Jožef Stefan Institute
Center for Technology Transfer and Innovation

TECHNOLOGY OFFER

SMALL-SIZED ELECTRO-ABSORPTION MODULATOR ENABLING IMPROVED OPTICAL COMMUNICATIONS INSIDE ELECTRONIC DEVICES

Fields of use

Optical Networks and Systems, Semiconductors, Data Processing/Data Interchange, Middleware, Signal Processing, Optics, Data communication components, Semiconductors, Laser Related, Fibre Optics, Semiconductor materials (e.g. silicon wafers)

Current state of technology

Under development/lab tested

Type of cooperation

License agreement, Technical cooperation agreement, Research cooperation agreement

Intellectual property

Secret Know-how, Patent(s) applied for but not yet granted

Developed by

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More information about the invention

Summary

A Slovenian – Swiss – Italian R&D organization consortium has developed an electro-absorption modulator (EAM) for use in telecommunications and optical/photonic integrated circuits. Due to its smaller size the device allows for improved signal transmission and is cheaper to produce compared to known EAMs. Industrial partners interested in license agreements, technical cooperation agreements, and/or research cooperation agreements, are sought.

Description of the invention

Electro-absorption modulators (EAMs) are candidates for use in external modulation links in telecommunications and internal links on integrated circuits of photonic and electronic devices. Compared to existing modulation systems, EAMs operate at 10-times lower voltages, generate less heat, and enable faster signal transmission.

Slovenian, Swiss and Italian researchers have developed an EAM based on a semiconductor material with exceptionally strong light-matter interaction. The device consists of an ultrathin (few nm) semiconductor film that is sandwiched between two transparent electrodes and whose transmission is modulated by the applied voltage between the two electrodes. A transverse electric field is applied via the electrodes. The device may be inserted directly into the light path (preferentially with the semiconductor film perpendicular to the light path) or cladding a waveguide (as in current electroabsorption modulator technology) to modulate the evanescent wave. Various embodiments and geometries were developed that achieve a significant light modulation on an unprecedentedly short optical path.

EAMs presented here are due to their small size more applicable in future electronic devices (e.g. desktops, mobile phones, modems, routers etc.) in which conventional electronic integrated circuits will be replaced by photonic circuits capable of faster, more energy efficient data transmission.

Since the technology aims to reach its full potential in an industrial setting wherever precise EAMs are needed, industrial partners are sought. The technology is in the field of finer mechanics, therefore technical cooperation is sought in order to facilitate continuous development rather than just routine production, and to validate the technology in an industrial setting. License agreements and / or agreements for research / technical cooperation will enable the researchers to maintain their focus on the research behind the technology whereas validation will be carried out in the industrial partner's setting. The possibility of joint applications to EU calls are not excluded.

The researchers involved in development of this EAM technology work on nanoelectronics and investigate electrical properties, fundamental physics and practical applications of nanomaterials, from their growth to incorporating them into devices and performing electrical, optical and nanomechanical characterization. Their research expands from fundamental science, mostly about photo excitation dynamics in low dimensional systems, to application in photonics and energy (polymeric and hybrid solar cells). New materials that promise new applications in the following highly competitive fields are of special interest: optical data storage, optical processing and telecommunications, especially in the form of integrated optics.

Main Advantages

In addition to known advantages of EAMs (lower energy consumption, lower heat generation and faster signal transmission) the device presented here achieves a significant light modulation on an unprecedentedly short optical path. Hence, the size of device is significantly reduced as well as the consumption of semiconductor material for its production as compared to known EAMs.

Comments Regarding Stage of Development

Currently the technology has a low technology readiness level (TRL 3-4 – experimental proof of concept, validated in laboratory). The researchers have the knowledge for developing the technology to higher TRLs. Further development and investments by industrial partners are desired to increase the stage of development of this technology.

Partner Sought

Industrial partners such as integrated device manufacturers, fabless manufacturers, foundaries and others interested in license agreements, research cooperation agreements, and/or technical cooperation agreements for further development, in order to validate and demonstrate the technology in an industrially relevant environment. The possibility of joint application to EU calls is not excluded.