Federal Ministry
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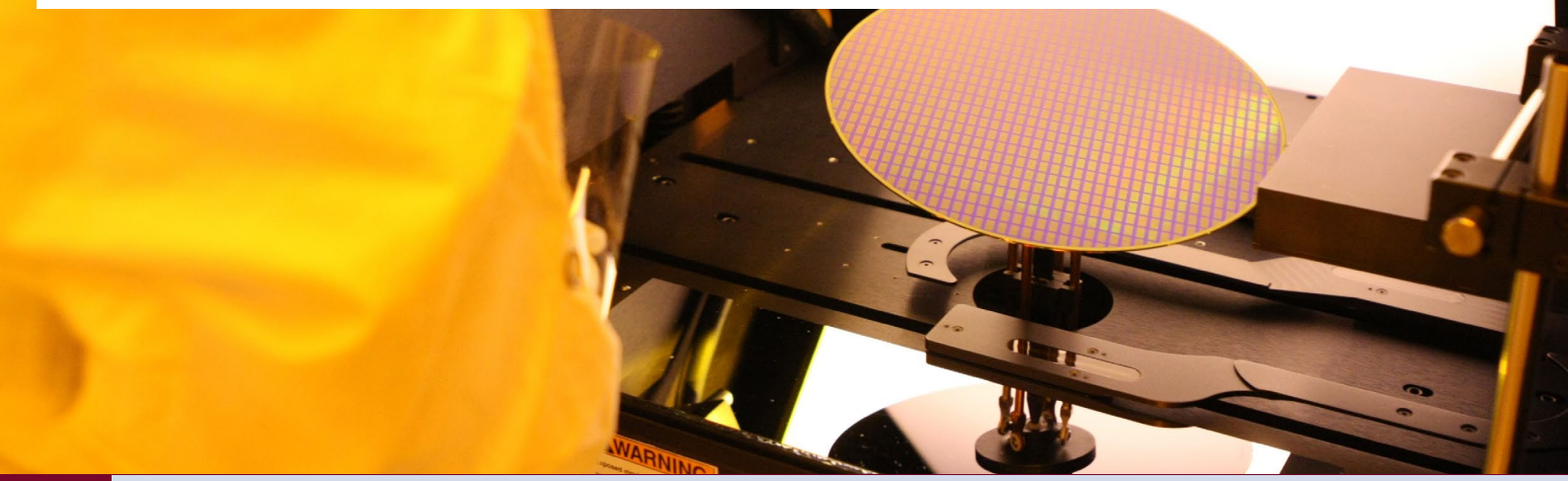
IPCEI
on Microelectronics




OSRAM OPTO SEMICONDUCTORS GMBH

# Construction and equipping of a new research environment for optoelectronic components

**OSRAM Opto Semiconductors GmbH, based in Regensburg, Germany, is a global high-tech company in the field of optoelectronics for applications in sensor technology and sensor interfaces. Its main activities focus on visible and infrared light-emitting diodes (LEDs) and high-power lasers. Osram develops innovative, future-oriented technologies for lighting, visualisation and sensor technology. The optoelectronic products are used, among other things, to detect movements or objects. They are used, for example, in vehicles, smartphones or in networked, intelligent lighting solutions for buildings and cities. With optoelectronic semiconductors, Osram exploits the possibilities of efficiently generating, transmitting and safely using light and data communication with electrical energy.**

## Challenges

The requirements of the international automotive and entertainment electronics industry for energy-efficient and flexible semiconductor products are increasing rapidly. Multifunctional and highly integrated microelectronic and optoelectronic products are needed that guarantee a high level of safety, especially for applications in automated driving. Essential cornerstones for this are the research and development of materials and functionalities for these special components, but also their individual, highly complex manufacturing processes, which can also be implemented in semiconductor production. This requires highly specialised production and process equipment, which is not or only insufficiently available in today's LED production.

## Objective

The aim of the project is to develop a new manufacturing environment for innovative optoelectronic components and prepare it for initial commercial use. In order to implement the innovations for substrate production, material development and connection technologies as well as plant automation, a new clean room building as well as production and logistics facilities are being built. This will create a completely new production in Regensburg that meets the requirements of the highest clean room classification and thus enables a new generation of products. This also entails the creation of 200 to 300 additional industrial and engineering jobs in one of the most modern high-tech production facilities in Europe. In addition to the development of innovative processes and methods in the field of optoelectronics, a pilot line for the production of intelligent LEDs will also be created in the new clean rooms. These will then be integrated, for example, in adaptive and energy-efficient LED front headlights and increase road safety, as they can actively adapt their light distribution to the surroundings and thus have less dazzle. The highly integrated, monolithic, pixelated LEDs required for this are based on flexibly configurable electronics at chip level and on thin-film LEDs. In order to be able to manufacture them cost-efficiently, production is being switched from 4-inch to 8-inch wafers. This also offers the advantage of being

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compatible with silicon-based microelectronics and their manufacturing processes.

## Approaches

There are various approaches to researching and developing new and very compact LEDs with minimal use of raw materials and maximum energy efficiency. On the one hand, new materials and geometries are being researched in order to push LED technology to the highest performance levels and make it suitable for applications such as e.g. video walls with narrow pixel spacing. This can be technically realised by dividing a large chip into individually controllable areas (pixelation) and by subsequently integrating complex driver logic on the LED („silicon meets LED"). There is a promising development in LEDs for UV (ultraviolet) and especially for deep UV applications. Such LEDs are used, for example, for water and surface disinfection, gas detection or the curing of paints and plastics. Thanks to a higher radiance and maximum energy efficiency the mercurial systems mainly used today can be replaced in the future. In addition, an 8-inch GaN-on-sapphire pilot line will be used to develop low-cost, high-volume manufacturing methods to improve compatibility with the silicon industry standard and faciliate the heterointegration of compound semiconductors and conventional silicon-based microelectronics.

## Perspectives

The developments from the project not only offer a technological platform on which optoelectronic components can be realised as components for future and innovative Internet of Things (IoT) applications from the automotive and communications sectors, but also secure a technological lead for microelectronics in Europe. These compact point light sources make it possible to develop highly energy-efficient and cost-effective products. The so-called package has a not inconsiderable share in the actual LED size. A Chip-Scale-Package (CSP) offers Osram the possibility of individual scalability to refine or sell products directly or in modules. By avoiding an additional casing, further costs are reduced, which can ensure the competitiveness of future LED generations. Through continuous exchange at conferences and trade fairs, a large number of European companies, research institutions and universities will also benefit from the results. With the development of high- performance, energy-saving and cost-effective semiconductor solutions, Osram's project contributes to advancing the key technology of micro- and nanoelectronics as a common European goal and addresses the societal challenge of digitalisation.

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