



ROBERT BOSCH GMBH AND BOSCH SEMICONDUCTOR MANUFACTURING DRESDEN GMBH

Planning, construction and upgrading of semiconductor production for innovative technologies and products

The Bosch Group is an international technology and services company with around 400,000 employees worldwide. Its business activities are divided into four divisions: Mobility Solutions, Industrial Technology, Consumer Goods, and Energy and Building Technology. Bosch manufactures semiconductors for around 50 years and is a globally active chip manufacturer for mobility applications. Bosch's current semiconductor portfolio primarily comprises microelectromechanical systems (MEMS), circuits (ASICs) for vehicle control units and power semiconductors. The company's MEMS sensors, which are used, for example, to measure pressure or acceleration, are also found in many smartphones and are also installed in fitness bracelets, flying drones, game consoles and smart home applications.

Challenges

The commercialisation of MEMS-based sensors (Micro-Electro-Mechanical-Systems) began more than 30 years ago, when sensors in compact design were available

in comparatively inexpensive versions and were mainly used in the automotive industry. Since the turn of the millennium, demand has increased with the development of mobile phones, laptops and tablets, and the demands on the performance and miniaturisation of sensors have grown. With the Internet of Things (IoT), the challenges now lie above all in greater reliability of the sensors, the implementation of intelligent functions, a compact and miniaturised design, as well as the development of new sensors with high energy efficiency. At the same time, production costs must be reduced in order to survive in the market. In the field of semiconductor manufacturing, this is done, for example, by processing larger wafer slices on which more components can be manufactured at the same time.

Objective

The aim of the project is to expand technology availability within Europe through new, innovative sensor solutions for automotive applications, consumer electronics

(CE) and the IoT. To this end, new MEMS based sensor elements and concepts are being researched, developed and prepared for subsequent series production. The infra-structure and process equipment required for this should implement manufacturing processes that are as universally applicable as possible with a high degree of overlap with other production lines in order to be able to respond flexibly to current market requirements and developments. The work focuses in particular on the development of new types of magnetic, humidity, gas and LiDAR (Light Detection And Ranging) sensors and the construction of the first prototypes. The sensors are developed as so-called System-on-Chip (SOC) and as System-in-Package (SiP) solution implemented to provide application-specific integration into the respective field of application. Innovative processes such as chip-scale-packaging, through-silicon-via-technology and a new wafer-bonding-technology to ensure a high sensor integration density and hermetic encapsulation will be used.



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Funding code

16IPCEI626, 16IPCEI632

Location

Reutlingen, Dresden



Approaches

As part of the project, existing production lines will be further developed and a new silicon-based, fully automated 5G-capable semiconductor factory will be built at the Dresden site. This is the first specialised digital building for the production of power and mixed-signal semiconductor components in Europe. The 300 mm silicon production line there will initially be designed for the cost-saving production of application-specific sensor evaluation electronics (ASIC), but will also be transferable to the production of MEMS sensors. In Reutlingen, existing semiconductor production facilities are being further developed so that the innovative inertial and pressure sensors produced there can be used for high-precision positioning in mobile devices. In addition, high-precision acceleration and rotation rate sensors are being developed, suitable materials qualified and corresponding deposition and structuring processes established. The aim is to prepare the sensors for industrial series production. The manufacturing processes for optical sensors for distance measurement – such as LIDAR sensors (Light Detection And Ranging), which are increasingly used in the field of autonomous driving – are facing the challenge to provide substrates with a high level of flatness. Only in this way can highly precise miniaturised mirrors for accurate optical distance measurement be created in the end.

Perspectives

By transferring development results to series production, Europe can expand its position as a supplier to the consumer electronics and automotive industries. At the same time, the shift towards electromobility will be supported by new technologies and cost-saving manufacturing processes, and applications of driver

assistance systems will be expanded. In addition, synergy effects are expected in Dresden with regard to the technology location in the area of semiconductor manufacturing and research organisations, which could also mean an economic upswing for the region. This project from the technology field „Intelligent sensors“ is strongly interwoven with Bosch's second project, which belongs to the IPCEI technology field „Power semiconductors“. With the development of high-performance, energy-saving and cost-effective semiconductor solutions, the two Bosch projects contribute to advancing the key technology of micro- and nanoelectronics as a common European goal and to addressing the societal challenge of digitalisation. The solutions developed here can also be transferred to other industries and fields of application.

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