New light amplifier can boost the potential of photonics

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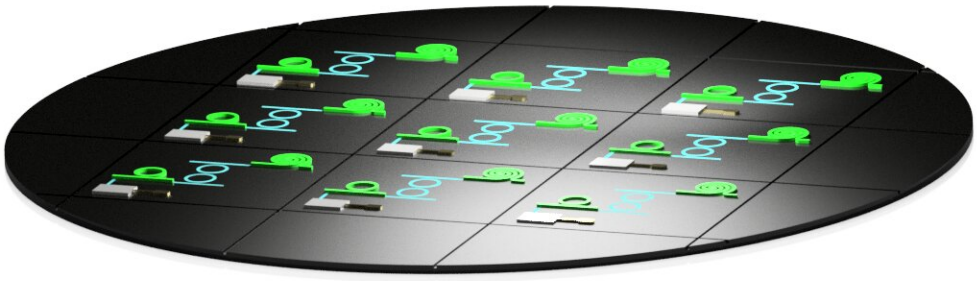


Wafer with both passive components of silicon nitride and the new amplifiers of erbium-doped aluminum oxide. Credit: University of Twente

A new light amplifier developed at the University of Twente not only boosts the light signals on a photonic chip, but it also enhances the applicability of those chips. Thanks to stronger light signals, detector chips for viruses or tumor markers can be made more sensitive, and autonomous cars could better scan their surroundings. One of the major advantages of the new amplifier is its small size. For preparing this concept for market introduction, Professor Sonia Garcia Blanco received a Proof of Concept grant of the European Research Council

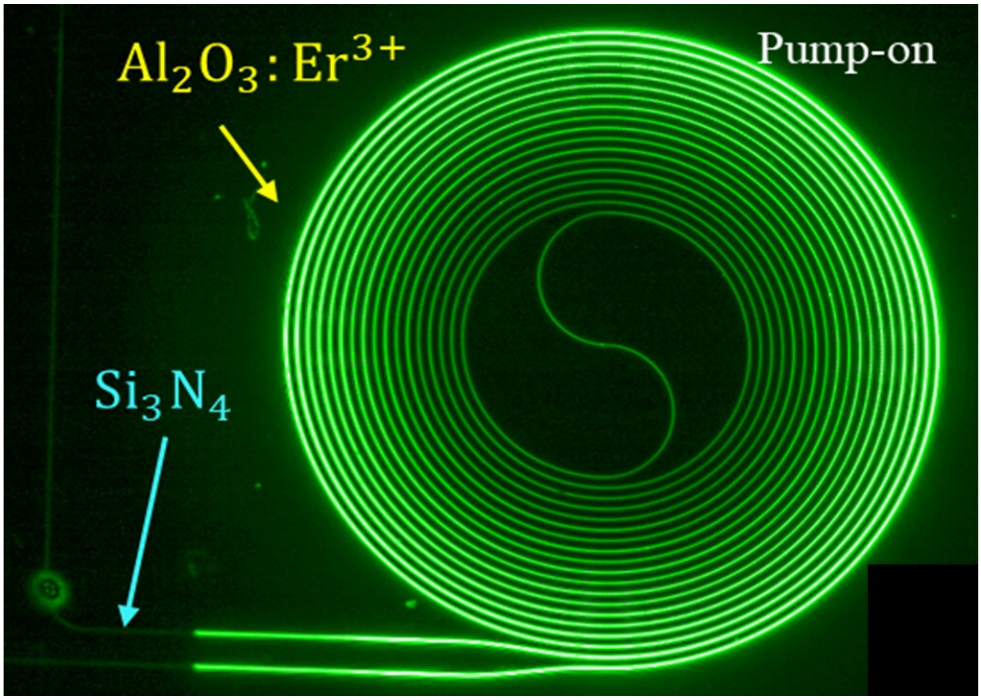
Photonic integrated circuits (PICs) are being introduced in a growing number of applications. These components process light signals. PICs can be found in medical detection, in datacenters and 5G signal processing. And the autonomous cars of the future heavily depend on LIDAR (light detection and ranging). The stronger the output signal, the better the car will be able to correctly evaluate its surroundings. As in electronics, optical amplifiers boost optical signals. However, in the case of photonics, amplifiers are not often integrated onto the same chip and thus need to be connected separately, which can make the system lossy and vulnerable. Sonia Garcia Blanco and her team have now developed an amplifier that overcomes these disadvantages. It makes use of the combination of aluminum oxide and erbium, and an innovative coupling technique.

Double layer

Erbium is often used in fiber optical amplifiers (EDFAs), but this mostly results in bulky components. Thanks to the correct combination of material, erbium concentration and waveguide architecture, the amplifier can be made very small, while providing high optical gain. A major question is how to connect the amplifier with the rest of the photonic circuit. This is achieved by using a double photonic layer coupler technology developed in Garcia-Blanco's group. A special tapering design permits transferring the light back and forth between the passive

silicon nitride photonic circuit and the amplifier section with negligible loss. In this way, the amplifier section becomes a building block that can be introduced by chip designers into any photonic chip that requires amplification. It resembles the way electronic building blocks can be introduced on every part of an electronic chip.

Garcia Blanco says, "Our optical gain building block addresses the current problems of performance, scalability and flexibility."



Optical amplifier setup with aluminum oxide and erbium. Credit: University of Twente

Provided by University of Twente