

## A Green Seating Solution

*G. White*

Thanks to AutoCRC research, we may soon be riding in comfort on seats padded with greener, lightweight recyclable cushions, as part of the drive for lower emissions vehicles.

Seat cushions can be made with modified polyester fibre, as a cleaner, greener alternative to today's polyurethane-based foam padding, according to AutoCRC, CSIRO and Futuris Automotive Interiors. Scientists at CSIRO's polymer science labs have created a special blend of recyclable fibre materials that perform like conventional foam, but are lighter, cost less to make and are recyclable. The new foams have potential for widespread use where foam is used for padding or protection. Seat makers would be the most likely first adopters of the technology.

Drivers of modern cars certainly appreciate the comfort of the seats, which have become more sophisticated with each new model. Modern automotive seats feature multiple adjustments, heating and even memory for individual comfort settings. However, the padding beneath the seat covering has not changed significantly since foam padding became standard practice in the 1960's. Foam offered superior comfort because it absorbed shocks and provided support over years of use while keeping its shape. Foam was a leap forward in other ways because it could be moulded into more comfortable shapes, reducing the number of wires and springs previously used to hold the old seats in shape.

As chemists refined the foam manufacturing processes, they also improved its shock absorbing performance, resistance to sagging and overall durability to the level we see today. Modern seat foams maintain their shape for many years in a severe environment of extreme loading and chemical attack. Today's typical seat design utilises moulded polyurethane (PU) foam cushions to provide critical comfort, safety and styling attributes. Their design makes up a significant percentage of a complete seat component cost (typically in the order of 10 - 20%) and total weight of the seating system.

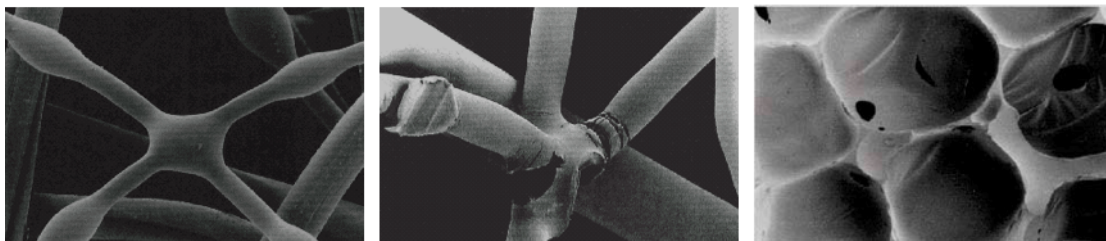


*Robotic seat testing*

Polyurethane foams have many good attributes, however their durability, which in most respects is a desirable property, also causes an environmental problem because polyurethane is not biodegradable or recyclable and needs significant landfill volume for disposal. Furthermore Polyurethane foam uses hazardous chemicals in its manufacture and

if incinerated, it generates toxic gases. These issues are driving governments and manufacturers to search for a greener solution for foam padding.

Natural fibres were extensively used in all types of seat cushions until the mid-1960's. These natural fibres, horsehair and hemp for example, were supported by steel springs and mesh to maintain the seat shape. These were all biodegradable or recyclable but the cushions tended to shift and sag over time, exposing the springs and becoming quite uncomfortable. When production of polyurethane foams became cost effective, most competitor materials were eliminated. Many alternatives have been proposed and Teijin's "ELK" polyester fibre has been deployed in train seats, but there has been little application in cars. The principle shortcoming with these foam alternatives has generally been their need for substantial additional support and tendency to sag, while PU foams can actually provide much of the structural shape functionality in a seat.



*Magnified structure of materials (from left to right) Teijin ELK, PET and PU foam*

Futuris Automotive Interiors is an innovative Australian car seat and interior manufacturer, based in Melbourne, with operations in Adelaide, Thailand and North America. Futuris teamed with AutoCRC and CSIRO to seek design and manufacturing alternatives that deliver a lower cost, lighter weight and environmentally friendly alternative to current technology PU foam products. The project aimed to develop a new technology platform for future seat designs, building on existing fibre materials and non-woven manufacturing processes.



*Non-woven fibre "foam" production*

This goal meant exploring a huge range of materials in many combinations, then testing their performance relative to PU foam. The CSIRO research team led by Dr. Stuart Lucas searched through fibres and lining agents (baked into the fibres for increased stability), and identified high potential combinations. They manufactured a range of these fibre materials in varying blends and densities.

The foam substitutes were all constructed

using commercial manufacturing methods.

The new materials are porous and have a lower density than PU Foam, while having comparable stiffness characteristics. This combination offers significant savings in materials, manufacturing costs and weight. Their air permeability also provides design opportunities for greater user comfort, including active seat cooling.



*A Ricardo Benelli seat  
cushioned with polyester fibre*

The material came tantalisingly close to meeting the PU foam specifications. The material maintained strength or resilience under cyclic loading without weakening or breaking. However the results also suggested that the conventional test procedures for foam, particularly the preparation stage, may need to be revised, to evaluate non-woven fibre materials. With updated procedures the new materials could possibly exceed the performance of PU foam for seats.

The Australian automotive industry must continue to may aggressively pursue lower cost solutions for its long-term survival. Seating cost is a significant proportion of the vehicle, and attacking one of the larger cost drivers in foam seating will help maintain and improve the global competitiveness of the Australian industry.

This alternative foam technology promises both lower manufacturing costs and substantial environmental benefits associated with reduced use of polyurethane foam.

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