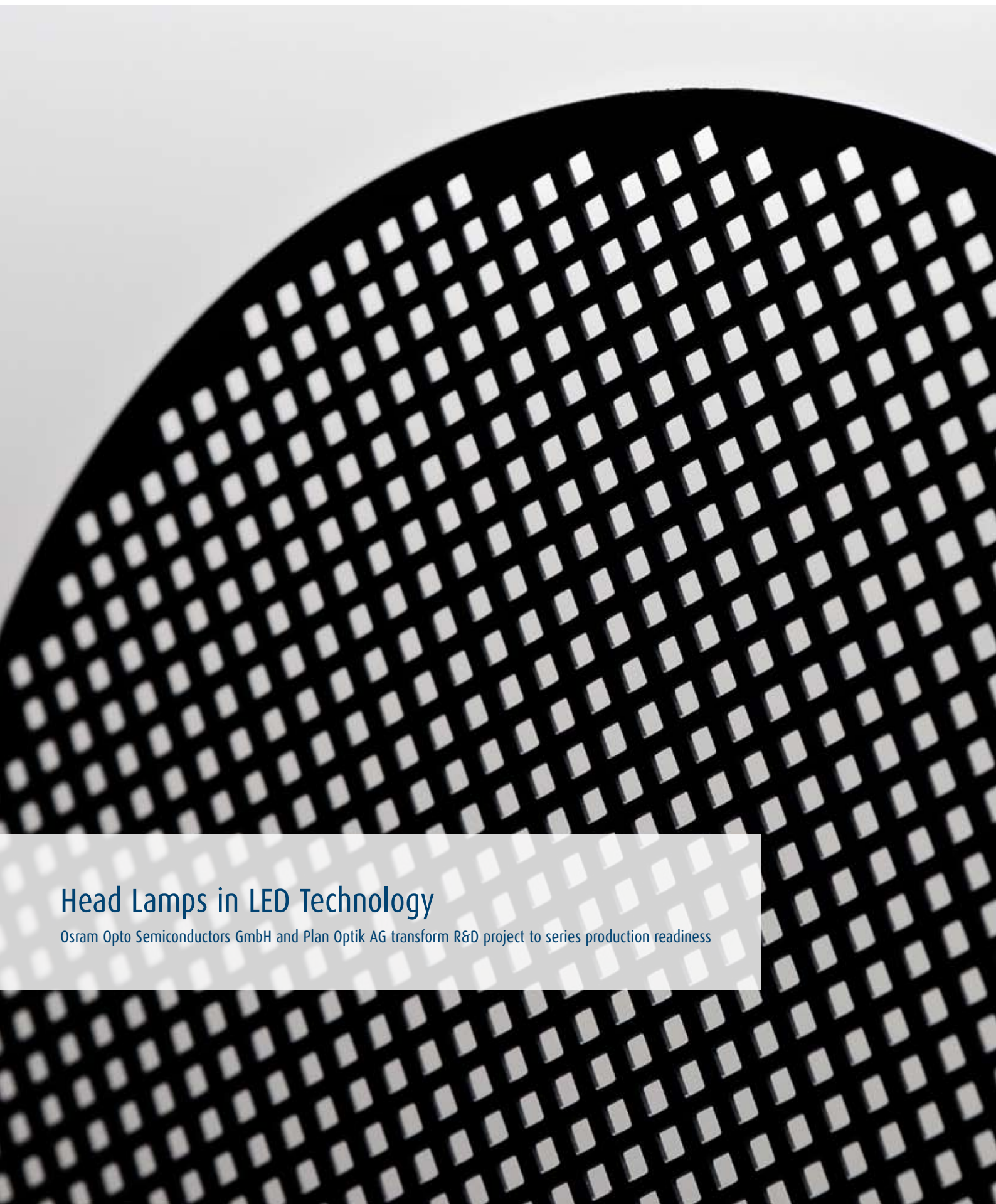
Plan Optik AG

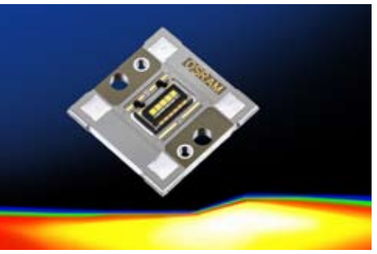


Head Lamps in LED Technology

Osram Opto Semiconductors GmbH and Plan Optik AG transform R&D project to series production readiness

The bright lights of the 21st century will increasingly owe their brightness to light-emitting diodes (LED). LEDs are also currently taking over the exterior lighting in the automobile sector, but in practically all areas of application LED technology offers considerable advantages over other lighting sources. Together with OSRAM Opto Semiconductors GmbH (Regensburg), Plan Optik AG has developed a research project which is now ready for series production: Specially coated micro structured wafers made in Elsoff form an important element in the LED main headlights of modern vehicles. OSRAM LEDs containing components made by Plan Optik AG are used, for example, in the Audi R8 as well as the new Audi A8.

LEDs are components made of semiconductors. In the LED chip the energy produced by the electric current is transformed with the generation of only a small amount of heat into light energy. White light, which is the type of light needed for headlights, is based on indium gallium nitride substrate. In the new version of the Audi A8 light-emitting diodes provide not only the dipped headlights and the full beam headlights but also various other special light functions. Apart from their efficiency, LEDs convince by virtue of their long life, which exceeds the life of the car. Furthermore, the light which they produce is very similar to daylight and thus provides additional safety for drivers. Thanks to their high level of energy efficiency LEDs save a considerable amount of energy, which is ultimately also reflected in reduced fuel consumption and CO2 emissions. In addition they offer outstanding advantages with regard to maintenance: the life of LED solutions corresponds at least to that of the vehicle, which makes light-bulb changes unnecessary and thus saves expense on the part of the car owner.



The LED for head lamp applications contains five chips. Special wafers of Plan Optik are used for the protection of the components and contrast enhancement.

OSRAM uses glass-silicon compound wafers by Plan Optik to protect the LED chip component and at the same time to ensure the anti-glare shield on the left-hand side of the light field, in other words on the opposite carriageway. “The idea was to put a silicon frame in position,” is how Georg Bogner, Head of Product Development Visible LED, describes the basic idea. To achieve this Plan Optik’s 150-mm wafers were diced so that the individual structuring could be used as a monolithic window, in other words as a sort of frame around the LED chip formed from a single piece. This ensures that the mechanical components are protected, for example against mechanical damage to the wires.

Since the individual diodes are very small, the wire connections needed to make electrical contact are also correspondingly thin and delicate and need to be protected. In addition to protecting the components the monolithic window ensures adequate contrast and thus anti-glare protection in the area of irradiation of the LED array. Since the light produced by the LEDs amounts to a greater luminescence than that available using previous technologies, the anti-glare shield is particularly important.

The terms of reference are achieved through the special micro structuring of the wafer, the high-quality lamination and the anti-reflective coating. “The degree of contrast at the line between light and dark amounts to 200:1,” explains Bogner. This is possible because Plan Optik wafers are extremely flat. This quality permits, so to speak, the positioning of the “covering” of the beam of light directly in front of the LED. The driver’s safety is increased by the use of the diodes. LED headlights illuminate the carriageway with optimal definition and without glare thanks not least to the exceptional quality of Plan Optik components. They produce a white light which is similar to daylight, which increases the contrast awareness. Especially in the peripheral field of vision, in other words where pedestrians, animals or badly-lit vehicles can suddenly appear at night, objects are easier to recognize with white LED light. But also potholes, obstacles and worn carriageway markings are much easier to see because of the characteristics of LED lighting. An additional advantage is that since the color temperature is close to that of natural sunlight, the driver’s eyes do not tire as quickly. All things considered, the technology has the potential for preventing many of the accidents which happen at night.

OSRAM works together with Plan Optik because the company profits from the extensive experience of the specialists in micro structured wafers from Elsoff. Bogner commented that OSRAM had previously had experience of wet etching through the affiliation with Siemens, but had not pursued this specialist field any further. “Our staff knew about Plan Optik as a very capable company, and that is how the first contact arose.” The new solution was developed jointly to its current state of readiness for series production. “Plan Optik has proved itself to be an efficient and very flexible partner,” commented Bogner admiringly.

LEDs will gain increasing acceptance in many areas for a variety of reasons, so that they represent a high turnover potential for Plan Optik too: not only dipped-beam and full headlights can be produced, but also special functions such as motorway lights, bending lights and all-weather lights can be realized using light diodes. The product platform developed with Plan Optik is currently available with up to five LED chips.

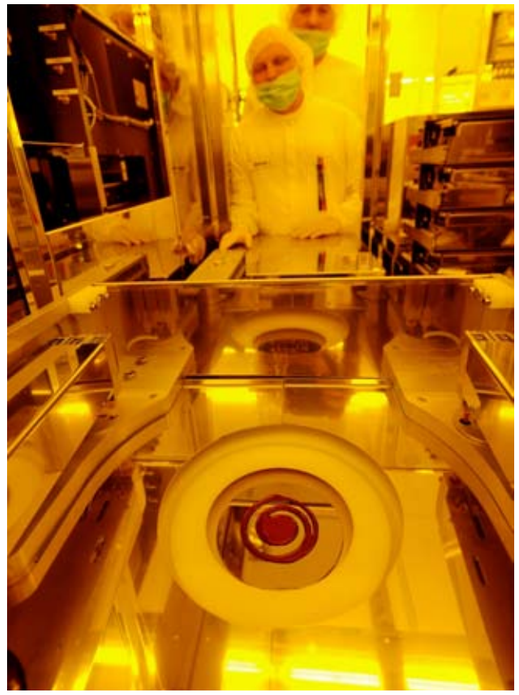
LED technology makes it possible: the complicated mechanics with servo-motors, which are necessary for example to adjust the bending lights with normal illuminants, are unnecessary with appropriately positioned LEDs. Headlights progress from being a predominantly mechanical component to becoming an electronic module which can be linked in to work with the rest of the vehicle’s electronics. In the case of a new-style anti-glare headlight, for example, data from the navigation system and information from a light-based driver assistance system can be combined. In this way the lighting system can independently light up only the appropriate sections of road when driving round a bend or if there is oncoming traffic. LED arrays will also play an important role in future in this respect: depending on the lighting function individual LED pixels can be switched on or off, thus permitting a perfect adaptation of the light to a variety of conditions.

The LED chips can be controlled electrically. They can be connected with sensors within the vehicle and can even take into account the navigation data in order to make provision for an optimal adjustment of the light. Thanks to the navigation system the lighting system knows exactly where the car is at any time. It recognizes built-up areas and switches to the town lights with their broader beam. It also recognizes junctions, and of course the system also realizes on the motorway when the long-distance motorway lights will be required.

LED lighting permits designers to realize a presentation which is typical of a specific brand through the use of a number of lighting modules. This is an advantage which should not be underestimated in view of the increasingly similar basic car shapes resulting from parameters dictated by the laws of aerodynamics. The small size of the light compared with the high lighting performance and high degree of compliance with the demands also permits an aerodynamically efficient design of the front of the car.

In addition to the automotive sector including the utility-vehicle segment, which has maintained its role as innovator in the sphere of LED technology, analysts see a wide range of possibilities for use, for example in signals technology in both the rail and air traffic sectors, given that LEDs permit a color-on-demand function. This means that the color can be changed by altering the electrical control of the chip. You no longer need green, yellow or red lamps or glass filters, but can change the light directly at the source. For such applications Plan Optik provides tried and tested solutions with the conductive via wafer technology, in order to implement compact and versatile arrays while simultaneously encapsulating the central components hermetically.

Conclusion: LED technology will gain increasing acceptance in the automotive sector and like other technologies in the past will filter down from the luxury segment into the lower market segments.



At OSRAM the processing of the LED chips is done under clean room conditions at all times.

Information box LED

LEDs are components made of semiconductors. In the LED chip the energy from the electrical power is transformed into light energy while generating only a small amount of heat. A very narrow band of light is emitted. A light diode consists of several layers of semi conductive material. When the diode operates under direct current, light is produced in the active layer. The light thus produced is decoupled either directly or by means of reflection. Unlike light bulbs, which emit a continuous spectrum, LEDs emit light in a specific color, which in turn is dependent on the semi conductive material used.

Two material systems (AlInGaP and InGaN) are used to produce LEDs with high brilliance levels in all colors from blue to red as well as white (luminescence conversion). Different currents are necessary in order to operate the diode in forward current. In order to produce white light the light of blue LEDs is directed through luminescent materials which usually contain phosphor and are therefore yellow in color. It is possible to control the color of the light through the composition of the luminescent material.

The rapid development in the performance of LEDs together with the high technology of Plan Optik now makes them also usable for anti-glare and full-beam headlights. With a color temperature of approx. 5,500 Kelvin the color of the light from white LEDs is very close to that of daylight (approx. 6,000 Kelvin) and certainly considerably closer than xenon light with approx. 4,000 Kelvin. The light output from LEDs is rising rapidly: today it lies at more than 40 lm/W, but in research laboratories there are already prototypes which achieve approx. 130 lm/W (compared with xenon light at approx. 90 lm/W and halogen light 20 lm/W).

About OSRAM Opto Semiconductors

As one of the world's leading manufacturers of optoelectronic semiconductors for the lighting, sensor and visualization sectors, OSRAM Opto Semiconductors regularly launches new technologies and products that make a lasting difference to these sectors.

More than three decades of experience in the development and manufacture of optoelectronic semiconductor components have made OSRAM Opto Semiconductors one of the most significant innovation and technology drivers in Germany. With its solid platform of experience and know-how, OSRAM Opto Semiconductors is not only a manufacturer of optoelectronic semiconductor components but also as a reliable partner for semiconductor technologies in a wide range of lighting applications. The extensive product portfolio of OSRAM Opto Semiconductors includes above all high-brightness high-power LEDs in the visible range.

With its headquarters in Regensburg (Germany), Sunnyvale (USA) for North America and Hong Kong for Asia, production sites in Regensburg (Germany) and Penang (Malaysia) and a global network of sales and marketing centers, OSRAM Opto Semiconductors is in an excellent position to meet the challenges faced by a global high-tech company.

About Plan Optik

Plan Optik AG is the leading supplier when it comes to the technology for the manufacture of structured wafers which serve as the active elements for numerous applications of MEMS technology in a variety of sectors. The wafers are made of glass, silicon-glass or quartz and are available in diameters up to 300 mm. Innovative solutions are based on micro structured components by Plan Optik, in particular in the fields of health care (micro dosage systems, lab-on-chips), automotive (sensors for driver-assistance systems and engine control, LED headlamps), aerospace (positioning and location sensors) as well as consumer electronics (CMOS chips). The fields of application in which wafers are used as carriers in the semiconductor industry as well as conductive via wafer solutions are continuously being expanded. As a manufacturer of glass micro lenses on the wafer level Plan Optik has become an important supplier for micro-optics manufacturers.

Plan Optik works together with customers including Infineon, Motorola, Boehringer, Samsung, Honeywell, Osram, Zeiss and Bosch and thus targets markets in Asia, Europe and North America. The company is listed in the Open Market (Entry Standard) of the Frankfurt Stock Exchange.

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