layer is present, it is not needed in the provision of low optical constants of the substrate in order to obtain higher α_ξ. It is necessary that the refractive index of substrate is low only. Furthermore, the more is the absorptive index of substrate, the stronger is the enhancement.

It is also shown that the use of the substrate-adjoining layer makes it possible to prevent a decrease of α_ξ, which takes place when the magnetic layer is deposited immediately on the substrate. It is well known that mentioned decrease of α_ξ is caused by the influence of interface interlayer, which is formed between the magnetic layer and substrate. With the layer of nonmagnetic dielectric material placed between the magnetic layer and substrate, α_ξ can even be, in specified conditions, enhanced despite the presence of interface interlayers.

26PO-2-12

MAGNETO-OPTICAL WAVEGUIDE ISOLATOR WITH 104 dB/cm NON-RECIPROCAL PROPAGATION

L. Lagae[1], *W. Van Parys*[1], *B. Moeyersoon*[1], *R. Vanheertum*[1], *D. Van Thourhout*[1], *R. Baets*[1], *B. Dagens*[2], *J. Decobert*[2], *O. Le Gouezigou*[2], *and D. Make*[2]
[1] IMEC vzw, Belgium
[2] Alcatel Thales III-V Lab, Marcoussis, France

Optical isolators protect active devices (i.e. lasers) from optical feedback. All research in the past focused on transmission of the light through ferromagnetic garnets [1] with low optical loss at telecom wavelengths and strong magneto-optical (MO) Faraday effects. The monolithic integration with III-V host materials would greatly reduce the cost of a laser diode package by avoiding the accurate alignment needed with an external isolator. The best reported result based on bonding of garnets on III-V materials shows an isolation ratio of only 5dB [2]. A novel concept for a – transversal magnetic mode (TM) - isolator based on a semiconductor optical amplifier (SOA) with a ferromagnetic contact was proposed [3] and demonstrated by us [4]. Lateral magnetization of the contact induces a non-reciprocal shift of the refractive index of TM guided modes, due to the MO Kerr effect. The propagation losses can be compensated by electrical pumping of the SOA through the ferromagnetic contact. Fig. 1a illustrates the device structure and Fig. 1b the operation principle.

A novel AlGaInAs-based multi-quantum well (MQW) active layer structure with built-in tensile strain has been developed [5] for TM-selective gain at 1.3μm wavelength. The sputter-deposited 50 nm thick $Co_{50}Fe_{50}$ film was patterned into 3.5 μm wide stripes through lift-off and serves as an etch mask to define the ridge waveguides. Fig. 1c shows a hysteresis measured by looping an external field to change the magnetization of the FM contact while measuring the amplified spontaneous emission of the SOA. The isolation strength of the device extracted from the transmitted optical power for both lateral magnetization directions is 104dB/cm.

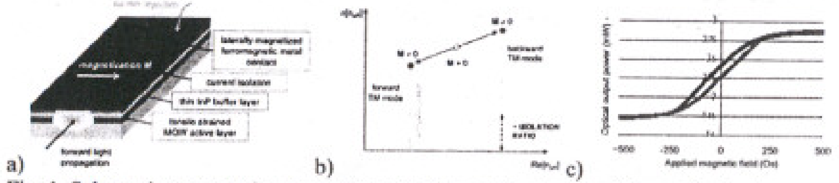

Fig. 1. Schematic presentation, operating principle and hysteresis of the optical isolator.

[1] H. Dötsch et al., JOSA B **22**, 240-253 (2005).
[2] H. Yokoi et al., Appl. Opt. **39**, 6158-6164 (2000).
[3] M. Takenaka et al., Proc. 11th Int. Conf. on InP and Rel. Mat. 1999, pp.289-292.
[4] M. Vanwolleghem et al., APL **85**, 3980-3982 (2004).
[5] J. Decobert et al., J. Crystal Growth **272**, 542-548 (2004).

26PO-2-13

NONLINEAR MAGNETO-OPTICS IN ONE-DIMENSIONAL AND THREE-DIMENSIONAL MAGNETOPHOTONIC CRYSTALS

O.A. Aktsipetrov[1], *T.V. Dolgova*[1], *A.A. Fedyanin*[1], *R.V. Kapra*[1], *T.V. Murzina*[1], *M. Inoue*[2], *T. Yoshida*[2], *D. Kobayashi*[2], *K. Nishimura*[2], *H. Uchida*[2], *V.G. Golubev*[3], *D.A. Kurdyukov*[3], *S.F. Kaplan*[3]
[1] Department of Physics, Moscow State University, 119992 Moscow, Russia
[2] Dept. of Electrical & Electronic Eng., Toyohashi University of Technology, 1-1 Hibari-Ga-Oka, Tempaku, Toyohashi 441-8580, Japan
[3] Ioffe Physico-Technical Institute, Politekhnicheskaya 26, 194021 St. Petersburg, Russia

In this paper the results of our recent studies of the magnetization-induced nonlinear optical second-order and third-order effects in one-dimensional (1D) and three-dimensional (3D) magnetophotonic crystals are surveyed. 3D magnetophotonic crystals are fabricated on the base of artificial opals infiltrated by yttrium iron-garnet (YIG). The samples of 1D magnetophotonic crystals and microcavities are prepared by RF-magnetron sputtering. Magneto-photonic microcavities are comprised of Bi-substituted yttrium-iron-garnet (Bi:YIG) $\lambda/2$-spacers, sandwiched between two dielectric multiplayer-distributed Bragg reflectors (BR). Each BR consists of five pairs of alternating quarter-wavelength-thick SiO_2 and Ta_2O_5 dielectric layers. 1D magnetophotonic crystals are comprised of pairs of $\lambda/4$ Bi:YIG and SiO_2 layers.

Nonlinear magneto-optical Kerr effect (NOMOKE) both in magnetization-induced second-harmonic and third-harmonic generation is observed in yttrium iron-garnet magnetophotonic microcavities at wavelengths of the resonant microcavity modes. Magnetization-induced variations of second-harmonic and third-harmonic intensities as well as magnetization-induced shift of phase and rotation of polarization of second-harmonic and third-

Moscow International Symposium on Magnetism

Dedicated to the 250th anniversary of
M.V.Lomonosov Moscow State University

June 25-30, 2005

Books of Abstracts

M.V.Lomonosov State University, Faculty of Physics

Scope of Symposium

- Magnetism and Superconductivity
- Nanomagnetism
- Magnetophotonics
- Magnetic Soft Matter
- Magnetotransport and Spintronics
- Medicine and Geophysics
- Magnetic Semiconductors
- New Magnetic Materials
- High Frequency Properties
- Micromagnetics
- Dilute Magnetic Semiconductors
- Metamaterials
- Theory
- Low Dimensional Magnetism
- Resonances
- Miscellaneous

Editors: N.Perov
I.Zhukov
S.Erokhin
D.Gusakova

Moscow 2005