

## **Aixtron partners in EU project YESvGaN – December 14, 2021**

Digitalization has triggered a massive increase in applications and electronic devices and thus also in the consumption of electrical energy. Intelligent and efficient power electronics are necessary to secure the power supply and environmentally friendly high energy use efficiency. The YESvGaN (Vertical GaN on Silicon: Wide Band Gap Power at Silicon Cost) research project therefore aims to develop highly efficient power transistors based on a novel process technology for large-scale industrial production.

For the development of vertical gallium nitride (GaN) power transistors with silicon as a substrate, the consortium relies on the epitaxy expertise of deposition equipment maker Aixtron SE of Herzogenrath, near Aachen, Germany. This is because, for this newly developed power device, the compound semiconductor material gallium nitride must grow over a large area in the form of crystalline layers on a suitable substrate such as a silicon wafer.

### **Combining wide-bandgap high performance and cost advantages of silicon technology**

“GaN power transistors on silicon wafers provide us with the intriguing opportunity to combine about 15% higher power density in gallium nitride compared to silicon (Si) with the cost advantages of the established silicon technology. The performance is thus expected to exceed that of modern silicon carbide (SiC) MOSFETs at chip costs rivaling those of Si IGBTs,” says professor Michael Heuken, VP Advanced Technologies at Aixtron.

This is made possible by the performance advantages of vertical wide-bandgap (WBG) transistors, which allow transistors made of wide-bandgap semiconductors such as gallium nitride (GaN) to be more powerful than conventional silicon semiconductors. The lower energy losses of up to 50% when switching high electrical power and the lower production costs due to the use of silicon wafers predestine GaN power transistors for use in many price-sensitive applications.

### **High energy efficiency and low CO2 emissions**

“Added to this is the advantage that they can significantly reduce energy consumption and CO2 emissions,” says Heuken. The YESvGaN consortium estimates the potential electricity savings by the consistent use of such YESvGaN vertical membrane GaN transistors in the EU in 2030 to be equivalent to the power output of seven nuclear power plants or ten coal-fired power plants.

Energy efficiency makes the use of these transistors attractive, particularly in the field of data centers with their high power consumption. These devices are also very beneficial as traction inverters for electric vehicles (EVs). The use of low-loss power electronics makes a valuable contribution to electro-mobility, not only by saving energy but also by extending the ranges of electric vehicles.

To further drive the market penetration of GaN-based devices, Aixtron is also testing epitaxial growth on 300mm-diameter epiwafers as part of the YESvGaN research project; currently, MOCVD technology is primarily used for crystalline growth on 150-200mm wafers. For the deposition of GaN layers on 300mm silicon substrates, Aixtron is developing the required equipment.

YESvGaN clusters the relevant competences along the value chain in a consortium of large companies, small- and medium-sized companies and institutes from seven European countries. As well as Aixtron, partners include Bosch GmbH, Ferdinand-Braun-Institut GmbH, Leibniz Institute for Highest Frequency Technology, Fraunhofer Institute for Integrated Systems and Device Technology IISB, Finpower GmbH, X-FAB Dresden GmbH & Co KG, X-FAB Global Services GmbH, NanoWired GmbH and Siltronic AG, Centre national de la recherche scientifique CNRS, Ion Beam Services S.A., STMicroelectronics (Tours)

SAS (France), EpiGaN N.V., Universiteit Gent (Belgium), EV Group, E. Thallner GmbH, Materials Center Leoben Forschung GmbH (Austria), Hexagam AB, Linköpings Universitet (Sweden), Smart Induction Converter Technologies S.L., Universitat de València (Spain), AUREL S.P.A., Consorzio nazionale interuniversitario per la nanoelettronica, Raw Power Srl (Italy).

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