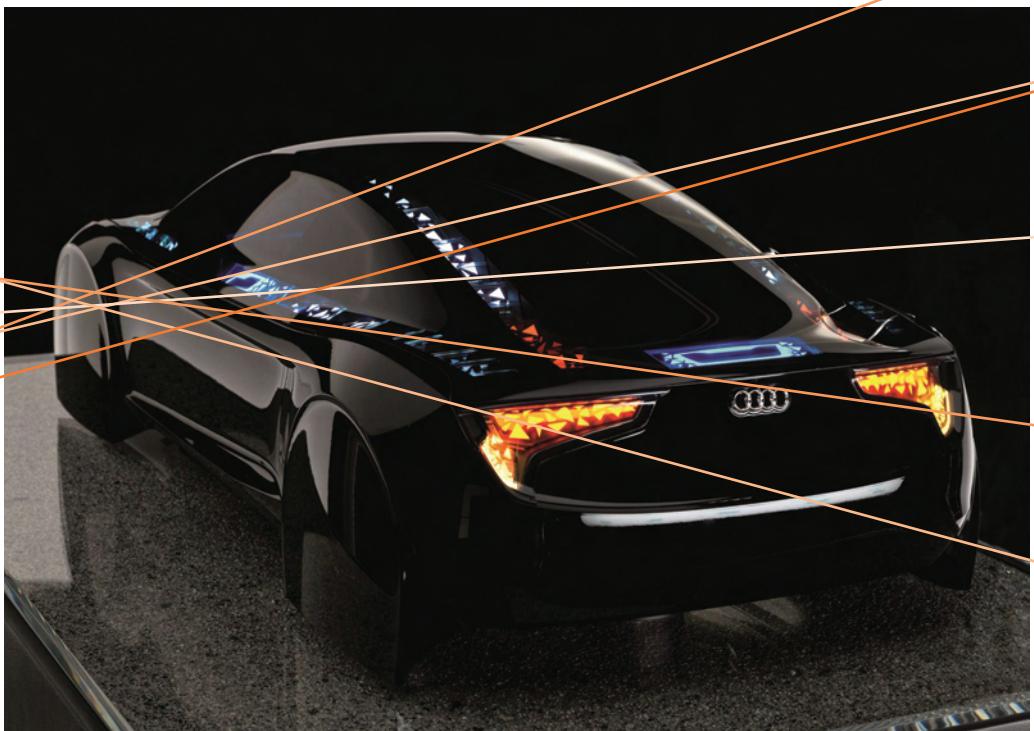




# OLEDs on the road

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AUDI'S CONCEPT VEHICLE MAKES EXTENSIVE USE OF OLED LIGHTING TECHNOLOGY  
SOURCE: AUDI



THE AUTOMOTIVE MARKET COULD PROVIDE A BOOST FOR **OLED** LIGHTING, AS CONCEPTS START TO BECOME REALITY

**T**he automotive industry is one of the markets where new technologies can appear and interact directly with the consumer. It is a market where plastic electronics are also beginning to emerge.

One technology that is struggling to find its feet in the consumer world, but could benefit by inclusion in vehicles, is OLED lighting.

While there are questions about its efficiency, and high price, being included in an already expensive item would bring it to the attention of the mass market.

**These cars serve the purpose of showcasing what a company can do with items that are still being developed.**



THE AUDI CONCEPT FEATURES TRIANGLE-SHAPED TRANSPARENT OLED PANELS THAT LIGHT TO REFLECT THE 'PERSONALITY' OF THE CAR  
PHOTO: AUDI

It is an idea used by Samsung and LG in their OLED televisions, which are being pitched as a premium item where more exotic technologies can be better accommodated.

### CONCEPT OF LIGHT

The vehicle market attracts consumers to new technologies by launching concept vehicles. These cars serve the purpose of showcasing what a company can do with items that are still being developed.

Yet many companies launch these concepts for commercial reasons too. Ford has released several vehicles over the last decade that took designs and technology from earlier concepts. So too have BMW and Mercedes.

Now the plastic electronics industry is looking to German manufacturer Audi for its latest concept to become a reality.

The company is known for its innovations in vehicle lighting, having been the first to include LEDs in tail lamps, and then again in the sidelights of a vehicle. It has now begun to pioneer the use of OLED lighting in vehicles – not just as a lens, but to also create cars that can respond to the driver's mood.

OLED lighting is the perfect addition to a vehicle for a number of reasons. It is lightweight, low-powered,

**OLED lighting developers will be hoping such high-profile illustrations of the technology's advantages will act as a catalyst for markets in buildings and infrastructure.**

and does not require any bulky lenses or wiring to allow it to work. Launching it in this market will bring the technology to the attention of the consumer and help illustrate its appeal as an integrated lighting technology.

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But Audi's concept does not just use OLED lighting as a new taillight, or a parking or indicator lens. Instead, it uses small OLED panels placed all around the car, which activate to change to look of the overall vehicle. Users can change the colour of the car based on their mood.

In addition, the company's 'Swarm' rear lighting system moves light around the back



SWARM REAR LIGHTING MOVES WITH THE VEHICLE, LETTING DRIVERS BEHIND KNOW IN DETAIL WHAT THE CAR IS DOING

PHOTO: AUDI

of the vehicle depending on motion, showing drivers behind that the car is turning, braking or accelerating.

### BENEFITS

Stephan Berlitz, head of lighting technology and electronics at Audi, took charge of the team that built the concept vehicle lighting system.

'The lighting system would not be possible with LEDs. What we have done is change the

mood of the car easily. LED lights would need additional optical devices, such as reflectors, scatter optics or conductors, to achieve what we have done with OLED panels,' he comments.

'With our concept, the OLED surface itself is the source of the light, and the thin plates look attractive, especially when cut into the design.'

They weigh little, light up extremely fast, develop a small amount of heat and last for

thousands of hours, while not using any more energy than a conventional LED.

### ADDING PERSONALITY

'Audi is looking at all kinds of uses for OLEDs. The concept is an exterior study for use of OLED lighting, in rear lighting and structuring the look of your car,' adds Berlitz.

'We have placed transparent OLEDs over the car, and in these are coloured triangles. The idea is to have colour-changeable OLEDs that allow for the silhouette colour depending on your mood – so from aggressive reds to more relaxed blues.'

**The idea is to give the car more of a personality. For the first time there is a lot of depth in the lighting.**

'The idea is to give the car more of a personality. For the first time there is a lot of depth, with three dimensions in the lighting. The idea is not only to replace the existing available light sources, but to use light as a design.'

There are other benefits in the use of OLED lighting too. At 1.8mm the devices offer a thinness that allows for passenger space savings, or for reducing the car size. Eschewing cooling requirements and sockets are also benefits.

Audi has worked with Philips to create its concept vehicle. The Dutch company has supplied the carmaker with its Lumiblade OLED technology, and has worked closely with the manufacturer to develop the lighting, with the expectation that it will enter the market.

## MEETING REGULATIONS

Dieter Thomas, communications specialist at Philips Lumiblade, notes: 'Audi has a long history when it comes to [lighting innovations for] cars: it was the first to incorporate LEDs into rear lighting, and was the first to use Xenon lights in headlights. It wants to be the first to bring OLED into cars.'

'The study in the concept is the first practical proof of what the future could look like with OLED lighting.'



THE CAR.BONES CONCEPT HAS BEEN USED TO ILLUSTRATE THE POTENTIAL USE OF OLED LIGHTING  
PHOTO: ASTRON FIAMM

Yet there are a series of regulations to overcome before OLED lighting can be used, especially as a design concept for an entire car.

Thomas comments: 'The design is great, and it works really well, but there are regulations around car lighting that must be adhered to. Vehicles that can change colour and light up could be distracting to other drivers, and some countries

have a strict law about what colour lights can be displayed on which vehicle.'

In Europe, vehicle lighting has to follow strict homologation rules, which allow the lighting lenses and bulbs to be sold in various markets. In addition some countries will only allow certain colours of lights to be displayed – red at the rear, orange on the sides and white at the front.

So the concept of a car lighting up will need some work with the European regulatory bodies before such a system could go on sale.

**While the concept of a colour-changing car will therefore take some time to come to market, using OLED panels is not far away.**

## CAR BONES

While the concept of a colour-changing car will therefore take some time to come to market, using OLED panels is not far away. OLED lighting developer Astron Fiamm has been working with the technology for vehicles since



WHILE OLEDS WILL NOT BE USED AS HEADLIGHTS, THEY CAN BE USED AS A RUNNING LIGHT OR AN INDICATOR

PHOTO: AUDI

2010, when it launched its Car.Bones concept. Shown

again at the Paris Motor Show 2012, the company attracted

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a lot of interest, and has announced that its panels meet the standards set by the European Commission. Astron Fiamm is working with

## AROUND THE INDUSTRY

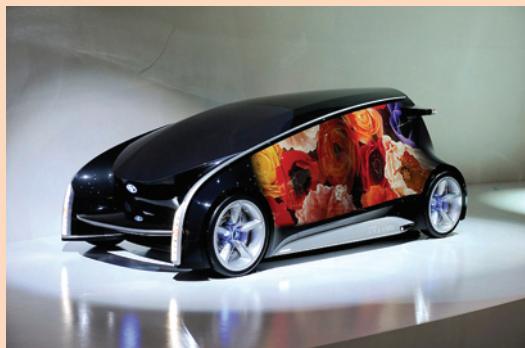
Audi is not the only vehicle manufacturer to experiment with OLEDs, although its concept would appear to be the closest to market for vehicle exteriors.

In 2011, Toyota launched a new concept, the Fun-Vii, which features a large OLED display on the exterior. Users upload photos or themes to change the appearance of the vehicle.

The car was designed only as a concept – the vehicle displayed at the Japan Motor show did not have seats or any interior. But it shows that cars can support advanced OLED technology for unique uses.

OLEDs are making more of an impact in car interiors. Audi used a display in place of the rear-view mirror in its R18 racing car at Le Mans 2012 and will use the same concept in its R8 e-Tron electric sports car when it is launched later in 2012. Lexus currently uses an OLED display in its centre console multimedia system, and believes it offers drivers better quality and reduced glare, allowing drivers to reduce the time needed to glance at the screen.

Other manufacturers are using OLEDs in other ways. Hyundai launched a concept vehicle in 2012 with an OLED instrument panel, removing the traditional speedometer and rev-counter, and replacing them with digital versions that allow for a driver to change the looks of the cluster. Ford has also shown interest in OLED displays, and is working with DuPont on their use in multimedia systems.



TOYOTA'S FUN VII CONCEPT USES OLED DISPLAYS TO CHANGE THE EXTERIOR OF THE CAR  
PHOTO: TOYOTA



AUDI ALSO BELIEVES THAT OLED WILL PROVIDE A STRONG AMBIENT LIGHT FOR THE INTERIOR, TO MATCH ITS MOOD LIGHTING EXTERIOR CONCEPT

PHOTO: AUDI

several vehicle manufacturers, and believes it could have OLED lighting installed on vehicles in two years.

Audi has already installed panels on vehicles, with its Swarm rear lighting, which it also aims to see approved at an EC level soon.

### SWARM

Berlitz comments: 'In terms of the Swarm rear lighting system, using OLEDs in this way allows for a quicker response, and also allows for one single panel that can show the movement over the entire rear of the car. The technology allows us to be able to make a car safer, as well as more stylish.'

Developers are targeting rear lighting because of the design possibilities, as well as advantages like quick response. For headlights the technology does not offer the point

source beam of light needed – though there are options for OLEDs to play a role in this area of a vehicle too.

'The speciality of an OLED is that it is a surface light source, while for a headlight you need a beam of light. What you could do is put an OLED in, and then a beam light source, similar to what is currently being done with LED lighting [as a side or daytime running light in the front]. They can be used as indicators, but not as a main light source when it comes to showing the way,' explains Thomas.

### LIGHT AS DESIGN

Astron Fiamm's simple illustration of how OLEDs can offer a 3D light source for vehicles has received plenty of interest.

Company co-founder Bruno Dussert-Vidalet says OLEDs provide more design flexibility

than all other lighting technologies, including LEDs. He sees OLED taillights and similar OLED components becoming part of a brand enhancement for early adopters in automotive.

For Audi, OLED lighting has aided the design of the whole car.

Thomas remarks: 'When you are a designer, you spend 3–4 years designing the car, and then you have to rely on basic warehouse parts for the lighting. Then it is a question of using normal light bulbs or LEDs, which come in a shape they cannot change.'

'With OLED, the designers can include a contour for the light source and include it as part of their overall design philosophy.

'It is mirrored in building design. An architect can spend years planning a building, making it look as modern as possible both outside and inside. But then when it comes to lighting, there is only a standard bulb or fitting available, which detracts from the design.'

'Just like in the vehicle, OLEDs allow for shaped and intrinsic panels to be used to aid the final product.'

### TIMESCALE

While products will filter slowly onto the market in vehicles, a little more development is still

**... a vehicle using its lights for four hours a day, every day for a year, would need to replace its OLED panel after 54 years.**

required. Thomas suggests that not only could OLED lighting appear soon, it may not be limited to one manufacturer to start with.

'It could be 3–4, maybe even five years, before we see OLED lighting on a wider scale, and not just with Audi,' he remarks.

'We are working with almost every automotive manufacturer; they are all looking at what they can do with OLEDs, and are all interested in the freedom of design, and the benefits of a low current 14V system.'

'With vehicles full of computer systems and heating systems, they are happy to look for any lighting system that will reduce electrical pull on the batteries. Every motor manufacturer is looking at the next big technology, and especially Audi, which is known as a lighting specialist.'

And matching the demands of the automotive industry for its lighting components will help unlock a much

bigger share of the automotive market for OLED.

While it will take some time before OLED is seen on the rear of cars that are bought or sold on the mass-market, Philips has a tight schedule when it comes to improving lifetimes and performance.

'We believe that in three years Lumiblade will be in the rear of a car. I see it, as has happened with the LED lighting; the OLED will start as an option, a luxury on the bigger series of cars first,' adds Thomas.

'Early adopters are there, and the market will pick up. Already there are reports that, by 2019, the automotive market will make up 18% of the entire market.'

#### LIFETIME

Philips' commercially available OLEDs offer 15,000-hour lifetimes. The company expects to match typical current LED lifetimes – 80,000 hours – in three years.

This, according to Thomas, would be more than sufficient for the back light of a BMW or Audi A8, for instance.

Berlitz adds: 'OLEDs suit Audi perfectly because they combine high-end technology, maximum precision and super design, and their lifetimes almost already meet the requirements of the automotive industry.'

Achieving 80,000-hour lifetimes for OLED lights in three years would be impressive, especially as current roadmaps indicate that by 2015, the highest lifetime achievable by competitors would be 40,000 hours.

LG OLED would achieve this, while Sumitomo would achieve a lifetime of 30,000 hours, and Panasonic Idemitsu a 20,000-hour lifetime.

To place Philips' claims into perspective, a vehicle using its lights for four hours a day, every day for a year, would need to replace its OLED panel after 54 years. Take into account that when driving through summer there is less use of lighting, and it is easy to see the rear-panel OLED outlasting the car.

OLED lighting can be an impressive tool for design, and vehicle design is evolving rapidly. It is only a matter of time until the concepts of Audi are taken seriously and tests are conducted to see whether colour-changing cars could become reality.

OLED lighting panels are nearly ready to make up a vehicle's lighting system and we could see a breakthrough soon. If they can be developed to offer the lifetimes envisaged by the likes of Philips in the medium-term, then the automotive market will be fitting OLED lights as standard sooner rather than later. +