

A leap in compactness and bandwidth, higher than 110 GHz, for a key telecommunications component opens the door to 6G at III-V Lab

The photodiode is a key component to increase the performance of telecommunications and in particular to cope with the continuous increase in traffic data. Reaching a bandwidth greater than 110GHz, this ultra-compact, high-sensitivity photodiode provides a major breakthrough at III-V Lab and Nokia Bell Labs, for 5G, and even makes it possible to reach the frequencies needed for 6G.

Palaiseau, 11/24/2021 - The photodiode is the telecommunication signal detector that converts the optical signal into an electrical signal.

The photodiode is thus used:

- for short distance connections such as data centre network, access network (fibre to the home),
- for terrestrial and submarine long-distance networks,
- but also for mobile networks (5G, 6G) in which the radio antennas are fed by optical fibre (backhaul/midhaul/fronthaul network).

An innovative technical result presented at the international ECOC conference

III-V Lab presented record performances for a high-speed photodiode at the international conference ECOC¹ :

- A bandwidth superior than 110 GHz with very high efficiency (responsivity) of 0.6 A/W and 85 GHz bandwidth for 0.8 A/W responsivity,
- A very low dependence to light polarization state (0.2 dB),
- A compact size of only 0.4*0.5mm² due to an optimum coupling region with optical fibre (gain is improved by more than 50% compared to traditional high speed/high bandwidth photodiode),

The anti-reflection coating deposited collectively on the entire wafer also reduces manufacturing costs (there are about 6 000 photodiodes on a 2" wafer).

A technical result far superior to that intended, allowing to reduce energy costs

This photodiode, with the combination of the three characteristics - bandwidth, compactness and response/efficiency coefficient - which makes it a unique and promising object, has been designed and realized in the framework of the European Project H2020 5G-PHOS, in which expected performances (60 GHz) are far inferior than those obtained (110GHz).

¹ European conference on optical communication, <https://www.ecoc2021.org/>, 13-16 September 2021, paper Th2D3, C. Caillaud and al "Ultra Compact High responsivity Photodiodes for >100 Gbaud Applications".



Started in 2017, ending in November 2021, 5G-PHOS addresses the challenging ultra dense 5G network (www.5g-phos.eu). It aims to provide a fibre network directly transmitting the radio signal in the base band, thereby allowing the use of low cost&energy antennas. In this network, the photodiode would directly convert the signal from the optical domain to the radio domain, without any signal processing on the antenna side (everything being done at the central office of the network operator).

A result achieved thanks to the alchemy of knowledge and skills at III-V Lab

III-V Lab has been able to benefit from funding from French Government in the framework of the recovery plan.

Bathed in a cultural environment rich in innovations, III-V Lab is located in the heart of the Saclay 's plateau, III-V Lab knows how to create effective partnerships.

Thanks to the complete mastery of the III-V semiconductor component manufacturing cycle (design, epitaxy, technological processes, characterization) III-V Lab manages to improve the performance of tomorrow's components.

About III-V Lab

III-V Lab is an Economic Interest Group ("Groupement d'Intérêt Economique") between Nokia, Thales and CEA, dedicated to industrial research and development of optoelectronic and microelectronic components based on III-V semiconductors, and their integration with silicon circuits. Created in 2004, III-V Lab brings together 120 researchers in the Paris region and actively cooperates with CEA-LETI's laboratories at Grenoble. III-V Lab has prototyping and production start-up resources to foster the emergence of high added-value component technologies which are then transferred to the industrial entities of the parent companies or their partners. www.3-5lab.fr

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