

Imec Leverages the Power of Silicon Fabrication to Create Innovative Neural Probe Demonstrator with Unprecedented Electrode Density

LEUVEN (Belgium) & SAN DIEGO (USA), Oct 3, 2017 – Imec, the world-leading research and innovation hub in nanoelectronics and digital technologies, today announced at its Imec Technology Forum (ITF) Health event, that it has designed and fabricated a demonstrator of a neural probe with unprecedented electrode density within the framework Neuroseeker, a large-scale EU-project. Designed and fabricated in silicon chip technology, the probe is suitable for breakthrough bio-interfaces and implants that will shape the future of neuroscience. With hundreds of electrodes capable of contacting and reading out single neurons, this probe incorporates innovations that point the way to a better understanding of the brain, and ultimately will lead to diagnostic and prosthetic tools to tackle human brain diseases.

Marleen Welkenhuysen, NeuroSeeker project manager at imec, commented: “Our goal was to fabricate a brain probe that would enable a breakthrough in the level of detail by which micro circuits of the brain cortex and also deep brain structures can be studied. Previous probes were severely restricted in the number of signals that could be captured simultaneously which limited their use as a basis for research and therapeutic tools. With this new probe, we demonstrate that it is possible to create powerful electronics that can interface with the brain on the level of small neuronal circuits and even individual neurons.”

35 percent of all diseases are brain diseases and after the age of 80, there is 90 percent probability that you will suffer from a brain disorder. To find a cure for diseases such as Alzheimer’s and Parkinson’s disease, we need a better insight in how the human brain, which is composed of around 80 billion interconnected cells that compute and relay signals chemically and electrically, works. Therefore, we need tools that align with the size and density of the brain network to measure what is going on in the brain and to influence brain activity. Nanofabrication with silicon chip technology, which is capable of realizing ultra-small sensing and activating electrodes at an unprecedented density on a very small surface, is up to the task. Scientists are now learning how to pack the required functionality and density in biocompatible packages for neuroscience applications, following a path similar to Moore’s Law for computer chips. Imec’s new demonstrator neural probe is a stepping stone on that path.

Imec's NeuroSeeker probe has the size of a chip package and consists of a base chip and protruding needle. The needle is biocompatible and extremely thin (8mm long, 50µm thick, and 100µm wide), to reduce damage to the brain tissue. Along the needle's shaft hundreds of electrodes are arranged, each a tiny square measuring 20x20µm². To allow for the dense layout of the electrodes and to be able to read out all electrodes simultaneously, the designers created an innovative time-division multiplexing scheme, which connects 8 electrodes through a single wire with the electronics in the base chip.

Imec's breakthrough brain probe was fabricated within in the frame of the European FP7 project NeuroSeeker (grant agreement n°600925), a four-year project that was launched in January 2013. The ambitious project was run by an international consortium of leading European and Canadian laboratories with expertise spanning the breath of brain research, from probe technology to theories of information representation. More information on the partners may be found at: <http://www.neuroseeker.eu/neuroseeker-partners>.

Imec's ITF Health is an exclusive event for business leaders, biomedical experts and visionaries in healthcare and nanotechnology. The forum is held on Oct 3 in San Diego, Calif., and provides insights into rapidly evolving R&D at the crossroads of healthcare and nanoelectronics, with a specific interest in solving current and future healthcare challenges. ITF Health is part of the series of Imec Technology Forums. Other ITF events are hosted in Belgium, the USA, Japan, Israel and South East Asia. Additional details and speakers can be found at <http://www.itf2017.be>.

About imec

Imec is the world-leading research and innovation hub in nanoelectronics and digital technologies. The combination of our widely acclaimed leadership in microchip technology and profound software and ICT expertise is what makes us unique. By leveraging our world-class infrastructure and local and global ecosystem of partners across a multitude of industries, we create groundbreaking innovation in application domains such as healthcare, smart cities and mobility, logistics and manufacturing, energy and education.

As a trusted partner for companies, start-ups and universities we bring together close to 3,500 brilliant minds from over 75 nationalities. Imec is headquartered in Leuven, Belgium and also has distributed R&D groups at a number of Flemish universities, in the Netherlands, Taiwan, USA, China, and offices in India and Japan. In 2016, imec's revenue (P&L) totaled 496 million euro. Further information on imec can be found at www.imec-int.com.

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