

With smart sensors

Bosch team wins innovation and advanced technology award

Federal President Horst Köhler pays tribute to leading-edge technology

December 3, 2008

PI 6522 AE KI/Na

- ▶ Smart sensors for more safety, environmental protection, health, and comfort
- ▶ Bosch team opens up new markets for surface micro-machining

Berlin/Stuttgart – The German Federal President Horst Köhler today presented the 2008 German innovation and advanced technology prize in Berlin. The award goes to the research and engineering team made up of Dr. Jiri Marek – the team spokesman – and Dr. Michael Offenburg from Bosch and Dr. Frank Melzer from Bosch Sensortec. On the one hand, they have developed essential key processes for surface micro-machining, thus creating the conditions for the manufacture of small, cost-effective, powerful, and energy-efficient sensors. On the other hand, they have taken this technology to a stage where it can be used in mass production, opening up a global market for micro-mechanical sensors – a market which Bosch leads today. With his innovation and advanced technology award, Federal President Horst Köhler singles out researchers and engineers who, on the basis of excellent research, pave the way for the market launch of remarkable projects and products, create and secure jobs, and improve the standard of living in Germany.

“The distinction bestowed on our team by the Federal President makes us proud. At the same time, it is recognition and motivation for all our associates who have successfully worked together to open up this area of business,” said Dr. Siegfried Dais, deputy chairman of the Bosch board of management. “We are pleased that we can offer researchers and engineers the creative and challenging environment they need as a basis for excellent achievements such as this.”

Safety thanks to cost-efficient sensors

If a car detects that it is skidding and stabilizes itself, if a laptop falls to the floor and protects the hard drive before impact, if a cell phone calls for help in an emergency and guides the rescuers reliably to its owner – this is invariably due to sensors, the “electronic sensory organs” with which technology perceives its surroundings. Sensors are regarded as the crucial elements of technical electronic systems that can react ever more intelligently to human needs – Invented for life.

One important condition for this development is that sensors have become significantly smaller and more powerful, as well as costing less to manufacture and consuming less energy. Marek, Offenberg, and Melzer paved the way for this development. They developed new processes for the manufacture of sensors on silicon chips in what is known as surface micro-machining, and broke into the world automotive and consumer goods market. This was the breakthrough to industrial mass-production for micro-electro-mechanical systems (MEMS).

In principle, micro-machining is an offshoot of modern electronic semiconductor technology. It uses micro-electronic and other key processes to create tiny, movable components that perform mechanical functions. As sensors, for example, they can precisely measure pressure or acceleration or, in the print heads of inkjet printers, they ensure that paper is printed clearly. They can also monitor the physical activity of patients with cardiac conditions. Up to now, mainly “bulk micromachining” processes have been used in manufacturing. Economically and technically, however, this can only be used for components in larger high-end appliances – in cars, for example, or in industrial plant. For sensor mass applications in consumer electronics, these sensors are too complicated and too big, and they consume too much electrical power.

Surface micro-machining as the key to cost-effective sensors

Together with their co-workers from research, development, and manufacturing, the Bosch team managed to make complex sensor components using surface micro-machining processes. The structures and components are deposited on the surface of a silicon wafer. Compared with other processes, the polycrystalline silicon layers that are deposited are extremely thick. With their new processes, the Bosch researchers can create vertical-walled structures in the deposited thick silicon layers, produce moved masses and oscillating spring elements, and accurately create vacuum chambers inside the silicon that has been deposited. In addition, they can combine the sensors with electronic evaluation circuits,

and protect their elements against environmental factors with ultra-thin seals that take up a minimum of space. All of this happens at the micron level, on structures that are far finer than a human hair, and at a cost that runs into just a few euros, even for complex sensor systems.

This progress in miniaturization opens up new applications for these sensors in consumer electronics. The Bosch BMA 150 acceleration sensor switches the cell-phone display from portrait to landscape format, depending on how the cell phone is being held. Or a sensor installed in a laptop detects if a laptop has been dropped, and protects the hard drive against data loss even before it hits the ground. In navigation systems, the micromechanical pressure sensor can measure altitude to the nearest 25 centimeters, and the precise orientation it gives makes mobile navigation possible even in buildings, as well as for automatic emergency call systems. Other applications of micro-mechanical sensors in consumer electronics include weather stations or altimeters in watches, training monitoring sensors in shoes or sportswear, and intuitive user interfaces for cell phones, remote controls, or game consoles that react to faint touches or changes in position.

More than 200 million sensors a year

Bosch currently manufactures more than 200 million micromechanical sensors a year – in total, more than a billion have already been manufactured. This makes the company the world's leading supplier of these sensors. Some 2,000 associates work in this area at Bosch. As production figures rise, so too does the demand for semiconductor switches for electronic signal processing in the sensors. It is for this reason that Bosch is constructing a new manufacturing facility in Reutlingen, Germany. It will produce semiconductors on eight-inch wafers, and create 800 additional jobs. At 600 million euros, it is the company's greatest single investment.

For micromechanical sensors, consumer electronics is a new market whose potential has to be tapped. This was why Bosch Sensortec GmbH was founded in 2005. Internationally, more than 50 associates work for this company. The market for micromechanical sensors will continue to grow strongly, especially in the area of consumer electronics. Worldwide, electronics engineers are working to make many functions of electronic devices even more user-friendly – with the help of micromechanical sensors.

For more information, visit: <http://www.deutscher-zukunftspreis.de/>

Press photo: 1-AE-15337, 1-AE-15338, 1-AE-15339, 1-AE-15340, 1-AE-15341

Contact person for press inquiries: Thomas Knoll, Tel.: +49 711 811-7088

The Bosch Group is a leading global supplier of technology and services. In the areas of automotive and industrial technology, consumer goods, and building technology, some 271,000 associates generated sales of 46.3 billion euros in fiscal 2007. The Bosch Group comprises Robert Bosch GmbH and its more than 300 subsidiaries and regional companies in roughly 50 countries. This worldwide development, manufacturing, and sales network is the foundation for further growth. Each year, Bosch spends more than 3 billion euros for research and development, and applies for over 3,000 patents worldwide. The company was set up in Stuttgart in 1886 by Robert Bosch (1861-1942) as "Workshop for Precision Mechanics and Electrical Engineering."

The special ownership structure of Robert Bosch GmbH guarantees the entrepreneurial freedom of the Bosch Group, making it possible for the company to plan over the long term and to undertake significant up-front investments in the safeguarding of its future. Ninety-two percent of the share capital of Robert Bosch GmbH is held by Robert Bosch Stiftung GmbH, a charitable foundation. The majority of voting rights are held by Robert Bosch Industrietreuhand KG, an industrial trust. The entrepreneurial ownership functions are carried out by the trust. The remaining shares are held by the Bosch family and by Robert Bosch GmbH.

Additional information can be accessed at www.bosch.com.