with Low Water-Vapor-Resistance

Knitted 3D spacer fabrics have a top and bottom layer knit which are kept apart by interlaced pile fibers. Knitted fabrics provide an elastic and soft structure. The 3D-knitted fabrics are currently the only functional materials for venting layers underneath the trim. These layers have a low water-vapor resistance and permit a high airflow, whereby the passenger sweating can pass for venting.

The maximum size of the pole fibers used in this process is 950 den ~0,3 mm. The long-term durability of the 3D-knitted fabric is limited by the technical restriction of the knitting process, the pile fiber size and the bent and twisted position in the 3 D interface, which prevents a higher pressure stability and durability.



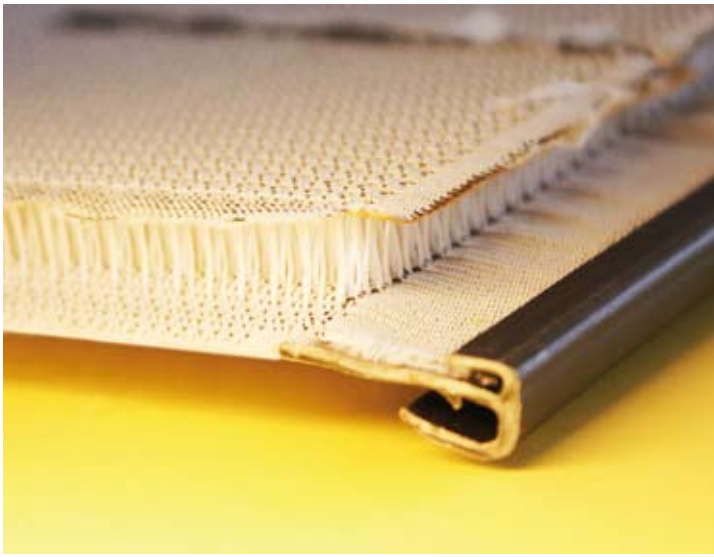
3D- Knitted Fabric with pile fiber threat line showing the bent position of the pile fibers between fabric faces.

Woven 3D spacer fabrics are also built by two outer layers. The woven layers are connected with the pile fibers, perpendicular to the top and bottom layers. The difference with the knitted fabric is that the pile is in one plane. The fibers are not twisted in 3D. The way how the pile fibers connect the surface layers makes the fabric more pressure-resistant.
Elastic weft fibers provide the elasticity for the base spring support. The woven 3D fabric needs neither base foam nor springs to carry the passenger weight.

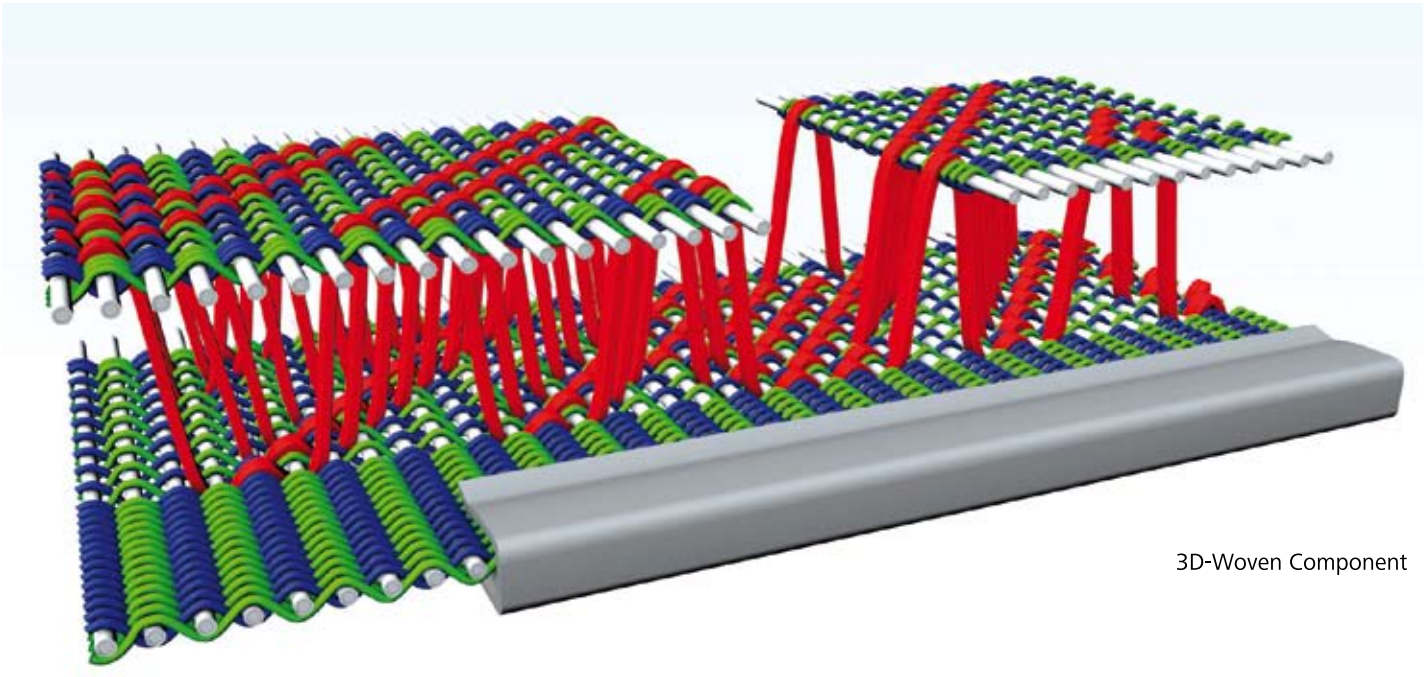
Due to the water-vapor differential pressure, powered by the transpiration of the passenger the seat is self-venting. Contours of 2D/3D with channels for trim fixation can be woven.

The rectangular fiber cross-section stabilizes the web in cross direction, thus preventing the fabric from tilting. 3D-woven fabrics have a larger freedom in design and fiber size than 3D-knitted fabrics, whereby the fiber size can be any size and much larger than in the flat or circular knitted fabrics (> 2800 den).

Trim fixation channels and contours can be realized to meet the requirements of the seat design. The air and water vapor open fabric permits climate exchange and conditions equal to the car interior, as verified in a test.



3D - Woven Fabric, 20 mm thick showing the bent shape of the pile fibers after weaving. The rigid fibers provide pressure stability.



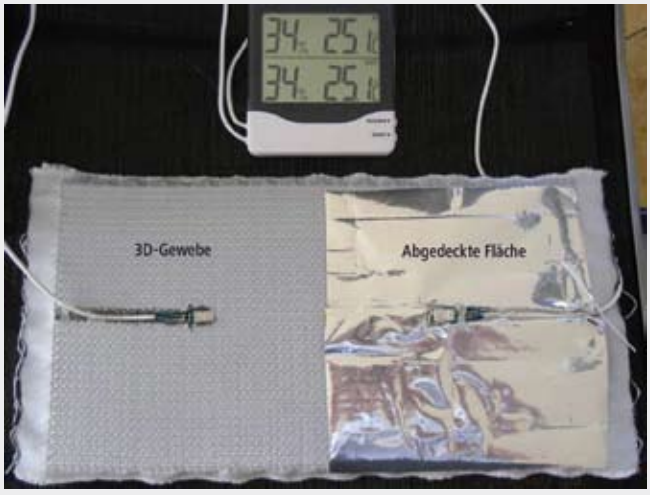
3D-Woven Component

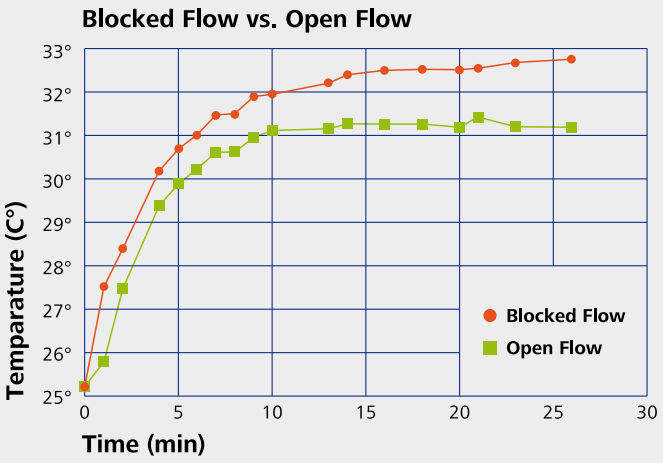
3D-Woven Test

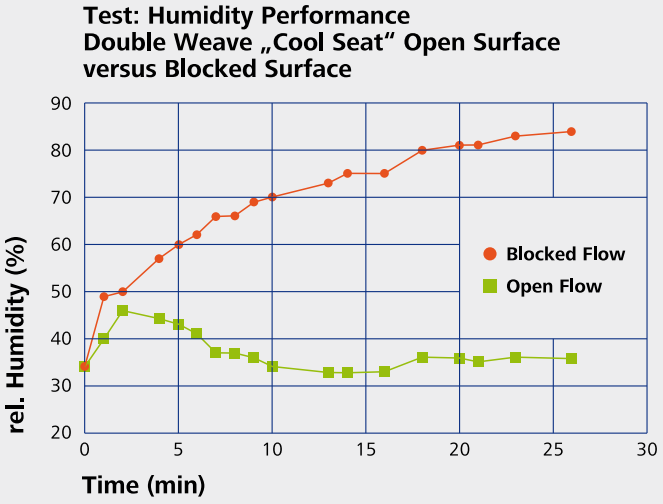
A test specimen, open in one half and covered vapor tight in the other part was used for the experiment. The covered part demonstrates the impermeable foam seat. In the open area of the 3D woven fabric, Transpiration from the skin could freely escape in the room.

At the start the skin temperature was 33°C and the room temperature 24°C at 34 % r.H. On the covered part, after a short swing, the humidity was 2 °C below the temperature of the covered area. In the covered part (blocked area), the humidity rose up to 85 %.

The test shows that the 3D woven materials meet all hydrothermal functions for a comfortable seat, with the seat conditions not remarkable differing from the room climate.







3D - Woven Hydrothermal Test, Setup with a blocked and a 3 D-woven open area, with Sensors for humidity/temperature and including measurement Data Graph.

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