

## German federal president's prize for innovation and advanced technology **Team of experts from Bosch nominated** Semiconductor technology with huge potential

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- ▶ Four research and engineering teams nominated for final round
- ▶ Bosch team opens up new markets with surface micro-machining
- ▶ Technology for more safety, environmental protection, and health

Berlin / Stuttgart – The Office of the German Federal President has announced its shortlist for the 2008 German Future Prize, the award for innovation and advanced technology. From the many first-class entries, the panel of experts has selected four outstanding projects for the final decision which Federal President Horst Köhler will announce on December 3, 2008.

For the fourth time in the ten-year history of this prestigious award, Bosch associates have succeeded in being shortlisted for the final round of four nominated expert teams. The Bosch team, comprising spokesman Dr.-Ing. Jiri Marek and team members Dr.-Ing. Michael Offenberg and Dr.-Ing. Frank Melzer, has developed key processes for surface micro-machining, thus creating the prerequisites for manufacturing small, cost-effective, powerful, and energy-efficient sensors. At the same time, they have taken this technology to a stage where it can be used for large-volume production, opening up a global market for micro-mechanical sensors – a market which Bosch leads today. "Together with all the associates of our company, we are pleased that our team of experts has reached the final round of the 2008 German Future Prize. In itself, being shortlisted by such a high-powered panel of judges is an accolade that makes us all proud," said Franz Fehrenbach, chairman of the Bosch board of management.

### **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” which perceive the surrounding conditions. 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 wafers in what is known as surface micro-machining. This is regarded as the breakthrough in 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 processes to create tiny components that perform mechanical functions. As sensors, for example, they can precisely measure pressure or acceleration. In the print heads of inkjet printers they ensure that paper is printed clearly, and in electronic projectors they control the positioning of the micromirrors. Up to now, mainly “bulk micro-machining” 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 plants. For sensor mass applications in consumer electronics, these sensors are too complicated, too big, and their power consumption is too high.

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

Together with their co-workers, the Bosch team managed to make complex sensor components using surface micro-machining processes. Unlike the processes used previously, the structures and components are deposited onto the surface of a silicon wafer, instead of etching them out of volume silicon. With their new processes, the Bosch researchers can create vertical-walled structures in the deposited silicon layers, produce moving masses and oscillating spring elements, and accurately create vacuum chambers inside silicon that has been deposited. In addition, they can combine the sensors with the electronic evaluation function, and protect their elements against environmental factors with ultra-thin seals that take up a minimum of space. All of this happens on 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 SMB 380 acceleration sensor detects if a laptop has been dropped, and protects the hard disk drive even before it hits the ground. In navigation systems, the micro-mechanical pressure sensor can measure altitude with an accuracy of 25 centimeters, and the precise elevation it provides makes mobile navigation possible even in buildings, as well as automatic emergency call systems. Other applications of these 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 micro-mechanical sensors a year, and is the world market leader for such sensors. Some 2,000 associates work in this area at Bosch. As production figures rise, so too does the demand for electronic circuits for signal processing inside these sensors. It is for this reason that Bosch is constructing a new semiconductor manufacturing facility in Reutlingen, Germany. It will produce semiconductors on eight-inch wafers, and create 800 new jobs. At 600 million euros, it is the company's greatest single investment. For micro-mechanical sensors, consumer electronics is a new market whose great potential has to be tapped. This was why Bosch Sensortec GmbH was founded in 2005. Worldwide, more than 50 associates work for this company. The market for micro-mechanical 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 micro-mechanical sensors.

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

**Further information:** <http://www.deutscher-zukunftspreis.de/>

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*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."*

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*Additional information can be accessed at [www.bosch.com](http://www.bosch.com).*