

Weight-saving polycarbonate glazing could cut automotive emissions. However, new data shows weight reduction is only one contributor to improved environmental performance

Moving beyond weight reduction

Plastics glazing technology is going to play a key role in helping the automotive industry meet the demanding emissions and fuel economy standards of the future, with its contribution stretching considerably beyond the obvious weight savings. That was the message presented to delegates at the fifth *European Plastics News* Plastics in Automotive Glazing conference in Frankfurt in December last year. The speaker lineup included technology suppliers, glazing producers and automotive industry insiders.

"The automotive industry is really going to struggle with the ecological challenges of the future," said Dr Peter Wells, reader at the Centre for Automotive Research at Cardiff University in Wales. "Historically, the industry has had the opportunity to buy its way out of economic and environmental pressures, but this has now passed. Electric and low carbon vehicles will increasingly shape demand and weight reduction will

PLASTICS IN automotive glazing EUROPE 2010

become more important than ever."

However, while polycarbonate-based glazing offers a substantial weight reduction when used as a direct replacement – polycarbonate typically delivers a 50% weight saving over glass – this is only part of the benefit package, according to John Marcantonio, project director of chemicals and plastics within the IAL Consultants division of BRG Chemicals.

"Is this all about lightweighting? I don't think so," he said. "If you are offering just light weight you won't



The Bugatti Veyron has a roof panel made of thermoformed polycarbonate manufactured by KRD Sicherheitstechnik

get very far. It is about adding value in the flexibility of design and in other ways."

One area that is currently being explored in detail is the thermal performance of polycarbonate compared with glass. Both of the major material suppliers to this marketplace – Bayer MaterialScience and Sabic Innovative Plastics – have been working hard on developing infrared blocking and absorbing additives that can help manage cabin heat build-up and loss.

"Polycarbonate is an effective thermal insulator. The thermal conductivity is one fifth that of glass. And better thermal insulation reduces fuel consumption by reducing the air conditioner load," said Sabic Innovative Plastics' segment manager for glazing in Europe, Matteo Terragni.

He presented details of a study the company recently completed on the energy required to maintain a 22°C cabin temperature in vehicles with panorama roof and backlight systems, comparing glass with polycar-



Wells: weight reduction will become more important than ever



Terragni: better thermal insulation lowers fuel consumption by reducing the air conditioner load

bonate using the company's latest Lexan extended near-IR blocking technology.

Modelling performance in a moving vehicle exposed to typical summer temperatures in Phoenix in the US (+40.6°C) and winter temperatures in Minneapolis (-5.2°C), the company's calculations show a reduction of HVAC loading of 7.1% in winter and 6.3% in summer. Terragni said that converting that into CO₂ equivalents would yield a 3.2g/km saving for a typical petrol-fuelled vehicle or a 2.6% extension of battery life for an electric car.

"What is really interesting is that these gains are on top of and in the same order as the weight savings," said Terragni. "This is brand new data. We have presented it to a couple of OEMs and the response was impressive."

Meanwhile, Bayer MaterialScience has secured the first application for its IR absorbing coloured polycarbonate glazing resin on the Bugatti Veyron Grand Sport targa top. While only a

low volume application – around 150 vehicles a year – this fully-glazed hard top has to meet vehicle performance requirements considerably beyond those of typical mass market vehicles. The Grand Sport has a top speed of 407 km/h.

Bugatti Engineering project manager Daniel Starmann told delegates that the brief for the roadster version of the Veyron was to deliver a very different user experience. But Bugatti wanted a monolithic connection between vehicle body and roof. The mid-engine arrangement made a traditional convertible roof impossible.

“The material of choice, just because of the weight issues, was polycarbonate but because of certain doubts from our management we started a parallel development in glass,” Starmann said. Glass was not, however, a favoured option due to the heavier weight, which would have made removal and fitting a task for two people.

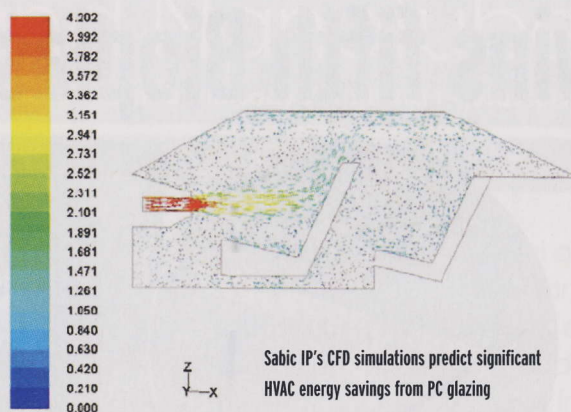
The roof panel, which is manufactured by German company KRD Sicherheitstechnik, comprises a thermoformed polycarbonate panel coated with the Momentive AS4000 system. It is bonded to a carbon fibre composite support frame at Bugatti’s factory in France.

The most critical part in the development was the bonding process, which had to be optimised to ensure the component could handle the estimated 4000N aerodynamic loading at peak speed. This was achieved with some modification to the adhesive chemistry and application process.

The project validates the weight saving claims for polymer-based roof modules. “Because we had developed glass and polycarbonate solutions in parallel we can be quite exact on the weight saving. The polycarbonate panel weighs 5.6kg, which is a reduction of 5.9kg on glass,” said Starmann.

The IR blocking resin meant that cabin temperature was found to be only 2°C higher than the hard top version in road trials at 35°C, despite the 43% increase in glazed area.

Starmann pointed out, however, that the polycarbonate roof signifi-



Sabic IP's CFD simulations predict significant HVAC energy savings from PC glazing

cantly altered the acoustics of the vehicle. “Because this car is intended to be driven open it is not a problem but it is quite a different noise,” he said.

While agreeing that the acoustics of polycarbonate are different to either metal or glass, this has not proved an obstacle in mainstream automotive applications, said Rym Benyahia, managing director and R&D leader at plastics glazing producer FreeGlass.

“This is a very complex issue as the acoustics are influenced by glue and many other factors. And it is not a simple comparison – a heavy glass cabriolet roof will squeak a lot more on bumpy roads than a lighter PC roof,” he said.

“In theoretical studies, the noise is pushed to higher frequencies. But in real vehicles the opposite is true due to the integration between the panel and the body. In all of the projects we have managed for customers we have had no negative feedback in regards to noise,” he said.

Established in 2001, Germany-based FreeGlass – which produces polycarbonate parts for Smart, Seat, Honda and Daimler – claims a 37% share of the European market and 20% of the polycarbonate glazing market worldwide.

Despite its 10-year history and leading position in the market, Benyahia said the company – wholly owned by glass maker Saint Gobain since 2007 – and the polycarbonate glazing industry is still on a learning curve. “Our yields reached budget for the first time in 2008. But after more than 4m glazing units we have still not seen two projects that are

similar,” he told delegates.

Benyahia told delegates that the benefits of polycarbonate must be delivered together with all of the expected performance and qualities of mineral glass. “No car maker will accept anything less,” he said.

German roof module producer Webasto, which has also invested heavily in polycarbonate glazing technology, believes that polymeric solutions can deliver what the automotive industry requires. But business development manager Peter Michalsky believes suppliers must be integrated

PLASTICS IN automotive glazing EUROPE 2010

tightly into the ever shortening product development process.

“The development time of a car is shortening each year by around one month,” he said. “We are addressing panorama roofs, opening roofs and windows with high levels of integration. Producers that want to put these types of products into production have to have very strong links with the integration companies.”

Meanwhile, one long-standing myth that was dispelled at the conference was that car designers are not aware of the opportunities that plastics can deliver them. In a special keynote presentation, former director of BMW Group Design Chris Bangle said: “Designers are often quite well informed of the latest technologies and materials. But many car companies put in a wall where this knowledge is not asked for and is not accepted.”

Bangle, who now operates his own design consultancy, Chris Bangle Associates out of Turin, said this does not apply to all of the car companies, but certainly does to some. “I am not talking about the particular companies I have worked for. But I know from talking to many people that it is the purchasing guys that are the biggest deciding factor in some companies.”

The fifth Plastics in Automotive Glazing conference took place in Frankfurt in December 2010. For more information about the event, email: epnconferences@crain.com



Starmann: polycarbonate roof significantly altered the acoustics of the Bugatti Veyron



Bangle: purchasing is the biggest deciding factor in some companies