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Bosch DRIE enabler for MEMS - Invention and technical progress

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MEMS (Micro Electro Mechanical Systems) at Bosch look back on 30 years of development and production. Silicon Deep Reactive Ion Etching (DRIE), also known as the “Bosch Process”, is one of the worldwide established MEMS key manufacturing processes on the market. The starting point of this plasma trench etch process for silicon dates back to the development in the early 1990’s at Bosch Corporate Research Center on a prototype equipment. “Bosch DRIE” became the enabler for silicon MEMS applications and products. A large variety of interesting bulk and surface micro machined MEMS products on the market address automotive, consumer and IoT applications, which nowadays support the daily life of all of us. These are pressure sensors, micro mirrors, microphone devices, gas flow and fluidic sensors, through-silicon-vias (TSV’s) and inertial sensors. New automotive and consumer applications like autonomous driving or virtual reality are increasingly pushing inertial sensor performance improvements like higher sensitivity and resolution. This demands a technical progress on “Bosch DRIE”, with progress mainly focused on the plasma etch equipment side. Cross wafer results and sensor performance is strongly influenced by plasma reactor conditions like chamber geometry, gas distribution, plasma source and substrate electrode construction and with strong influences of plasma reactor materials on sensor response and wafer test results. Therefore, a close co-operation between equipment suppliers and MEMS manufacturers is needed to improve and

optimize DRIE equipment hardware and processes, in parallel to product development, in order to fulfil enhanced MEMS product requirements for the future.

The “Bosch Process” turned out to be the key technology behind the worldwide production of billions of silicon MEMS sensors every year, able to structure silicon at arbitrary shapes with very high etch rates and at extremely high precision nowadays.

Speaker Biography

Andrea Urban, born at Schilp in 1967, Waiblingen, Germany. She graduated her high school in 1987. She completed her diploma in 1992 in the Studies of “Materials Engineering and Surface Technologies”, at Fachhochschule Aalen, Germany. She joined the Robert Bosch GmbH Corporate Research and Technology Center in Stuttgart, Germany in 1992. She is working as a technology specialist mainly related to inertial sensor manufacturing, which strongly influenced the development and installation of MEMS acceleration sensors and gyroscopes for mass-manufacturing in Bosch’s production line. She is the co-inventor of the “Bosch Deep Reactive Ion Etching Process”. She was entrusted with the co-ordination of the European Semiconductor Equipment Assessment I-SPEEDER project, which had a significant impact on the equipment tool basis for advanced Deep Reactive Ion Etching. In 2003, she joined as the new founded Engineering Sensor Process Technology division at Robert Bosch GmbH, Reutlingen, Germany. As a Senior Expert working on the development of new process technologies and their transfer into series production for upcoming generations of MEMS sensors.

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