Monolithically integrated evanescent wave sensor

The invention introduced by IoffeLED Ltd. refers to photonics, namely, means of measuring the chemical composition of the substance and/or characteristics of absorption/reflection spectra using optical methods.

The task of the proposed technical solution is to develop a monolithic miniature sensor of the chemical composition, which has an expanded area of application. The solution is a part of the work within the EC funded project El Peacetolero (#945320).

The goal is achieved by the fact that the monolithic chemical sensor contains at least one first semiconductor structure with p-n junction and at least one second semiconductor structure with a p-n junction, spatially spread on the substrate, a sensitive area for the placement of the studied substance and electrical contacts, formed on the p-layers and on the n-layers respectively (see Fig.1). The substrate is transparent to the radiation formed in a forward biased p-n junction, the radiation intensity received by the second p-n junction area depends on refractive index and absorption coefficient of the studied substance.

The advantages of the technology is a 100% optical efficiency of coupling radiation into the ATR crystal (that is, into the substrate), possibility to make very small sensors, say 0.2x0.2 mm, and low production cost.

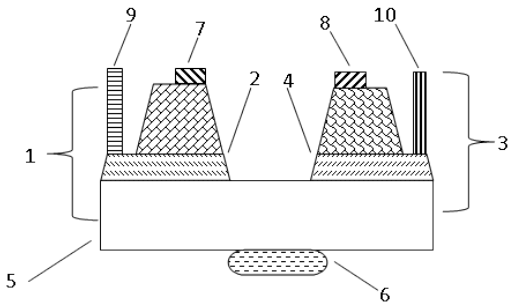

Fig. 1 from RF patent № 2727560

1- 1-st p-n structure (mesa)
2- P-n junction in the first mesa
3- 2-nd p-n structure (mesa)
4- P-n junction in the second mesa
5- Substrate (ATR crystal)
6- Analyte
7- Anode of the 1-st p-n structure (mesa)
8- Anode of the 2-nd p-n structure (mesa)
9- Cathode of the 1-st p-n structure (mesa)
10- Cathode of the 2-nd p-n structure (mesa)

The sensor has been tested by placing different liquids on top of a InGaAsSb/InAs based devices ($\lambda = 3.6\ \mu m$) showing good sensitivity and responsibility of the measured data. There are several designs and improvements of the proposed sensor that are now under test and investigations. The patent is pending.

Interested parties can send their inquiries to Boris Matveev (bmat@iropt3.ioffe.ru).