

Miniaturized optical isolator with a volume < 0.5 ml

Optical isolators are components that exhibit a direction-dependent transmission of light. They are used to protect diode lasers against optical feedback that deteriorates the electro-optical performance or may even lead to critical damages.

FBH's Joint Lab Quantum Photonic Components has developed a platform for miniaturized optical isolators with a small volume that can be used for the integration of isolators with wavelengths between approximately 400 nm and 950 nm. Due to their compactness, they are ideal for the usage in diode-based laser systems that have strict constraints in terms of size, mass, and power consumption.

The addressed range of wavelengths closes a gap in the availability of commercial products and enables new applications in the field of optical quantum technologies that require ultra-compact, laser-based light sources.

Advantages

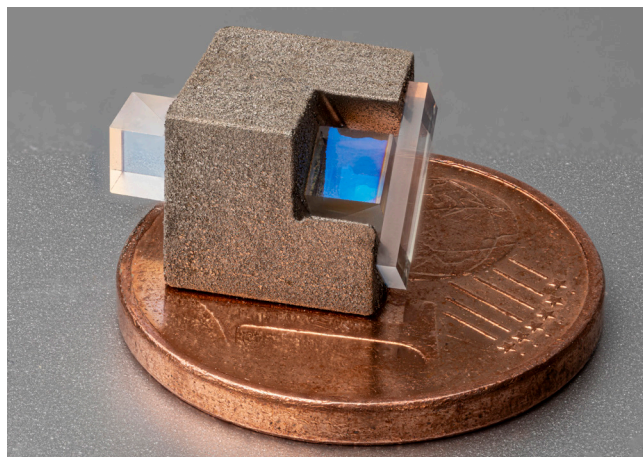
- ultra-compact for miniaturized applications
- broad wavelength range: from 400 nm to 950 nm
- excellent performance with isolation > 30 dB

Key parameters

isolation	> 30 dB
insertion loss	< 1.5 dB (transmission > 70%)
volume	< 0.5 ml (6.5 x 6.5 x 10.3 mm ³)
free aperture	1.4 x 1.4 mm ² (for 600 µm beam)
polarization rotation	outgoing matches incoming pol.
magneto-optical materials	CeF ₃ /TGG/TSAG (~400 - 560 nm) CdMnTe (~560 - 950 nm)
magnet material	high-remanence FeNdB alloy

Measured performance

wavelength	isolation	insertion loss
461 nm	> 32 dB	1.4 dB (27%)
689 nm	> 31 dB	1.2 dB (24%)
698 nm	> 32 dB	1.4 dB (27%)



➤ FBH's miniaturized optical isolator.

Applications

- optical quantum technologies with strict dimension, mass, and power requirements like
 - (table-top) quantum computers
 - metrology, e.g. compact optical clocks
 - quantum sensors
- utilization in any kind of laser with a corresponding wavelength

Profile

The Ferdinand-Braun-Institut, Leibniz-Institut für Höchstfrequenztechnik (FBH) researches electronic and optical components, modules and systems based on compound semiconductors. In the field of III-V electronics, it manufactures high-frequency devices and circuits for communications, power electronics, and sensor technology. Moreover, FBH develops light sources from the visible to the UV spectral range: high-power diode lasers, UV light sources, and hybrid laser systems. Applications range from medical technology, materials processing and sensors to optical communications in space and integrated quantum technology. In close cooperation with industry, its research results lead to cutting-edge products.

The institute is a member of the Leibniz Association and part of Research Fab Microelectronics Germany (FMD).