

KET Pilot Line Project

AGATE

Development of Advanced GaN Substrates & Technologies



The deployment of GaN technologies with superior capabilities including higher voltage, larger temperature range, but also better reliability and lifetime is key for Europe's competitiveness in addressing societal challenges in transportation, energy efficiency, and renewable energy. The ENIAC JU project AGATE will cover the whole value chain, from material and equipment to devices, setting up two pilot lines for GaN-based advanced substrates and devices to accelerate the introduction and market acceptance of these new technologies.

Sub Programme

- ❑ Equipment, Materials and Manufacturing
- ❑ Automotive and Transport
- ❑ Energy Efficiency

Objectives

According to the High-Level Experts Group (HLG) micro and nanoelectronics are essential for all goods and services which need intelligent control in all innovative sectors and are therefore identified as Key Enabling Technologies (KET). Although Silicon-based devices are offering the low-cost high volume capacities and leading edge devices architectures, wide bandgap materials are getting more and more attractive thanks to their high performances for More than Moore applications. For example in switching applications, Si is running out of steam due to its limitations in material properties.

Gallium Nitride is an advanced semiconductor material with high carrier mobility, a platform for many structures, and represents huge potential to enable breakthroughs in various applications like power converters, LEDs, RF or solar cells. The deployment of these technologies is key for Europe to strengthen its competitiveness while addressing societal chal-

lenges on transportation, energy efficiency, and renewable energy.

Manufacturing capabilities have been limited by the compatibility of the wafer with silicon production environment: diameter, cost, handling, and material quality. The aim of this KET proposal is to show that innovative GaN-based substrates and devices can be manufactured in a standard process line, with adapted equipment at a cost competitive level on 6 inch wafers, while keeping open the route to 8 inch.

The project aims at covering the whole value chain from material & equipment to device makers with a specific focus on advanced substrates and power devices and the creation of two pilot lines.

The project plans to set-up two pilot lines for GaN-based advanced substrates and devices to help the introduction and market acceptance of these new technologies.

A major goal of the project is to bring a high level of innovation thanks to substrate engineering: the leading

edge layer transfer technologies gives access to customized thin film stacking, high performance Material and Coefficient of Thermal Expansion (CTE) matching. The objective is to implement an advanced pilot line for GaN engineered substrate to create an industrial European source of GaN based on engineered substrates and improved epitaxial structures. Superior performances such as higher voltage, larger temperature range, but also better reliability and lifetime with respect to the classical GaN on Si epitaxial wafers approach will need to be demonstrated on relevant high power devices such as 600-1200V Schottky Barrier Diodes and High Electron Mobility Transistors. In order to cover all these aspects and thus contribute to map an essential part of the GaN value chain, the different end-user partners propose complementary device pilot lines.

Work and consortium

Soitec will lead the consortium and be the project coordinator. The consortium is well balanced and covers the full value chain from material to devices: substrates and material suppliers (Soitec, Plansee), equipment suppliers (EVG), power device makers (ON Semi and ST), optoelectronics (TopGaN), and solar application (GPTech). It includes main actors from research institutes (CEA-LETI, IHPP - Unipress, ULPGC-IUMA).

Expected results

The expected results are the manufacturing in small volumes of innovative demonstrators on GaN advanced substrates and GaN-based high

power switches devices with substantially improved performance. The objective is to deliver these prototypes to the potential customers.

Another outcome expected is to evaluate the right cost structure to penetrate the market: high yield, acceptable substrate wafer cost, low manufacturing and assembly cost.

The proposed European GaN lines shall demonstrate the capability of the equipment and materials for an industrial environment.

Finally, feasibility demonstrations and innovations are expected in optoelectronics or energy application.

Impact

These pilot lines upstream will foster innovation of EU players and support demonstrator projects. Typically key players in automotive or energy conversion are expecting the emergence of GaN substrates and devices availability to develop innovative and competitive systems.

The expected impacts

- Job creation or safeguarding along the value chain and within the ecosystem
- Drive investment in the Pilot lines and within the GaN based material ecosystem
- Securing European semiconductor manufacturing capacity and autonomy

This project will generate multiple interactions between material and tool suppliers, substrate manufacturer and end users. All these partners cover a large and continuous part of the European GaN value chain. Thus, the project will lay the foundations of a robust European GaN technology ecosystem enabling long-term and sustainable growth.

Equipment, Materials and Manufacturing

Partners

- SOITEC
- STMicroelectronics (Tours) SAS
- On Semiconductor Belgium BVBA
- Green Power Technologies
- PLANSEE
- EV Group
- CEA-LETI
- IHPP
- TOPGAN
- ULPGC-IUMA

Project co-ordinator:

- Eric Butaud, SOITEC

Key project dates:

- Start: 01.04.2013
- Finish: 31.03.2016

Countries involved:

- Austria
- Belgium
- France
- Poland
- Spain

Total budget:

- € 59.6 million



The ENIAC Joint Undertaking, set up in February 2008, co-ordinates European nanoelectronics research activities through competitive calls for proposals. It takes public-private partnerships to the next level, bringing together the ENIAC member states, the European Commission and AENEAS, the association of R&D actors in this field, to foster growth and reinforce sustainable European competitiveness.

Details correct at time of print but subject to possible change. Updates will be included in the project summary at the end of the project.

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