



Why We're Bullish on OLED Lighting in Automotive

The fledgling industry for organic light-emitting diode (OLED) industry is now entering a phase of concerted efforts to achieve commercialization on a wider scale. OLED lighting is inching toward mass production, particularly for industrial and large-scale applications, despite a relatively lower demand for OLED products compared to LED solutions -- for now. Office and residential lighting segments are often touted as the most preferred fits for OLED lighting technology, where OLEDs promise better aesthetics and architectural integration compared to LEDs and incandescent lights. These markets would seem most ready to pay a premium for such capabilities.

Long-term, however, NanoMarkets sees another end market emerging strongly for OLED lighting opportunities: the automotive industry, both for exterior and interior usage.

http://nanomarkets.net/images/uploads/OLED_Auto.pdf

Understanding How Automakers Adopt New Technology

Due to its overall size, longevity, societal ubiquity, and growth of alliances (including shared procurement), the auto industry is a prized target for any supplier base. It is also extremely competitive with penny-pinching car makers constantly seeking any edge -- and new technologies tend to be more expensive and less proven in real-world use than the conventional and familiar products they replace or fit alongside. Nevertheless, new technologies can make inroads if they address specific cost-savings or improve usability or the customer experience.

Typically new technologies in automotive tend to be adopted in higher-end models where the purchasing demographic is more likely to appreciate and pay for some extra functionality or comfort, such as GPS systems or rear-facing cameras for impact detection. Eventually those technologies may (or may not) sufficiently prove their value in functionality and profitability (performance/cost ratios), and find their way into more mainstream automotive brands and models.

On the one hand, long lead times (typically several years) do not sit well with technology vendors, which are constantly pursuing technological improvements. On top of that are layers of strict safety and performance regulations which must be met by both components and final products. On the other hand, getting a particular product designed into a popular vehicle, even for premium models with smaller addressable customer bases, nearly guarantees sales in the tens of thousands of units. Lighting is a key focus of much automotive design, and this bodes well for OLED lighting as well.



Moreover, big-ticket items can, to an extent, absorb pricey externalities, whereas individually such products might find consumer-direct market adoption a harder sell -- an OLED table lamp costing hundreds or even thousands of dollars, for example. In this sense, the automotive market may be more accepting than the office or residential lighting segment.

Why OLED Lighting Makes Sense in Automotive

Addressing specific cost-savings or attract buyers based on critical factors of cost, safety, comfort and style is the key for any new technology to make inroads in the automotive sector. This is how OLED lighting technology should be viewed, to the extent it adds value along these dimensions of usability or the customer experience.

How OLEDs Might Add Value to Cars		
	Pros	Cons
Comfort	Inside “glowing” OLED panels may make for a more comfortable experience for passengers. OLED taillights make for more trunk space	May be a tendency to leave lights on and this may disturb driver
Safety	Wide-area lit panels may be more visible to other cars and pedestrians than conventional car and truck lighting	
Style	No one can deny that the novelty of OLED lighting create a feeling of stylishness	Some of the OLED lighting that has been demonstrated so far has weak aesthetics. In addition, it is unclear how long OLED auto lighting—especially exterior lighting—may last under harsh conditions
Cost	Eliminates specialized optics sometimes required with LEDs	OLED lighting is currently expensive

OLED lighting opportunities in general automotive applications align into two categories: exterior (rear taillights, directional signals, decorative lighting) and interior (dome lighting, functional lighting, decorative/mood lighting, dashboard illumination) use. Initial technical focus has mostly been on exterior vehicle lamps, although exterior OLED lighting is actually



more challenging due to environmental conditions requiring encapsulation, and performance requirements varying by geographic legislation.

The promised excellent market potential for OLED lighting in general automotive use assumes aligning the technology's performance to meet this sector's needs -- namely, a luminance range of 2,000-3,000 cd/m² and efficacy range of 80-100 lm/W. Lifetime is the overriding key requirement for automotive lighting, and OLED technology has come quite close to achieving its ultimate goal of around 40,000 hours. While we don't see much market potential in automotive headlights which require far greater luminance and efficacy ($\geq 50,000$ cd/m² and >100 lm/W respectively), OLED lighting technology is arriving at levels suitable for indicators and rear taillights, for example to enable a thinner taillight package that consequently increases trunk space.

Note that extra trunk space has always been a big selling feature for cars of all kinds, so here is a benefit of OLED lighting that feeds directly into a marketing feature for the car as a whole. Some suggest that OLED lighting's lack of optics and housing can reduce a vehicle's weight and thus improve fuel efficiency, though this is perhaps a less compelling argument in general automotive than in related transportation applications such as aircraft. Another case can be made that OLED lighting consumes less power than conventional or LED lighting, which is an important feature as vehicles increasingly pack in more complex and power-hungry systems from various driving automation and controls to infotainment.

OLED Lighting in Automotive: Where and When?

As an (initially) expensive technology to incorporate, OLED lighting likely will follow the typical pathway of introduction in higher-end models, meaning its initial market will start off fairly narrow. That said, some brands/makers of cars are more receptive to deploying novel technologies than others. German carmakers, for example, seem to be especially enthusiastic to try out the latest automotive technology ideas, and this seems to be true for OLED deployment in cars as well. Among the technology's more vocal supporters is BMW, which has revealed plans for OLED lighting in its Vision Future Luxury sedan, and sees "hybrid" OLED-LED lighting systems as the next logical step, possibly incorporated into BMW motorcycles within two-three years. Audi and Volkswagen also have showcased OLED lighting possibilities in automobiles, from rear taillights to interior roof and ambient lighting.

NanoMarkets expects challenges for OLED lighting to achieve high levels of reliability and thermal stability under the typical application conditions seen for automotive lighting. Encapsulation methods are getting better, but we expect exterior OLED lighting to be deployed at a relatively slow pace. Internal lighting, so far viewed as less strategic and limited to functional use, has seen growing interest by car manufacturers to meet both functional and aesthetic needs. In fact, because there is less challenge from harsh



environments, we think OLEDs for dashboards and internal mood lighting could very well evolve faster than external automobile lighting.

There is another powerful force that will drive commercial adoption of OLED lighting in the automotive sector: the growth of the size of OLED panels. We can imagine OLED lighting being deployed in small patches initially, but eventually covering much larger areas -- the whole of the ceiling of a car, for example. This growth in the size of lighting panels reflects two assumptions: car designers accepting OLED lighting and becoming "braver" about deploying bigger panels, and the technical ability to make large panels, which is an item on the R&D agenda of most OLED lighting makers.

Taking all these factors together, we forecast that the market for OLED lighting panels in automotive will ramp up from a few million dollars in 2014-2016, to over \$17 million in 2019 and \$68 million by 2021. Admittedly these are not exactly eye-popping numbers. First of all, however, this reflects a market that's just beginning to ramp up (remember the earlier point about long lead times). Secondly, companies already producing OLED lighting won't turn away prospects for selling several million dollars of products they've already developed. And thirdly, panels are only one side of the equation -- we also see a market for OLED luminaires, and it's noticeably brighter. We project \$20 million in sales by 2017 and nearly \$140 million by 2021.

The contents of this article were drawn from a recent NanoMarkets report, "[OLED Automotive Lighting—2014](#)" that the firm recently issued. For information on this and other related reports, please visit www.nanomarkets.net