



## Bosch Sensortec GmbH

www.bosch-sensortec.com

Bosch Sensortec GmbH was founded in 2005 and is a wholly owned subsidiary of Robert Bosch GmbH. Bosch Sensortec develops and markets microelectromechanical (MEMS) sensors and solutions for smartphones, tablets, wearables and Internet of Things (IoT) applications. These include, for example, environmental sensors, optical microsystems and the associated software solutions.

### INDUSTRY

Microelectronics

### LOCATION

Reutlingen  
(Germany)

### TRUMPF PRODUCTS

■ Single-mode VCSEL

### APPLICATIONS

■ Optical sensor systems

## Challenges

Fine dust in the air is dangerous: When inhaled, it is harmful to health, because the particles can move straight from the lungs into the blood. The dust particles are not exhaled again, but remain in the body. So far, municipalities have measured the fine dust concentration in public at certain points and published average values for the entire city. But that provides little information in real time about the air that people are breathing. Mainly because fine dust pollution indoors is often much higher than outdoors, for example from cooking in the kitchen, fireplaces or candles. Bosch Sensortec and TRUMPF Photonic Components are seeking a way for everyone to quickly and reliably measure their own ambient air and protect themselves from fine dust pollution.



"The best thing about fine dust measurement using a mini laser: The sensor does not need direct contact with the air, so it can also be positioned behind glass or a display."

### PETER OSTERTAG

DIRECTOR OPTICS BUSINESS AT BOSCH  
SENSORTEC



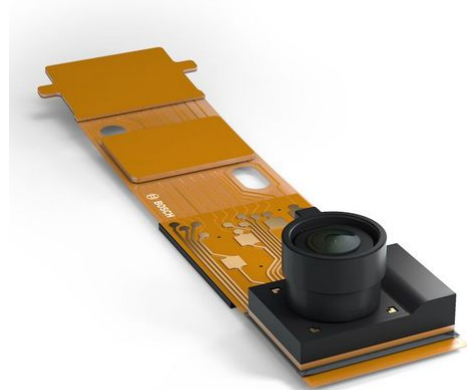
## Solutions

Both development partners take the following approach: We implement it optically, using VCSEL. VCSELS (vertical-cavity surface-emitting lasers) are micrometer-sized diodes that generate laser light with high

beam quality and can capture and analyze reflections using a photodiode. Several spatially distributed mini lasers scan the ambient air for particles, the photodiode measures the interference of the return beams, and the system calculates the size and number of the air particles found. The measurement procedure is called SMI (self-mixing interference). Since the measurement is purely optical, there is no need for direct contact with the air - the VCSELs are protected behind a small pane. A fan that draws in the air for measurement is also not required - the sensor therefore works completely noise-free and never needs to be cleaned or serviced. With this new measurement approach, the volume of the sensor can shrink to just a few millimeters, making it 450 times smaller than all previous fine dust sensors. Peter Ostertag from Bosch Sensortec is delighted: "Never mind a matchbox, the new sensor is the size of a match head." The technology makes it possible for range hoods to automatically regulate their power if too much fine dust is produced during cooking. Or ventilation systems that start up when fine dust sensors in the building alert them.

## Implementation

The development partnership for the fine dust sensor started in 2015. It is not the first joint project for Bosch Sensortec and TRUMPF. Peter Ostertag explains: "Developments with TRUMPF are always a true partnership - targeted and full of mutual respect. What I appreciate most is that TRUMPF has an open mindset and responds quickly."



## Forecast

The optical particle sensor is so tiny and energy-efficient that it can be discretely integrated anywhere. Of course, this is also of interest for a range of completely different applications: Bosch Sensortec and TRUMPF are already researching other ideas for which they could use the new sensor concept.

