

Lightweight Automotive Seating for Energy Efficiency

Given slumping economies and shrinking budgets, consumers are more cost conscious than ever before, demanding vehicles that go further on a tank of gas. Fuel efficiency is therefore of utmost importance, setting the high standard for slashing vehicle weights in every way possible. The automotive industry is extremely interested in a multitude of approaches to making their product offerings slimmer and trimmer, with a particular interest in the design and composition of automotive seating.

The issue of weight is especially important for the design of seating in electric vehicles (EVs). Until battery life and charging capabilities can be significantly improved, consumers are going to demand the longest possible life out of every charge. As such, the lighter an EV's weight, the farther it can go on a single charge, since less energy is required to move a smaller, lighter vehicle than a heavier one.

In response to both consumer cost issues and environmental concerns, the vehicle industry is responding with some remarkable materials that decrease the weight of vehicles dramatically, not least of which is a vehicle's seating design. Using lightweight fabrics and textiles as well as less heavy components and accessories, automotive seating designers have come a long way toward reducing overall weights and achieving greater fuel and battery efficiencies.

Today, modern vehicle interiors are going well beyond conventional materials such as leather, metal, and wood. Innovative textiles, foams, and finishes are all enhancing not only the driving experience, but the fuel efficiency of passenger vehicles. The materials in today's and future vehicles will be both sustainable and more functional than ever before, with some exciting automotive seating advancements that increase comfort and functionality.

Smart, Lightweight Textiles for Vehicle Interiors

Estimates put the total textile weight in the average mid-sized vehicle at about 25 kg. Yet as more and more components within a vehicle convert from plastics to textiles, experts suggest that there will be an overall increase in textile weight



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within the average vehicle to 35 kg by 2020. The demand for textiles for surfaces, such as panels for doors, dashboards, air filtration systems, and trimmings will be the primary driver for this boost in textile weight.ⁱ

When every kilogram counts, 25 kg of textile weight can be a trouble spot for vehicle makers looking to improve fuel efficiency while maintaining a sense of style and comfort. Today, most of a vehicle's textile weight is contained within the seating design, which is why there has been a lot of attention focused on automotive seating textile composition. Tomorrow's vehicles will have some of the most advanced, lightweight, durable textiles on the market.

Perhaps one of the most interesting innovations in automotive seating textiles is the use of nano-enabled fabrics. Not only are nano-based textiles lighter weight in most cases, they also offer a multitude of benefits over conventional textiles, including lower environmental impact, improved safety, greater engine efficiency, and increased passenger comfort. As such, we are beginning to see nano-based fabrics trialled on a number of surfaces in vehicle prototypes.

In addition to all of the aforementioned benefits, nano-enabled automotive textiles offer much more durability and functionality. They are able to repel dirt, wear longer and more durably, and have increased fire resistance. In particular, some new nano-materials may offer self-cleaning properties by making dirt and moisture simply roll off the surface. This is possible through tiny fibers that are coated with nanoparticles and placed close together so that impurities can be washed off with water.

Nano-enabled textiles are also more tear and wear resistant, anti-microbial and anti-bacterial, antistatic, and offer UV resistance for longer color fastness. All of these benefits mean that vehicles created with these textiles will wear longer, create less waste, and of course be lighter weight and easier to maintain. As these are all qualities coveted by today's consumers, nano-materials are likely to play a big role in automotive seating designs of the future.ⁱⁱ

Yet in the wake of interest in advanced textiles, some manufacturers are turning toward more natural textiles instead as a way of decreasing weight and increasing fuel efficiency. For instance, Daimler has developed textile seat covers that are comprised of 25% pure sheep's wool for their E 300 BlueTEC Hybrid.ⁱⁱⁱ There's 15%

pure sheep's wool in their GLK Class seating as well. Not only is wool highly renewable compared to petroleum-based synthetic fabrics, it also offers significant comfort advantages. It has excellent electrostatic properties, absorbs moisture really well, and positively impacts climatic seating comfort in high temperatures, which can have knock-on effects on fuel efficiency. Daimler is also making use of cotton insulating elements in several of their seat designs.^{iv} Together these natural fibers should offer some nice comfort increases while also decreasing overall vehicle weight.

Lighter-Weight Seat Materials – Metals, Foams, and Composites

Another area of focus for achieving lighter weight automotive seating are the components that form the frame and foam base of the seats. Working with alternative materials and designs, vehicle seating designers are finding some creative ways to develop comfortable seating with much less heft. Of course, you can't compromise safety in the quest for a more lightweight seat, so industry safety standards are always on the minds of these seating designers as well.

Johnson Controls has been doing a lot of innovation in this space. Their seat metal components - which can be applied to recliners, latches, tracks, frames, adjusters, and stand-alone or integrated seating systems – offer lightweight features and modular flexibility. For instance, their CRH PEL track and Keiper Taumel 3000 recliner come together to provide both height adjustment and decreased mass and size without compromising technical safety and development time.^v

It's not just passenger vehicles that are receiving an automotive seating makeover. Comfort, safety, and fuel efficiency are all extremely important issues for truck drivers, which has created a significant challenge for seating designers focused on larger commercial vehicles.

One of the innovators in this space is Grammer, a company that has recently unveiled a new innovative truck seat design. One of their truck seats has been designed with multi-functional electronic armrests and other features making it one of the most comfortable seats on the market.

Another design is the new MSG 115 suspension seat, a seat design that can be adapted to any customer design specifications. They're made with high-tensile steel or lightweight composite materials composed of fiber-reinforced plastic. Both of

Grammer's seating designs are 40% lighter than conventional static seats, but just as importantly, offer much greater comfort for those truck drivers who must make long treks cross-country.^{vi}

Environmental strides are also being made in the foam construction for automotive seating. Given that the foam in a vehicle's seat can account for much of its weight, there are tremendous opportunities for weight improvements.

Lear has also been working in this space, having recently developed their SoyFoam technology which offers both excellent comfort and is made from a renewable material (soy) rather than non-renewable petroleum stock. Not only that, but when combined with their Dynamic Environmental Comfort System (DECS) - the layered system used for constructing their seating - the SoyFoam design offers 50% lighter weight than other comfort systems.

Another interesting innovation in Lear seating is their use of ECO Padding, which is a softwood fiber-based padding that is both recyclable and renewable. It replaces traditional non-renewably-based polyurethane trim, pad, and foam inserts for added seating sustainability.^{vii}



smart forvision seating
with BASF lightweight
foam and e-textiles

BASF has also created lightweight seating foam, which you can find in the smart forvision, one of the smallest, lightest vehicles on the market today. Their foam is up to 20% lighter than other seating materials, and can be produced in a variety of hardnesses for customized comfort.^{viii}

Faurecia has also developed a lightweight foam material they call Light Attitude, which is purported to be 15% lighter than conventional seating. This material is made from plastic and is used to create ultra-slim backrests using sports shoe sole technology for superior comfort. The material is recyclable and has a lower profile as well, for increase sustainability and fuel efficiency.^{ix}

Greater Innovation and Weight Reductions Yet to Come in Auto Seating

As you can see, there has been a great deal of activity in the automotive seating space of late, and more will no doubt be on the way in the years to come. As vehicle

manufacturers and consumers alike continue to push for more energy efficient vehicles, weight restrictions will drive innovation in the seating design for further fuel efficiency improvements.

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