TECHNOLOGY OFFER

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OPTICAL DIODE

Integrated optical circuits and sensitive optical components such as semi-conductor laser diodes must be protected from back reflection. A conventional solution to this problem is Faraday optical diodes, which, however, require large magnetic fields, have a large footprint, and are not suited for integrated optical circuits. We offer a novel, performant optical diode exploiting spin-orbit coupling of light.

BACKGROUND

Reflections at optical interfaces are unavoidable and can cause a threat for sensitive optical components, for precise measurements, and for stable operation of an optical system. Conventionally, undesired reflected light is suppressed using Faraday optical diodes / isolators, which, however, are expensive, require large magnetic fields and are difficult to integrate into miniaturized optical circuits.

TECHNOLOGY

When light is strongly confined, e.g. in a thin waveguide, it exhibits surprising properties. For example, in such structures, there is an inherent link between the local polarization of the light field and its propagation direction – an effect sometimes referred to as spin-orbit coupling of light. Implanting polarization-dependent absorbers into such waveguide structures one can take advantage of this effect to realize a novel optical diode which is an interesting alternative to conventional Faraday-effect-based solutions.

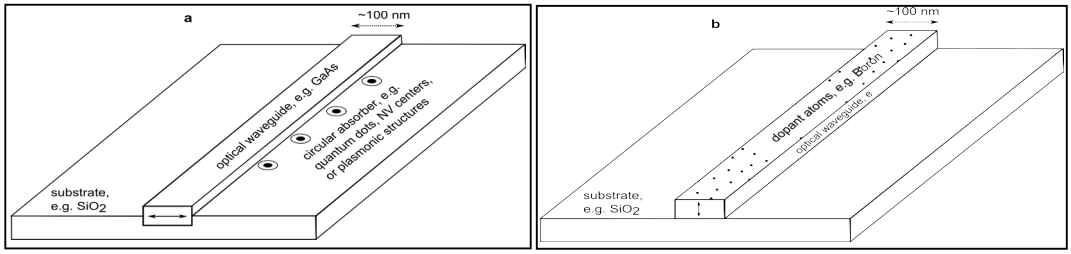

Figure: Integrated optical diode based on the inherent link between the local polarization of light and its propagation direction that occurs in thin optical waveguides. ***a*** *Implementation example with mounted, polarization-dependent absorbers (e.g., quantum dots, defect centers, valley-polarized semi-conductor structures) coupled to a waveguide.* ***b*** *Example with impurity atoms doped into the waveguide.*

ADVANTAGES

- Can be miniaturized
- Compatible with integrated, on-chip optics
- Can work with low / without magnetic fields
- Transmission direction can be switched
- Direct integration into optical waveguides
- Broad band and inexpensive

REFERENCE:
M037/14

APPLICATIONS:
- protection of sensitive devices such as semi-conductor laser diodes
- suppression of back-reflection to avoid built-up of standing wave between (integrated) optical elements
- construction of uni-directional optical elements

OPTIONS:
R&D collaboration, licensing, sale of patent

KEYWORDS:
optical diode, optical isolator, integrated optical component, fiber-optical component, optical waveguide

DEVELOPMENT STATUS:
Isolation of ~10 dB demonstrated in the lab at ~80 % forward transmission, see publication Phys. Rev. X 5, 041036 (2015)

IPR:
Austrian patent AT 516 164 granted; applications filed in EP, US and JP.

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