

Information and communication technology | Data transmission | Technology Offer

## Key component for the integration of electronic data processing and optical information transmission

Electro-optical component with transparent electrodes, low operating voltage and high cut-off frequency

### Field of application

Electro-optical elements which are capable of being integrated with electronic circuits are of great interest for the general transformation of information between the memory, processor and optical transmission elements.

To achieve a seamless transition between electronic information processing and optical information transfer, it is desirable to integrate fast optoelectronic components (in particular modulators) together with the associated electronic components (e.g. drivers, amplifiers, storage components, and microcontrollers) on the same substrate (e.g. silicon-on-insulator, SOI). To achieve this goal, optical waveguides must be provided with several additional properties which are independent from the substrate. This can be achieved through a strong interaction between the light in the waveguide and a suitable electro-optical material surrounding the light guide.

### State of the art

Fast electro-optical modulators currently require special substrates which generally make use of the Pockels effect. Unfortunately, this prevents the integration of complex electronic components which, by means of the application of an electric potential, change their refractive index.

### Innovation

The object of this invention is to provide an optoelectronic component based on a waveguide which can be integrated with electronic components on a common semiconductor substrate (e.g. silicon). The novel element is characterized by a broad electronic bandwidth and can be operated with low voltages. Such an element is a key component for combining electronic CMOS-based information processing and optical information transmission.

The novel electro-optical component is based on the rapid change of transmission characteristics of an optical waveguide by means of the application of electric potentials, respectively the induction of electrical currents. This waveguide consists of a high refractive index core, surrounded by low-refractive index materials at least one of which exhibits optoelectronic characteristics. An electric field is created by applying an electric potential to optically transparent or semi-transparent electrodes which are close to the waveguide core. This electric field shares a substantial overlap with the optical mode and thus can modify the transmission characteristics of the waveguide by means of opto-electronic interactions.

### Your benefits at a glance

- ✓ Electronic and optical components that can be integrated on the same semiconductor substrate
- ✓ High electronic bandwidth
- ✓ Low operating electric potentials (voltages)

### Technology transfer

Technologie-Lizenz-Büro GmbH is responsible for the exploitation of this technology and assists companies in obtaining licenses.

### Patent portfolio

Patents in DE, FR, GB (EP 2 074 473 A1) and US (US 2010/0021124 A1) are granted.

### Contact

Dr.-Ing. Florian Schwabe

[schwabe@tlb.de](mailto:schwabe@tlb.de)

Technologie-Lizenz-Büro (TLB)

der Baden-Württembergischen Hochschulen GmbH

Ettlinger Straße 25, D-76137 Karlsruhe

Tel. 0721 79004-0, Fax 0721 79004-79

[www.tlb.de](http://www.tlb.de)

Reference number: 079/06TLB